# United States Patent

**Horsley**

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## [54] MOLDED NYLON MASTER SWITCH WITH IMPROVED PIVOTED CAM OPERATOR


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[73] Assignee: **Dominion Bridge Company Limited**



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[52] **U.S. Cl.** .....**200/6 B,** 200/153 T

[51] **Int. Cl.** .....**H01h 3/42**

[58] **Field of Search**.....200/6 R, 6 A, 6 B, 38 C, 153 L, 200/153 T, 168 S; 74/567



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*Primary Examiner*—J. R. Scott

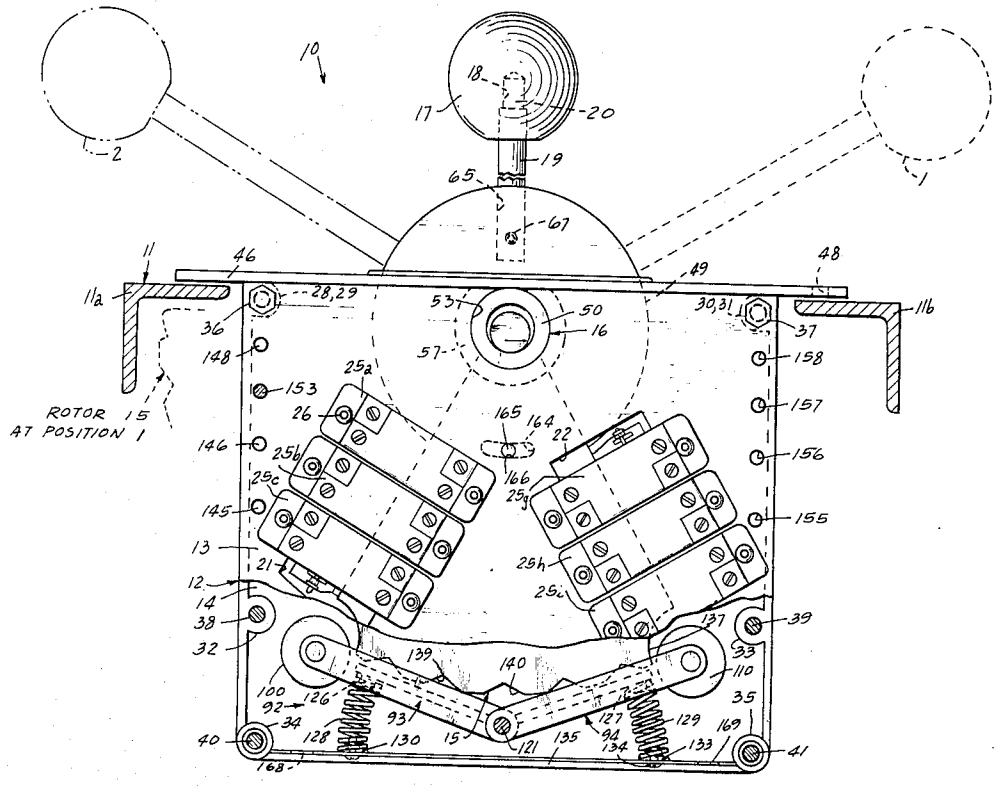
*Attorney*—Hill, Sherman, Meroni, Gross & Simpson



[57] **ABSTRACT**

A molded nylon master switch includes a housing of mating, molded housing sections. A plurality of switches are mounted in arcuate patterns on the side walls of the housing sections and operated by a plurality of cams carried on a rotor which is disposed between and journalled to the housing side walls. The rotor is initially manufactured in blank form having a plurality of arcuate ridges on each side which are transformed into cams in accordance with a desired switch operating sequence through the utilization of simple steps of machine forming the individual cams.


