

Oct. 25, 1960

D. C. GINN  
FOOT SWITCH

2,957,960

Filed May 14, 1957

2 Sheets-Sheet 1

FIG. 1

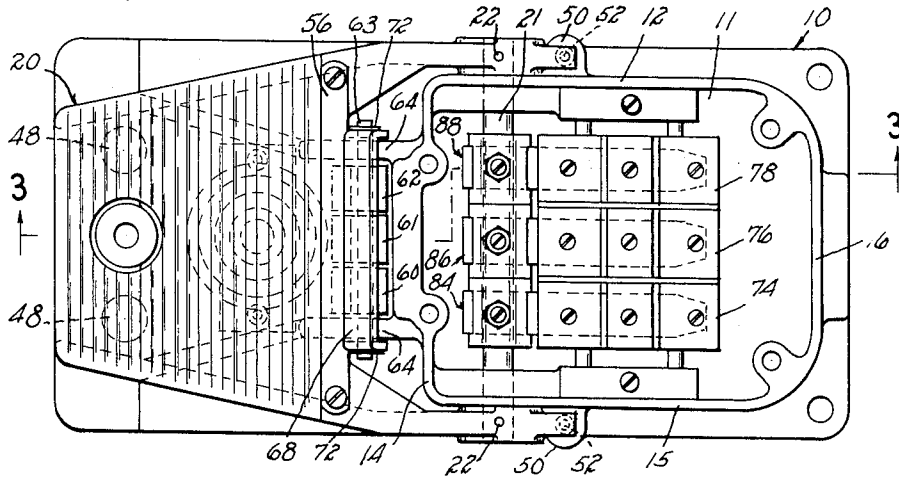
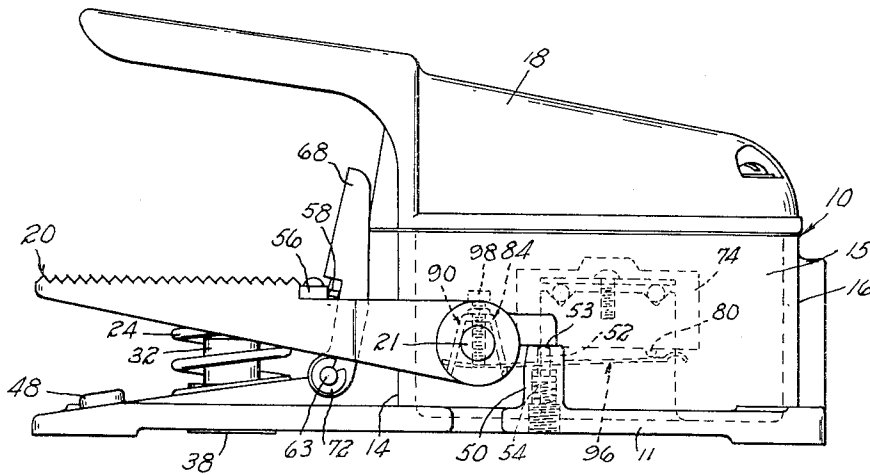