**30 Claims, 13 Drawing Figures**



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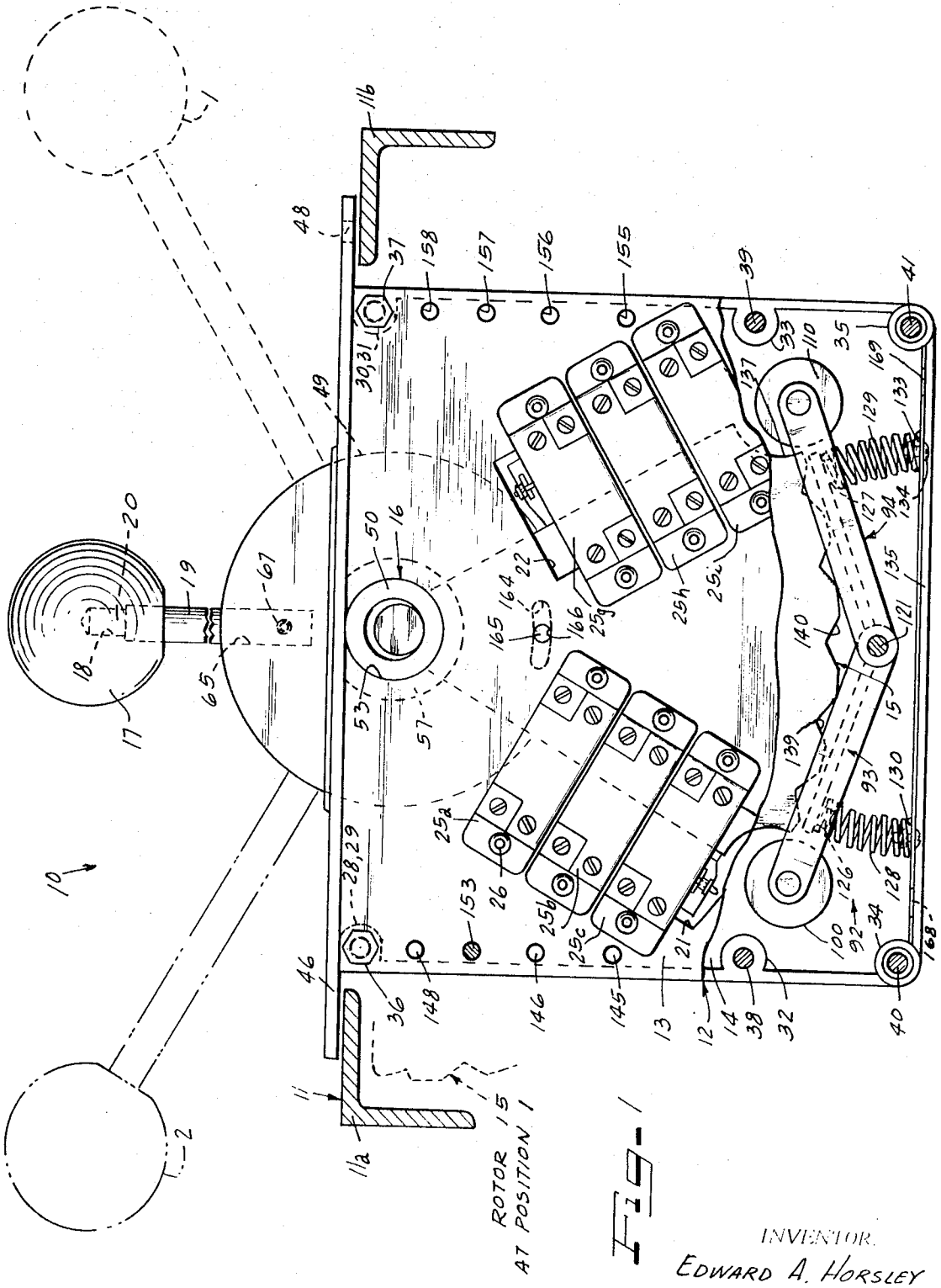
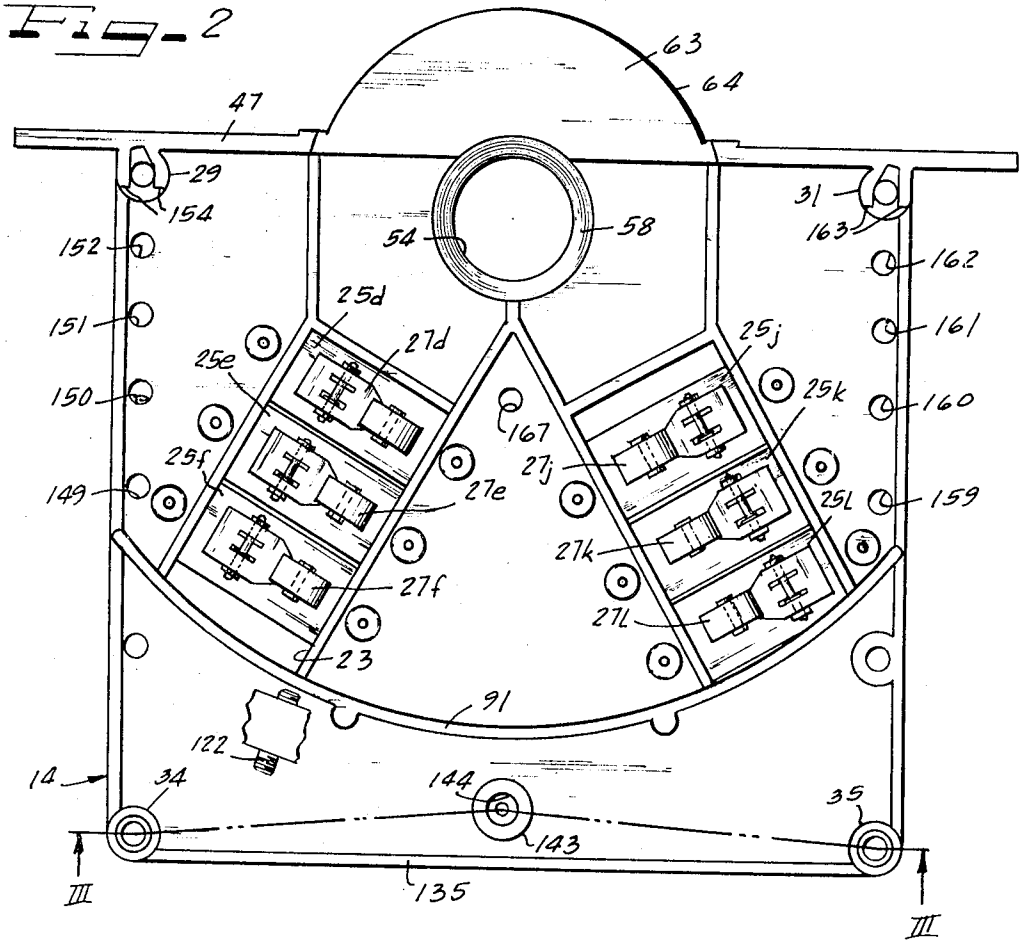



FIG. 1

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Fig. 2



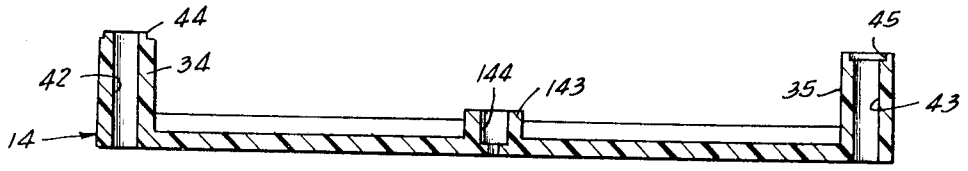




Fig. 3

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Fig. 4

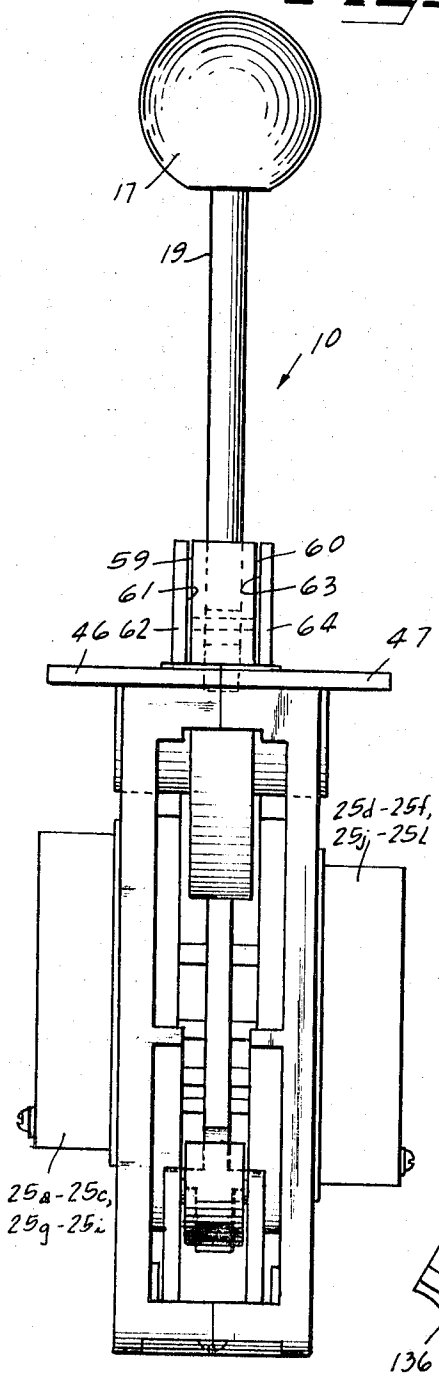



Fig. 5

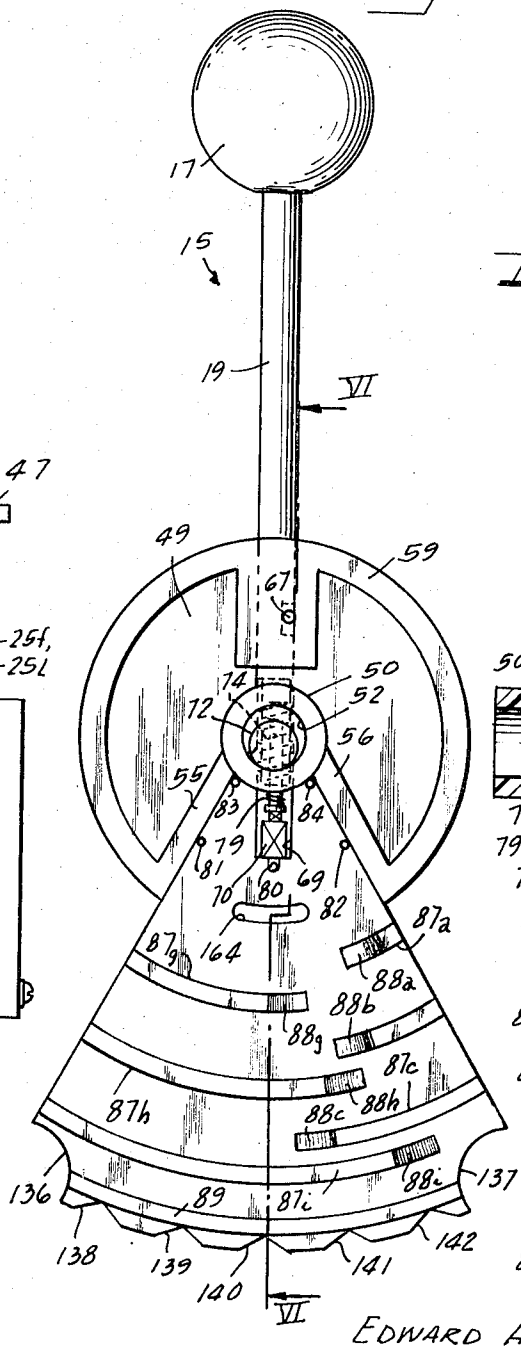
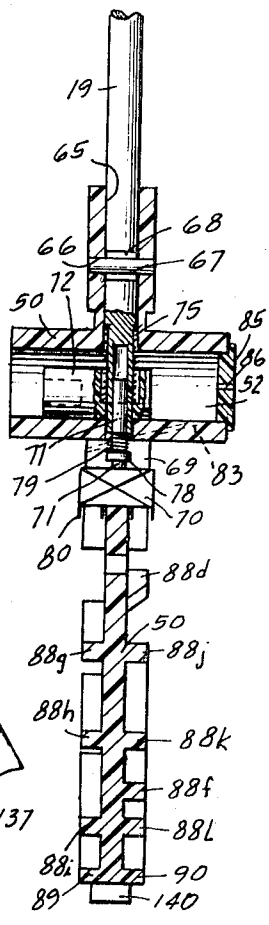



Fig. 6




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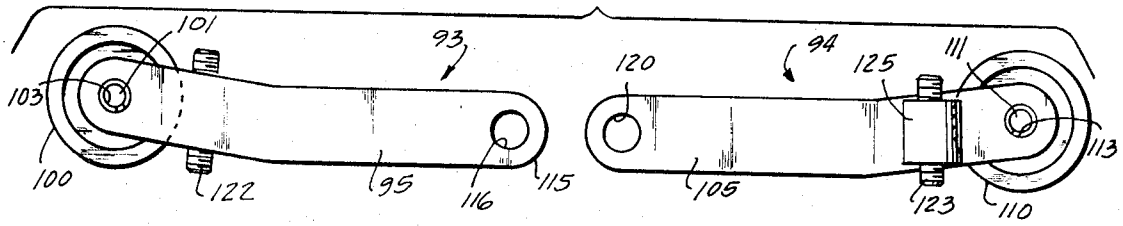
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Fig. 8



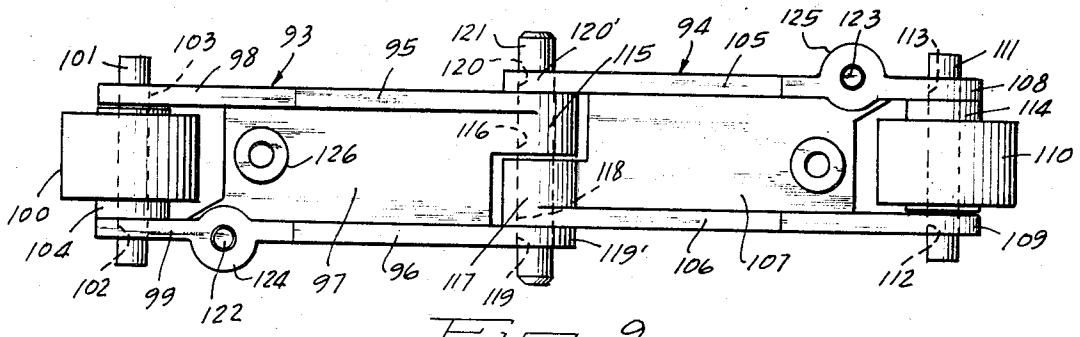
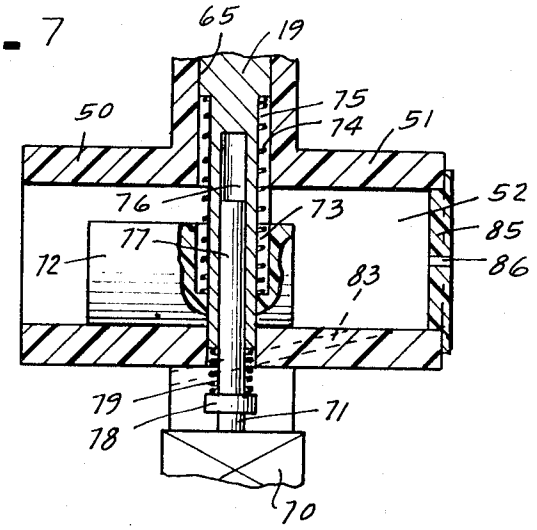