FIG. 2



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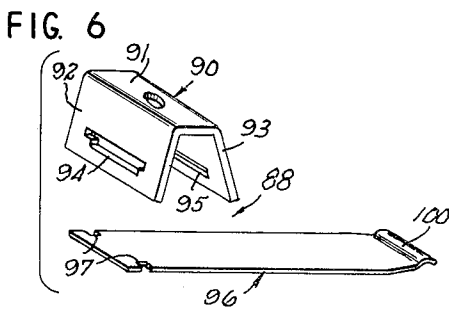
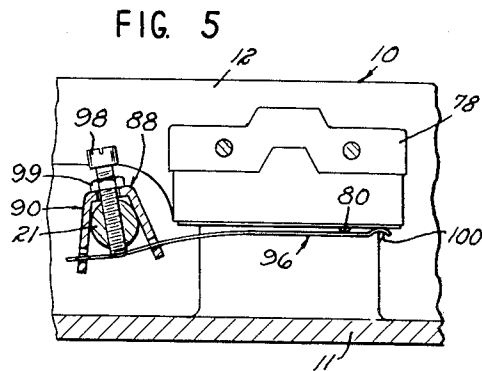
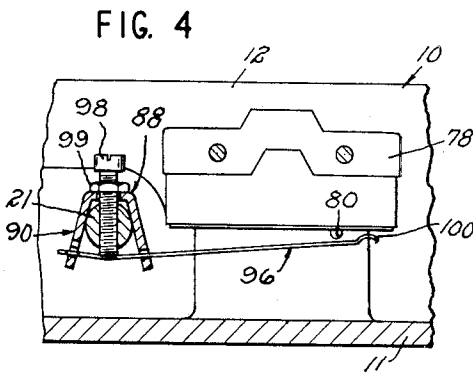
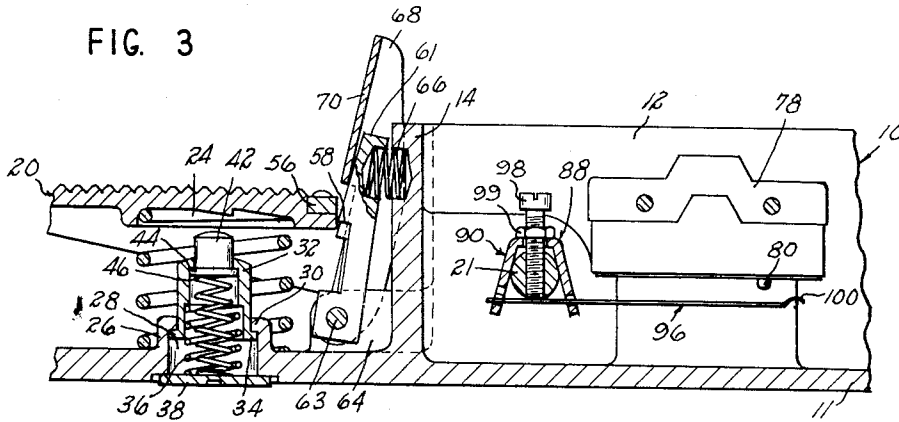
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FOOT SWITCH

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12 Claims. (Cl. 200—86.5)

This invention relates to foot switches and more particularly to novel improvements in multi-stage foot switches.

This invention is primarily concerned with foot switches of the type wherein the treadle of the switch is operatively connected to a plurality of switch actuators respectively associated with a plurality of switches and whereby, as the treadle is depressed through a plurality of predetermined positions, the switches will be actuated in a particular sequence. When it is desired to vary the sequence of switch operation in switches of this type, it is usually necessary either to make a major adjustment or replacement of parts in the switch or to utilize a different foot switch particularly adapted for the sequence desired.

It is a primary object of this invention to provide for use with a multi-stage foot switch of the type described, a novel and improved switch actuating mechanism whereby the operating sequence of the switches controlled by the treadle may be easily varied, at the discretion of the user, by means of a simple minor adjustment in the actuating mechanism so as to provide any desired sequence of switch operation even when the maximum number of stages of the foot switch are not utilized.

It is further an object of this invention to provide a switch of the type described having an improved means for temporarily retaining the treadle in a plurality of depressed positions whereby the number of depressed positions of the treadle or, in other words, stages of operation of the foot switch may be varied, as desired.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings:

Fig. 1 is a top view of a foot switch constructed in accordance with the invention with the cover removed;

Fig. 2 is a side view of the switch of Fig. 1 with the cover in place;

Fig. 3 is an enlarged fragmentary cross sectional view substantially along the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary view, partly in section, of a portion of the switch of Fig. 3 illustrating the adjustment of the switch actuating means;

Fig. 5 is a fragmentary view, partly in section, similar to Fig. 4 and illustrating the switch actuating means in a switch actuating position; and

Fig. 6 is a perspective view of elements of the switch actuating means.