Fig. 9

Fig. 7




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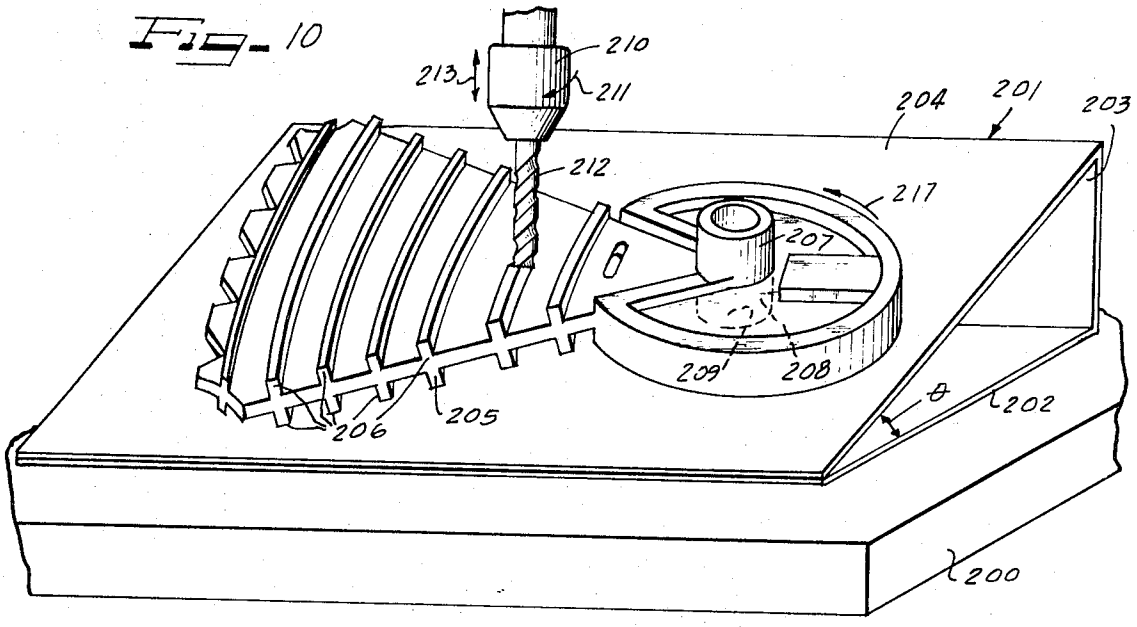
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Fig. 10



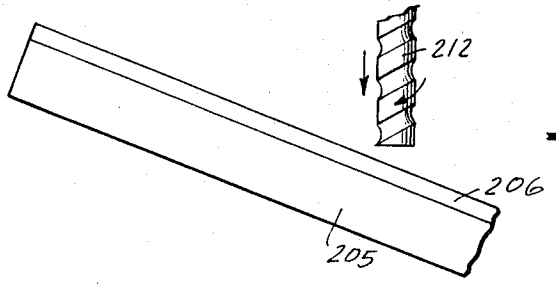




Fig. 11

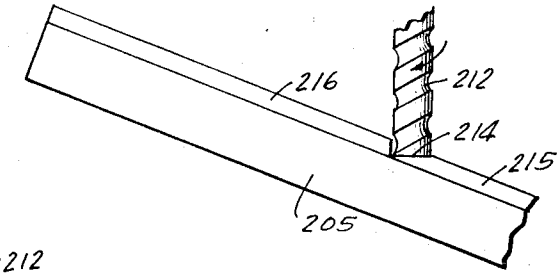



Fig. 12

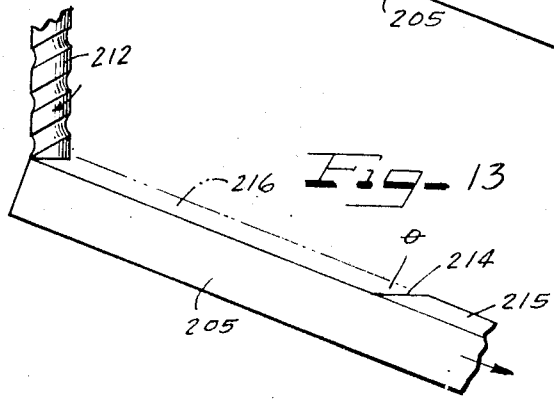



Fig. 13

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# MOLDED NYLON MASTER SWITCH WITH IMPROVED PIVOTED CAM OPERATOR

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a master switch and is more specifically concerned with the provision of a multi-position master switch which is primarily constructed of molded components.

2. Description of the Prior Art

Master switches, particularly multi-position master switches employed in hoisting and lowering controls of large over head cranes, have historically been constructed about an elongate rotatable shaft having a handle orthogonally affixed to one end thereof for manual operation, and carrying a plurality of cams therealong for operating a plurality of adjacent switches. If additional control features were required, the elongate structure was made even longer in cases where additional control features were required further elongation of the master switch was not permissable due to space limitations, it was a practice heretofore to mount a second master switch for the added control functions adjacent to the first master switch. This, of course, required staggering of the controler handles and still utilized valuable space when a number of such master switches were required, an undesired array of controler handles staggered in two directions was the obvious result.