With reference to the drawings, the foot switch shown therein and constructed in accordance with the invention comprises a housing 10 having a base 11, and upright walls 12, 14, 15 and 16 forming an upwardly opening switch compartment. A cover 18 is mounted on the housing 10 and extends substantially the complete

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length of the switch to provide a guard precluding inadvertent contact with the treadle 20 such as by a falling object. A shaft 21 is journaled in the housing and extends through the side walls 12 and 15 thereof. The treadle 20 is fixed for rotation with the shaft 21 by means of dowel pins 22.

With particular reference to Figs. 2 and 3, the treadle is biased upwardly in a clockwise direction, as viewed in Figs. 2 and 3, toward its at rest position by means of a treadle spring 24 one end of which engages the underside of the treadle and the other end of which is engaged about an upwardly extending boss 26 on the base 11. The boss 26 is provided with a recess 28 and a centrally disposed aperture defining an annular lip 30. A tubular cap or cup-shaped element 32 is slidably received in the aperture in the boss 26 and is provided at one end with a shoulder 34 engageable with the lip 30 to limit upward movement of the cap. An auxiliary treadle spring 36 is engaged at one end with a plate 38 mounted on the underside of the base 11 and closing the recess 28. The other end of the spring 36 engages the cap 32 to urge the cap upwardly.

The cap 32 is further provided with a central aperture in which is slidably received a second cap or cup shaped element 42 having an annular shoulder 44 engageable with the rim of the central aperture in the cap 32 to limit upward travel of the cap 42. Mounted coaxially within the spring 36 is a second auxiliary spring 46 engageable at one end with the cap 42 and at the other end with the plate 38 to urge the cap 42 upwardly.

As the treadle is depressed from its at rest position, shown in Fig. 3, in a counterclockwise direction, the main spring 24 will be compressed until the underside of the treadle engages the top of the cap 42 whereupon further depression of the treadle will necessitate compression of the auxiliary spring 46 in addition to the spring 24. It should be evident that sufficient further depression of the treadle will result in the engagement of the underside thereof with the top of the cap 32, whereupon further compression will require the additional compression of the auxiliary spring 36. It is preferable that the treadle springs 24, 36 and 46 be of comparable strength so that a distinct "feel" will be provided when the treadle engages first the cap 42 and then the cap 32.

A pair of rubber bumpers 48 on the base 11 limit counterclockwise movement of the treadle and a boss 50 on the base limits upward clockwise movement thereof. As seen in Fig. 2 a plunger 52 is slidably mounted within the boss 50 and is biased upwardly by a spring 54 received within the boss and retained therein by a threaded plug. The plunger 52 is engageable with the treadle as at 53 during the latter portion of the clockwise movement of the treadle to minimize the shock of engagement of the treadle and the boss 50.

With particular reference to Figs. 1-3, the treadle is provided with a strike plate 56 extending laterally thereof and sequentially engageable with the latching shoulders 58 of a plurality of latching levers 60, 61, 62. The levers 60-62 are pivotally mounted on a rod 63 supported in a pair of spaced apart webs of flanges 64 on the housing 10. Each latching lever is biased in a counterclockwise direction, as viewed in Fig. 3, toward engagement with the strike plate 56 by means of a spring 66 having its end portions disposed in recesses in the latching lever and housing 10, respectively. A latch trip lever 68 is pivotally mounted on the outer end of the rod 63 and is provided with a transversely extending web 70 engageable with the latching levers to move them in a clockwise treadle disengaging direction.

As shown in Figs. 2 and 3, the latching shoulders of the latching levers are disposed at varying distances from

the pivotal axis of the levers. These distances are selected to provide latching engagement of the shoulders with the treadle in three different depressed positions of the treadle corresponding, respectively, to engagement of the treadle with the caps 42 and 32 and the bumpers 48. With the treadle latched in any of its depressed positions, the operator need only kick the latch trip lever 63 to disengage the latching levers and treadle and permit the return of the treadle to its at rest position.