In addition to the above drawbacks involving space requirements and space limitations, the provision of a plurality of master switches constructed in accordance with prior techniques, was a costly addition to control systems because of the relative expense of such switches due to switch materials and to the machining operations required for the components, particularly the great number of cams required for such a number of master switches.

## SUMMARY OF THE INVENTION

Because of the drawbacks of prior master switches, including those set forth above, the present invention has as an objective the provision of a low cost multi-position master switch of compact construction which may be mounted side-by-side with a plurality of like master switches to provide in building block fashion a desired number of controlled functions while at the same time occupying a minimum volume of space.

The foregoing objective is realized by employing construction techniques which result in a number of new features for master switch construction. A first of these features resides in the provision of a master switch whose geometric configuration departs from known prior art switches employing elongate cam shafts. A master switch according to the present invention utilizes an arcuately movable member having arcuate radially positioned cams on opposite surfaces thereof for operating associated switches which are disposed in arcuate patterns and in parallel to the path of travel of the arcuately movable member. The total length of the master switch along the axis of the camming structure is therefore primarily governed by the dimensions of the switches in that direction, the thickness of material required for mounting the switches and the thickness of the double-faced camming structure.

Another feature of the present invention resides in the provision of all major components of the master switch of molded synthetic material, preferably nylon. This feature has several advantages including the low cost of synthetic material with respect to prior used materials, the elimination of separate bearings due to the low frictional forces of, for example, nylon on nylon, the utilization of the material itself for fastening components through the utilization of self-tapping screws, and the ability of quick machining where necessary.

Another feature of the present invention is the provision of the camming structure as a relatively narrow molded synthetic member which advantageously saves space, as noted above, and which may be rapidly machine worked with simple tools, for example on a drill press, to provide any desired camming pattern, since the cost of providing molds for all possible cam patterns would be economically prohibited. Therefore, a blank camming structure, according to the present invention, is positioned in a jig at the desired angle of cam inclination and excess material is removed from the blank to form the cams simply by relative movement of a cutting tool and the blank.



A master switch, according to the present invention, may also be provided with a detent mechanism for effecting detenting at a plurality of positions. The cam structure, or rotor, has an arcuate edge in which a plurality of detent notches are formed. A pair of spring-loaded, oppositely extending pivotal arms each carry a roller to be received by the notches. The outboard notches are considerably larger than the intermediate notches to define a center or home position. These outboard notches receive greater portions of the wheels upon detenting than do the intermediate notches and, consequently, provide a greater resistance to be overcome by an operator when he tries to manipulate the master switch from its home position. This hinders "teasing" of the switch by an operator, and along with the use of snap-action switches the detenting feature prevents racing of an arcing of the contactors.

## BRIEF DESCRIPTION OF THE DRAWING

Other objects, features and advantages of the invention, its organization, construction and operation will be best understood from the following detailed description of preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a side elevational view of a master switch constructed according to the principles of the present invention and shown partially broken away;

FIG. **2** is a side elevational view of the interior side of a molded housing section of the master switch of FIG. **1**, shown with its associated switches mounted in place;

FIG. **3** is a cross-sectional view of the housing section of FIG. **2** taken along the line **33**;

FIG. **4** is an end elevational view of the master switch illustrated in FIG. **1**;

FIG. **5** is an elevational view of a rotor camming structure according to the present invention;

FIG. **6** is a cross-sectional view of the rotor of FIG. **5** taken along the line **6—6**;

FIG. **7** is an enlarged cross-sectional view of the hub portion of the rotor of FIGS. **5** and **6** particularly illustrating the provision of a dead man switch;

FIG. **8** is a side elevational view of a pair of detent arms which rotatably carry large diameter detent reels;

FIG. **9** is a bottom view of the detent arms of FIG. **8** shown with an interconnecting pivot pin for mounting the arms between the side walls of the switch housing;

FIG. **10** is a schematic representation of a jig and tool positioned for forming cams from a blank rotor work piece; and

FIGS. **11–13** schematically illustrate the steps of forming cams with the apparatus of FIG. **10**.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1–3** of the drawings, a master switch, generally referenced **10**, is illustrated as comprising a housing **12** which includes a pair of identical mating housing sections **13** and **14**. A cam structure, hereinafter referred to as a rotor **15**, is disposed between the housing sections **13**, **14** and journalled to the housing, as indicated at **16**.

The rotor **15** includes a manually operable handle **19** having a threaded portion **20** for engaging a threaded bore **18** of a knob **17**.

The housing sections **13**, **14** include openings **21**, **22** and **23**, **24** therein respectively over which a plurality of switches **25***a–25* are mounted by fastening means, for example by self-tapping screws **26**. The switches **25***a–25l* are preferably of the snap-action type and include corresponding wheeled switch actuators, only actuators **27***d–27f* and **27***j–27l* being illustrated on the drawings.

The housing sections **13**, **14** include a plurality of abutting hollow cylindrical posts **28–35**, pairs of which posts are

aligned to receive fastening means such as the nut, washer and bolt combinations 36–41.

Referring to FIGS. 2 and 3 in particular, each of the housing sections 13, 14 includes a post 34 having a bore 42 therethrough for receiving a corresponding fastening means, and a post 35 having a bore 43 therethrough for receiving a corresponding fastening means. The post 34 includes a reduced diameter portion 44 and the post 35 includes a counter bore portion 45 for receiving the reduced diameter portion 44 of the other housing section as an aid in the alignment and registration of master switch components during fabrication.

The housing section 13 and 14 include top walls 46 and 47, respectively. In FIG. 1 a switch mounting structure 11, including frame members 11*a* and 11*b* may be provided for mounting the master switch 10. Such mounting may be effected by the provision of mounting holes 48 at desired locations in the top walls 46 and 47 to receive means for fastening the master switch 10 to the frame 11.

Referring to FIGS. 1, 2 and 4–7 the rotor 15 is illustrated as it may appear both within and outside of the master switch 10. The rotor 15 comprises an annular portion 49 having a pair of hollow cylindrical hub members 50, 51 extending generally perpendicular thereto. The hollow hub members 50 and 51 define a passageway 52 along the interior surfaces thereof and the exterior surfaces thereof extend through an aperture 53 of housing section 13 and an aperture 54 of housing section 14 for forming a bearing to journal the rotor to the housing. The housing sections 13 and 14 include circular bearing paths 57 and 58, respectively, for bearing against raised portions 55 and 56 on each side of the rotor annular portion 49.