It should be noted that the outer ends of the latching shoulders of the latching levers lie substantially in a straight line approximately parallel to the longitudinal center lines of the levers when the levers are all in the position shown in Fig. 3. In this manner, each of the latching levers will overlie the treadle, when engaged therewith, by approximately the same amount thus necessitating a minimum of movement of the trip lever 63 to disengage the treadle.

The rod 63 on which the latching levers are mounted is retained on the webs 64 by means of easily removable snap rings 72 on the ends thereof. In this manner, the rod 63 may be easily removed from the switch to permit removal of one or more of the latching levers 60-62 in order to condition the switch for one or two-stage operation rather than three stage operation.

Mounted in the switch compartment formed by the base 11 and upright walls of the housing 10 are three electrical switches 74, 76 and 78, each comprising an actuating plunger 80. In accordance with the invention, mounted on the shaft 21 for rotation therewith are three switch actuating mechanisms 84, 86 and 88, respectively associated with the switches 74, 76 and 78. Each of the actuators 84, 86 and 88 are identical, and therefore in the interests of brevity, only the actuator 88 will be described in detail.

The actuator 88 is comprised on an inverted U-shaped bracket 90 having a base 91 along opposite sides of which depend a pair of spaced apart legs 92, 93. The bracket is mounted on the shaft 21 with the legs 92, 93 disposed on opposite side of the shaft and extending outwardly thereof in a tangential direction relative to the shaft. The leg 92 is provided at its outer end with a T-shaped aperture 94 and the leg 93 is provided at its outer end with a rectangular aperture 95 aligned with the aperture 94. Loosely supported at one end by the apertures 94, 95 is an elongated leaf-spring 96 having at one end a pair of notches 97 in its longitudinal edges for the mounting of said one end of the spring within the T-shaped aperture 94.

The spring 96 extends longitudinally in the plane of rotation of the shaft 21, and its free end extends a substantial distance beyond the shaft for engagement with the plunger 80 of the switch 78. A screw 98 extends through the base 91 of the bracket and is threadably received diametrically of the shaft 21 for engagement at its lower end with that portion of the spring disposed intermediate the legs 92, 93 of the bracket. As it will be later explained, the portion of the screw 98 relative to the spring 96 will determine the rotated position of the shaft 21 at which the switch 78 will be actuated. A nut 99 is provided on the screw to lock the screw in selected adjusted position.

In the specific embodiment shown, the actuator 88 is normally associated with the latching lever 62, the latching shoulder of which will engage the treadle in its maximum depressed position. With the spring 96 and screw 98 in the relative positions of Fig. 3, wherein the screw merely engages the portion of the spring intermediate the legs 92, 93 to maintain the spring bottomed in the apertures 94, 95, the switch 78 will be actuated upon depression of the treadle into its maximum depressed position.

When, however, it is desired to actuate the switch 78 in response to depression of the treadle into a position corresponding to treadle engagement with either the lever 60 or 61, the screw 98 is threaded toward the spring 96, as

shown in Fig. 4 to bow that portion of spring, intermediate the legs of the bracket, outwardly of the shaft 21. This deformation of the spring will warp the free end of the spring toward the switch 78. Obviously, with the spring in this deformed condition, a lesser rotation of the shaft 21 from its at rest position is required to engage the spring with the plunger 80. By this simple adjustment of the actuator 88 the switch proper may be conditioned for actuation of the switch 78 in any position of the treadle that is desired.

With the actuator 88 adjusted for actuation of the switch 78 at the first stage of depression of the treadle, or in other words, with the treadle engaged by the latching lever 60, further depression of the treadle through a second and third stage of operation will, of course, result in additional rotation of the shaft 21 and thus the actuator 88. In order to preclude excessive force on the plunger 80 by the spring 96, the spring is provided with a rounded portion or projection 100 at its free end which, as can be seen in Fig. 5, is engageable with the underside of the switch 78. During rotation of the shaft 21 subsequent to actuation of the switch, the projection 100 acts as a fulcrum and serves to maintain the free end portion of the spring substantially parallel to the underside of the switch 78. It is preferred that the height of the projection 100 be such that it will engage the switch 78 just subsequent to the actuation of the switch and that the projection be located relatively closely adjacent the plunger 80 so that, in effect, the portion of the spring 97 engaging the actuator 80 will, during normal operation of the switch, be maintained at a distance from the bottom of the switch corresponding to the height of the projection 99.