The raised portions 55 and 56 join a raised peripheral portion 59 (60) of the annular portion 49 of the rotor 15. The housing sections include arcuate shaped upstanding portions 62 and 64 having inner surfaces 61 and 63 which extend in close proximity to the corresponding raised peripheral portions of the rotor portion 49 so as to protect the master switch from the introduction of foreign matter. Of course, a boot or other sealing means may be provided in place of or in addition to the elements 59–64.

The master switch 10 is provided with a dead man feature by the provision of a dead man switch 70 which is operated by longitudinal movement of the handle 19 in the rotor 15. The rotor 15 is provided with a bore 65 for receiving one end of the handle 19 for sliding longitudinal movement therein. The rotor is also provided with a bore 66 which extends transversely of the bore 65 to receive a limit 1 in 67 by way of a milled out notch 68 in the handle 19. The notch 68 defines the permissable length of travel of the handle 19. The switch 70 is affixed in a cavity 69 of the rotor 15 and includes a movable operating button 71. The handle 19 includes a portion 75 of reduced diameter about which is disposed a spring 74 which bears against an abuttment 75'. A spring retainer 72 is positioned within the passageway 52 and includes a counterbore 73 therein to seat the other end of the spring 74. The spring 74 is therefore effective to urge the handle 19 in the upward direction as viewed in the drawings.

The reduced portion 75 of the handle 19 includes an axial bore 76 for slidingly receiving a switch actuator 77 having a head 78 in contact with the operating button 71 of the dead man switch 70. A second spring 79 is positioned about the actuator 77 and bears against the head 78 and the end of the handle 19. The length of the notch 68 is such as will permit sufficient over travel of the operating components of the switch 70 while the spring 79 permits upward movements of the handle without reoperation of the switch 70 until a predetermined length handle movement has been effected.

The dead man switch 70 includes switch terminals 80 for receiving electrical connecting wires (not shown). These wires may be on either or both sides of the rotor 15; therefore, a desired number of holes, such as 81, 82, may be provided through the rotor to guide the connecting wires to one side thereof, and a desired number of passageways, such as 83, 84, may be provided to guide the wires toward the axis of rotation of the rotor 15 by extending such wires into the passageway 52. Such connecting wires may exit the rotor by way of a desired number of holes, such as 86, in a plug 85 and be affixed to the rotor at or near the axis of rotation for purpose of strain relief by, for example, a silicon rubber compound.

The rotor 15 includes a fan-shaped cam construction which carries on both sides thereof arcuate individual cams 87*a*–87*l* which correspond to and which are based for operative association with the switches 25*a*–25*l*. The cams 87*a*–87*l* include respective inclined surfaces 88*a*–88*l* which rise away from the surface of the fan-shaped section in an interference relationship with the wheeled actuators 27*a*–27*l*. Attention is invited to the direction of incline of the cams 87*a*–87*l* and there radial disposition from the hub 16 and how the cams are associated with the switches whereby as the controller handle is moved to a position 1 in FIG. 1 switches 25*a*–25*f* are actuated in the desired sequence and switches 25*g*–25*l* are actuated in the desired sequence as the controller handle is moved toward position 2 in FIG. 1, the positions 1 and 2 being the extreme positions in which the handle may be placed to control, for example, maximum hoisting and lowering speeds of a crane.

The rotor 15 also includes on each side thereof arcuate guide ridges 89, 90 to help maintain the rotor perpendicular to the housing by bearing when necessary against the arcuate guide ridges, such as ridge 91, of the housing sections due to lateral forces applied by the spring loaded switch actuators 27*a*–27 and/or an operator to the rotor 15.

The master switch 10 is provided with a plurality of controller handle positions intermediate the positions 1 and 2 illustrated in FIG. 1, which positions are associated with operational conditions of the switches 27*a*–27*l*. To establish these positions and provide, for example, 6 positions for hoisting and 6 positions for lowering, the master switch 10 is provided with a tent mechanism 22. The detent mechanism 92 comprises a pair of pivotally connected arms 93 and 94 as illustrated in FIGS. 1, 8 and 9. The arm 93 includes a pair of vertical members 95, 96 with a horizontal member 97 extending therebetween and integral therewith. The members 95 and 96 have respective extended portions 98 and 99 between which is mounted a large diameter wheel 100 by means of a pin 101 which extends through apertures 102 and 103 of the extended portions 99 and 98, respectively. Likewise, the arm 94 includes a pair of ridical members 105 and 106 and a horizontal member 107 extending therebetween and integral therewith. The members 105 and 106 include extending portions 108 and 109, respectively for mounting a large diameter wheel 110 therebetween by means of a pin 111 which extends through apertures 112 and 113 of the members 109 and 108, respectively.

The arm 93 includes a cylindrical portion 115 having a bore 116 aligned with a bore 119 in an extending portion 119', and the arm 94 includes a cylindrical portion 117 having a bore 118 aligned with an aperture 120 in an extending portion 120' of the vertical member 105. A pin 121 extends through the apertures 120, 119 and the bores 116, 118 for pivotally connecting the arms 93 and 94 together. The ends of the pin 121 are received by an annular protrusion on the interior of each housing section having a bore therein, as illustrated by reference characters 143 and 144 in FIGS. 2 and 3.

A plate 132 is provided to bear against a raised edge of each housing section, such as edge 135 in order to position springs of the detent mechanism 92. The plate 132 carries a pair of bolts 131, 134 and corresponding nets 130, 133 to position a corresponding pair of springs 128 and 129. The opposite ends of the springs 128, 129 embrace raised annular portions 126 and 127, respectively on the horizontal members 97 and 107 of arms 93 and 94. The springs 128 and 129 therefore urge the arms 93 and 94 clockwise and counterclockwise, respectively, about the pin 121 to be received by detent notches on the rotor 15.

The rotor **15** includes an arcuate edge having a plurality of notches **136–142** therein for detenting the large diameter rollers **100, 110** as the rotor **15** is moved along an arcuate path. The notches **136–142** and the wheels **100, 110** define **6** arcuate positions either side of a seventh center, position.