Thus, it can be seen that there has been provided a multi-stage foot switch having novel electrical switch actuating means whereby a plurality of electrical switches may be actuated in a preselected and easily varied sequence. Further, the construction of the switch permits the conditioning of the switch for a multi-stage or single stage operation with only a minor adjustment of the switch being necessary to change from one condition to the other. The versatility of a switch constructed in accordance with the invention is, of course, obvious and the switch may be utilized to control a multitude of operations, limited only by the maximum number of electrical switches and stages of operation of the switch.

I claim:

1. In a switch assembly of the type having a movable control member, a switch actuator mechanism comprising an elongated substantially flat spring longitudinally extending in the plane of movement of the control member, a pair of anchors mounted for movement with the control member and loosely engageable with the spring at points spaced apart longitudinally of the spring, and an adjustment member supported on the control member for movement relative thereto at approximately right angles to the spring and being engageable with the portion of the spring intermediate said anchors whereby movement of said adjustment member relative to the anchors will deform said portion of the spring to effect relative movement of one end of the spring in the plane of movement of the control member.

2. In a switch assembly of the type having a movable control member, a switch actuating mechanism comprising an elongated substantially flat spring longitudinally extending in the plane of movement of the control member with one end thereof extending beyond the control member, a pair of spaced apart support members mounted for movement with the control member and provided with a pair of spaced apart apertures receiving the spring, and an adjustment member supported on the control member for movement relative thereto and being engageable with the portion of the spring intermediate said support members whereby movement of the adjustment member relative to the support members will de-

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form said portion of the spring to effect movement of said one end of the spring relative to and in the plane of movement of the control member.

3. In a switch assembly of the type having a movable control member and a switch having a movable operating member, a switch actuating mechanism comprising an elongated substantially flat spring longitudinally extending in the plane of movement of the control member for engagement with the operating member and having a raised portion at one end engageable with the switch subsequent to engagement of said operating member, a support for the spring mounted for movement with the control member and including a pair of anchors loosely engageable with the spring at points spaced apart longitudinally of the spring and an adjustment member supported on the control member for movement relative thereto at approximately right angles to the spring and being engageable with the spring intermediate said anchors.

4. In a switch assembly of the type having a rotatable control shaft, a switch actuating mechanism comprising a pair of support members disposed on opposite sides of the shaft and supported thereon for movement therewith, one of the support members having a T-shaped aperture adjacent the outer end thereof, the other of said support members having an aperture aligned with said T-shaped aperture, a leaf-spring having a notch in each longitudinal edge loosely receivable in said apertures with the notches engaged in said T-shaped aperture and with one end of the spring extending substantially beyond the support members, and an adjustment member supported on the control shaft for movement relative to the support members and being engageable with the portion of the spring intermediate said apertures.

5. In a switch assembly having a rotatable control shaft, a switch actuating mechanism comprising an inverted U-shaped bracket having a base and a pair of legs depending from opposite sides of the base, the bracket being mounted on the support member with said legs on opposite sides of the shaft, each of said legs being provided with an aperture adjacent the lower end thereof, an elongated leaf-spring loosely engageable in the apertures with one end thereof extending a substantial distance beyond said bracket, and an adjustment member threadably received in the shaft with one end extending through the base of the bracket and with its other end being engageable with said spring intermediate said legs.

6. In a foot switch, a treadle mounted for substantially vertical movement, an oscillatable shaft mounted for movement in response to movement of the treadle, a support member mounted on the shaft and comprising a pair of legs extending on opposite sides of the shaft, an elongated leaf-spring, means on said legs loosely engageable with said spring for the support thereof with one end of the spring extending a substantial distance beyond said support member, an adjustment member adjustably supported on said shaft for movement at approximately right angles to said spring and engageable with said spring intermediate said legs, and a switch having a movable actuating member disposed in the path of movement of said one end of the spring.

7. In a foot switch of the type having a treadle mounted for substantially vertical movement and an oscillatable shaft mounted for movement in response to movement of the treadle, a support member mounted on the shaft and comprising a pair of legs extending therefrom on opposite sides of the shaft, a leaf-spring carried by the outer ends of said legs with one end of the spring extending a substantial distance beyond said support member, an adjustment member supported on said shaft for movement at approximately right angles to said spring and engageable with said spring intermediate said legs, and a switch having a body and an actuating plunger mounted with said plunger disposed in the path of movement of

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said spring for engagement thereby inwardly of said one end of the spring, said one end of the spring being provided with a raised portion engageable with the body of said switch subsequent to engagement of the plunger by the spring.

8. In a foot switch, a treadle mounted for substantially vertical movement, an elongated oscillatable shaft mounted for movement in response to movement of the treadle, latching means engageable with the treadle to temporarily latch the treadle in a plurality of depressed positions, a plurality of switch actuating mechanisms carried by said shaft at least equal in number to the number of latching positions of the treadle, each actuating mechanism comprising a support member mounted on the shaft and having a pair of legs disposed on opposite sides of the shaft, a leaf-spring carried by said pair of legs with one end thereof extending a substantial distance beyond the support member, and a selectively adjustable member threadably supported on the shaft for movement at approximately right angles to the spring and engageable with the spring intermediate said legs, and a switch associated with each switch actuating mechanism mounted and having an operating plunger disposed in the path of movement of the associated spring.

9. In a foot switch, a housing, a treadle mounted on the housing for substantially vertical movement, a plurality of springs sequentially and cumulatively engageable with the treadle during depression thereof, a plurality of pivoted latching levers sequentially engageable with the treadle in the depressed positions thereof respectively corresponding generally to engagement of the treadle by said springs, means detachably mounting said levers on the housing, a trip lever pivotally supported on the housing and engageable with said latching levers for disengagement thereof from the treadle, a plurality of switch actuating means mounted for movement in response to movement of the treadle, and a plurality of switches in the housing respectively associated with said switch actuating mechanisms.

10. In a foot switch, a housing, a treadle pivotally mounted on the housing for substantially vertical movement, a plurality of springs sequentially and cumulatively engageable with the treadle during depression thereof, a rod removably supported on the housing, a plurality of latching levers pivotally supported on the rod and engageable respectively with the treadle in depressed positions of the treadle respectively corresponding generally to engagement thereof by said springs, detachable means retaining the rod on the housing, a trip lever pivotally supported on the housing and engageable with said latching levers for disengagement thereof from the treadle, a plurality of switch actuating mechanisms supported on the housing for movement in response to movement of the treadle, and a plurality of switches in the housing respectively associated with said switch actuating mechanisms.

11. In a multiswitch control utilizing a single elongated actuator rotatable about its longitudinal axis for operating a multiplicity of switches in predetermined progression, selective means for said rotary actuator including a discrete element associated with each of said switches for actuation thereof and each said element having at least a resilient portion, and adjustment means for each said resilient portion to preset the contour thereof for establishing the particular sequence of progression for operation of said multiplicity of switches.

12. A selective switch control utilizing a single elongated actuator rotatable about its longitudinal axis for operating several switches in predetermined progression, said rotary actuator comprising switch engageable means including a plurality of elongated elements each disposed for operative engagement with one of said switches and each element having a resilient portion and adjustment means therefor to preset the contour thereof for estab-

lishing the particular sequence of progression for operation of said multiplicity of switches, and a fulcrum on the free end of each of said elongated elements to maintain each said elongated element substantially parallel with a surface of its respective switch during engagement therewith. 5

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