The outboard notches **136, 137** receive the large diameter wheels **100, 110**, respectively, when the switch is in the center position. This corresponds to an off condition in hoist motor applications. The notches **136** and **137** are of much greater dimension than the notches **138–142** so as to receive a greater portion of the wheels **100, 110** so that a greater distance to overcoming the detent action is provided at the center position in order to prevent "teasing" of the switch by an operator. Means are provided for adjusting the amount of detenting wherein the arms **93** and **94** include integral therewith cylindrical portions **124** and **125** which carry set screws **122** and **123**. Access to the set screws **122** and **123** is provided by means of apertures **168** and **169** in the plate **132**.

These set screws abut the outer arcuate surface of respective guide ridges **91** to adjustably limit the extent of travel of the arms **93** and **94** toward the rotor **15**.

Attention is invited that the arms **93** and **94** are identical in construction and that the wheels **100, 110** include respective extended hub portions **104, 114** to substantially center the wheels with respect to the spring retaining projections **126** and **127**.

Referring to FIGS. **1** and **2**, means are provided for limiting the movement of the rotor **15** between the center position and any one of the positions on side of center. This feature is realized through the provision of a plurality of apertures **145–148** and corresponding apertures **149–152** on the left side of the switch as viewed in FIGS. **1** and **2** to receive a stop pin **153** illustrated in aperture **147**. Aperture **147**, stop pin **153** and aperture **151** define a stop for the fourth position away from center toward the extreme position **1**. On the other side of the switch a similar plurality of apertures **155–158** and **159–162** are provided to receive a stop pin for selectively limiting travel of the rotor toward the extreme position **2**.

As illustrated in FIG. **1** and **2**, the housing sections include posts **28, 29** and **30, 31** having flat bottom portions which define a stop for the sixth switch position on each side of the switch corresponding to the extreme positions **1** and **2**. In FIG. **2** it is illustrated that the post **29** and the post **31** include flat portions **154** and **163** which define these stop positions.

The immediately foregoing material has set forth means for limiting movement of the master switch controller handle between the second and sixth positions. Means are also provided for limiting the movement of the master controller to the first position on each side of the center position. As illustrated in FIGS. **1, 2** and **5** the rotor **15** is provided with an arcuate slot **164** for receiving a pin **165**, the ends of which are engaged in the apertures **166** and **167**, respectively, of the housing sections **13** and **14**. The length of the arcuate slot **164** corresponds to the length of travel of the rotor **15** between the first two positions on each side of the center position. The master switch is therefore applicable to a number of desired physical movement limitations for the rotor **15**.

Referring now to FIGS. **10–13** there is illustrated a method of forming the cams of the rotor **15**. The cams are supplied as blank work pieces having arcuate ridges thereon from which the individual cams are to be formed. A simple technique for forming such cams involves the utilization of a simple fixture or jig for supporting the blank work piece on a machine tool, for example on a drill press. In FIG. **10** a table top **200** may be the work table of a drill press. Positioned on the top **200** is a fixture **201** which includes a planar member **202** having a planar member **204** disposed at an angle $\theta$ with respect thereto. Another planar member **203**, or other suitable means interconnects the planar members **202** and **204** to form a stable work surface at an angle $\theta$ to the table top **200**. The angle $\theta$, as can readily be seen through the geometrics of a line which intersects a pair of parallel lines, is equal to the desired angle of inclination of the inclined camming surface. This angle has been found to be advantageously in the area of 20° to 30° for application in the above-discussed master switch.

The planar member **204** includes at least one aperture **209** therein for receiving the hub portions, here referenced **207** and **208** of the blank work piece so that the fan-shaped portion **205** extends parallel to the surface of the planar member **204**. The fan-shaped member **205** includes a plurality of arcuate ridges **206** extending substantially perpendicular thereto from which the cams are to be formed.

Positioned above the work piece and at right angles to the planar member **202** is a drill press illustrated by the reference **210** and the arrows **211** and **213**. The drill press **210** carries a flat tipped tool **212** for cutting the cams. To cut a cam, the spinning tool **212** is moved downwardly to enter the plastic material of a ridge **206** to effectively divide the ridge into two portions **215** and **216** having an intermediate portion **214** therebetween which is the formed inclined surface of the cam. After the cutting insertion of the tool **212** and formation of the surface **214**, the work piece is rotated about its hub **207, 208** as indicated by the arrow **217** to trim away the excess portion of the cam, that is to trim away the portion **216**.

Of course, the blank work piece could have a flat surface rather than raised ridges and the tool could cut an arcuate groove in the work piece by the same method described above. Also, in some cases it will not be necessary to completely remove all of the ridge portion **216**.

The forgoing discussion has illustrated the cutting of the individual cams through the utilization of a fixture to hold the work piece at an angle; however, the same method may be employed with the work piece and the tool at different positions as long as the relative movement therebetween is substantially that previously discussed. Of course, this method is applicable to other than a arcuate cutting and could be employed with an X–Y movement whereby a work piece is moved in different directions across the surface of a table such as the table top **200**.

While I have described my invention by reference to specific illustrative embodiments thereof, it is to be understood that many changes and modifications may become apparent to those skilled in the art without departing from the spirit and scope of my invention, and it is to be understood that I intend to include within the patent warranted hereon all such changes and modifications as may reasonably and properly be included within the scope of my contribution to the art.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

**1**. A master switch comprising:

first and second housing sections connected together to form a housing, each of said housing sections including a side wall spaced from the like side wall of the other housing;

a plurality of switches mounted on said side walls; and

a rotor disposed between and journalled to said side walls for arcuate movement about an axis, said rotor including a plurality of cams for operating said switches in response to arcuate movement of said rotor.

**2**. A master switch according to claim **1**, wherein each of said switches includes a cam follower switch actuator, and each of said housing sections includes means defining apertures therein, said switches mounted on the outside of said housing with their respective actuators extending through the apertures for engagement by said cams.

**3**. A master switch according to claim **1**, wherein each of said housing sections and said rotor are single molded components.

**4**. A master switch according to claim **3**, wherein said components are nylon.

**5**. A master switch according to claim **1**, comprising settable stop means including at least one stop member secured between said housing sections in the path of travel of said rotor.

**6**. A master switch according to claim **1**, wherein said rotor comprises a handle secured thereto for manual operation.

7. A master switch according to claim 6, wherein said rotor includes a bore receiving said handle for longitudinal movement therein, means defining a cavity, and another switch mounted in said cavity for operation upon longitudinal movement of said handle.

8. A master switch according to claim 1, wherein said rotor includes first and second hub portions extending therefrom, and said first and second housing sections each include a circular aperture for receiving said first and second hub portions for rotary movement therein.

9. A master switch according to claim 1, wherein said rotor includes bearing surfaces and said housing sections each include bearing surfaces for slideably engaging the bearing surfaces of said rotor.

10. A master switch according to claim 1, wherein each of said housing sections includes a plurality of elongate hollow spacer posts for receiving fastening means, and wherein at least two such posts on each section are shaped to register with respectively opposite ones of such posts on the other section to aid in alignment of parts during fabrication of the master switch.

11. A master switch according to claim 1, wherein said rotor includes means defining an arcuate slot therein co-axial with said axis, and a pin secured to said housing and extending into said slot to limit the movement of said rotor.

12. A master switch according to claim 1, wherein each of said housing sections includes a top wall for abuttment with the top wall of the other housing section and a notch therein to complement the like notch in the other housing section to form a rectangular aperture, said rotor includes a generally annular portion co-axial with the axis of arcuate movement extending through and filling the rectangular aperture, and a manually operable handle connected to said annular portion of said rotor.

13. A master switch according to claim 12, wherein each of said housing sections includes an arcuate-shaped portion protruding from said top wall, said protruding portions sandwiching said annular portion of said rotor therebetween to prevent the admission of foreign matter into said housing.

14. A master switch according to claim 1, wherein said rotor comprises a generally flat fan-shaped segment carrying said plurality of cams thereon, each of said cams comprising an arcuate ridge having an inclined portion with respect to said fan-shaped segment, and each of said switches including a cam follower switch actuator disposed in an interference relationship with the path of travel of a respective cam.

15. A master switch according to claim 14, wherein said rotor has a home position and is movable through an angle each side of its home position, and wherein said plurality of switches are mounted with respect to said cams such that alternate cams are associated with switches on alternate sides of the home position.

16. A master switch comprising:
- a housing including first and second spaced apart side walls;
- a plurality of switches mounted on said side walls; and
- a rotor disposed between and journalled to said side walls for arcuate movement about an axis,
  - said rotor including a plurality of cams for operating said switches in response to arcuate movement of said rotor, a bore in said rotor, a handle received by the bore for longitudinal movement therein, and another switch mounted on said rotor for operation by said handle upon longitudinal movement thereof.

17. A master switch according to claim 16, comprising biasing means urging said handle away from said other switch.

18. A master switch according to claim 17, comprising means for limiting the amount of longitudinal movement of said handle.

19. A master switch according to claim 16, comprising a switch operating member disposed between said handle and said other switch and movable relative said handle, and spring means urging said handle and said operating member apart so as to maintain said switch operated in the position defined by the maximum inward movement of the handle until said handle is moved a predetermined distance away from said other switch.

20. A master switch according to claim 16, wherein said handle includes a spring seat, a first spring having one end thereof bearing against said spring seat, a spring retainer having a bore therethrough for receiving said handle and a counter bore for seating the other end of said spring to urge said handle away from said spring retainer, means for limiting the movement of said handle within the bore of said rotor, a bore in said handle, a pin having a shaft portion and a head portion, said shaft portion extending into the bore in said handle and said head portion bearing against said other switch, and a second spring bearing against said handle and said head and urging said head away from said handle.

21 A master switch according to claim 20, wherein said means for limiting the movement of said handle comprises means defining a notch in said handle having walls spaced longitudinally of the handle, and a limit pin extending between said walls of said notch and secured to said rotor.

22. A master switch according to claim 16, comprising a transverse bore about the axis of arcuate movement of said rotor, and at least one passageway extending from the exterior of said rotor into said transverse bore for extending electrical connection to said other switch adjacent the axis of arcuate movement.

23. A master switch according to claim 22, comprising a plug for said transverse bore having at least one electrical lead hole there-through.

24. A master switch comprising:
- a housing including first and second spaced apart side walls;
- a plurality of switches mounted on said side walls in arcuate patterns;
- a rotor disposed between and journalled to said side walls for arcuate movement about an axis,
  - said rotor including a handle for manual manipulation by an operator and a plurality of cams for operating said switches in response to arcuate movement of said rotor; and
- detent means operatively coupled to said rotor to provide said master switch with a plurality of operational positions each of which is associated with at least one of said switches.

25. A master switch according to claim 24, wherein said rotor includes a fan-shaped segment including an arcuate edge and means defining a plurality of detent notches in said arcuate edge, an arm pivotally connected to said housing, a spring biasing said arm toward said arcuate edge, and a wheel rotatably carried by said arm for reception by the detent notches.

26. A master switch according to claim 24, wherein said rotor includes a fan-shaped segment including an arcuate edge and means defining a plurality of detent notches in said arcuate edge, a pair of arms each having an end pivotally connected to said housing, a pair of wheels rotatably carried on the free ends of respective arms, and means urging said arms toward said rotor whereby said wheels are received by the detent notches.

27. A master switch according to claim 26, wherein the outboard ones of said notches in the arcuate edge are defined by the notch defining means as being of greater dimension than the intermediate notches to receive greater portions of said wheels than the intermediate notches, detenting with respect to said outboard notches being thereby more difficult to overcome than with respect to the intermediate notches whereby an operator is provided with an indication of a home position.

28. A master switch according to claim 27, comprising means for adjustably limiting the movement of said arms toward said rotor.

29. A master switch according to claim 28, wherein said means for limiting comprises a member extending from each of said side walls into the interior of said housing and a set screw on each of said arms for bearing against a respective extending member.

30. A master switch comprising:

a switch frame including at least one side wall;

a rotor journalled to said frame for arcuate movement about an axis perpendicular to said side wall;

said rotor including a handle for manual manipulation and a planar member parallel to said side wall and a plurality of spaced apart arcuate cams co-axial of said axis carried on said planar member; and a plurality of



switches mounted on said side wall,

said switches including a cam follower switch actuators disposed in interference relationships with respective ones of said cams for operation thereby upon arcuate manipulation of said handle.

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