July 1, 1947. C. W. WOOD 2,423,361

DIRECTIONAL SWITCH OPERATING MECHANISM

Filed Oct. 26, 1944

Fig. 1.

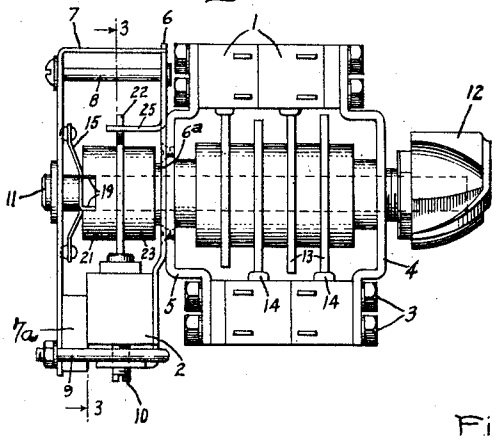


Fig. 2.

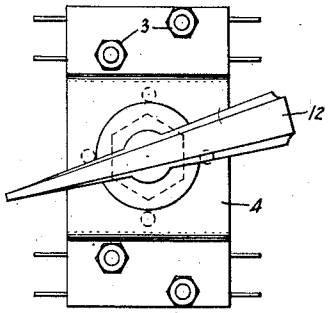


Fig. 3.

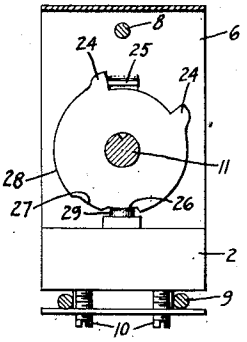
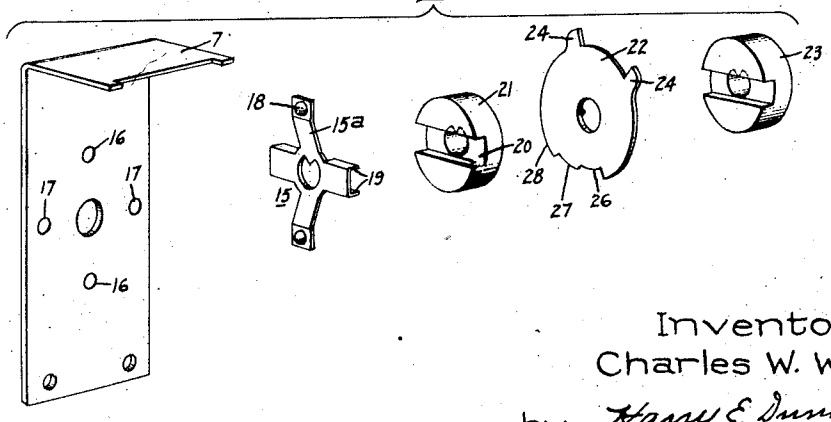


Fig. 4.



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DIRECTIONAL SWITCH OPERATING MECHANISM

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7 Claims. (Cl. 200—5)

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My invention relates to directional switch operating mechanisms, and more particularly to directional switch units for reversible position selector switches.

It is a general object of my invention to provide a new and improved directional unit for a reversible position selector mechanism.

It is a further object of my invention to provide a new and improved direction-responsive reversing switch mechanism for a remote position selector switch.

It is a further object of my invention to provide, in a reversible selector switch having a plurality of predetermined spaced apart positions, means responsive to reversal of movement of the selector mechanism for effecting operation of a reversing switch only after predetermined travel of the selector mechanism in either direction greater than half the distance between adjacent selector positions.

It is customary in positioning control systems, to utilize an electric positioning motor controlled remotely by a multicircuit position selector switch. In some such systems the positioning motor runs only in one direction so that, if the selector control switch is moved backward only a small distance, the positioning motor will run forward through a large number of positions until it reaches the newly selected position. It is desirable, therefore, to provide in connection with the selector switch a motor reversing switch operable in response to reversal of movement of the selector mechanism. With such control the positioning motor will run in the direction of movement of the selector switch and, therefore, take the shortest path between its initial and newly selected positions.

It is not uncommon for an operator of a position selector switch, in moving the switch from one position to another, carelessly or accidentally to override the desired position and then to return the switch to such position by reverse movement. If a direction-responsive reversing switch included in the unit is arranged for actuation immediately upon initiation of reverse selector movement, such overtravel and return will produce an undesired operation of the reversing switch. In order to minimize undesired reversing operations, it has been found desirable to allow overtravel of the selector mechanism greater than half the distance between adjacent selector positions. Accordingly, therefore, my invention provides means for delaying the operation of the directional reversing unit of a selector mechanism in passing from one selected position to another

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in either direction so that the reversing unit is not operated until the selector mechanism has traversed appreciably more than half the distance between two adjacent selector positions.

In accordance with my invention, the above described delay feature is incorporated in a direction-responsive reversing switch by providing a reversing switch of the snap-action type having a definite amount of differential between the switch operating positions of its actuating member. The snap-action switch is actuated by a cam frictionally connected to the selector mechanism and movable between two limiting switch operating positions through an intermediate position within the range of switch differential, so that movement of the cam from either switch operating position to the intermediate position only is ineffective to actuate the reversing switch. The frictional driving connection of the cam allows unlimited overtravel of the selector mechanism in either direction after actuation of the reversing switch.

My invention will be more fully understood and its objects and advantages further appreciated by referring now to the following detailed specification taken in conjunction with the accompanying drawing in which Fig. 1 is a side view of a multiposition selector switch including a directional mechanism embodying my invention; Fig. 2 is an end view of the switch shown at Fig. 1; Fig. 3 is a cross-sectional view taken along the line 3—3 of Fig. 1; and Fig. 4 is an exploded perspective view of certain parts of the directional operating mechanism and selector detent mechanism.

Referring now to the drawing, I have shown my invention applied to a reversible multiposition selector switch including a plurality of position selector switches 1 and a reversing switch 2 of the snap-action type. Preferably, the switches 1 and 2 are of the type described and claimed in Patent 2,332,911, issued on October 26, 1943, to George M. Hausler. As described in the aforesaid patent, these switches are overcenter snap-action switches operated by a rectilinearly movable actuating member having a small amount of differential between its switch operating positions; that is, the actuating member has two spaced apart positions at which the switch contacts snap overcenter in opposite directions of movement of the actuating member. The switches 1 are stacked in two oppositely disposed groups and are clamped between a pair of end plates 4 and 5 by a plurality of through bolts 3. To the outer surface of end plate 5 there is attached, in face

to face relation, an L-shaped plate 6 carrying the reversing switch 2. The reversing switch and its associated directional operating mechanism are mounted between the plate 6 and an oppositely disposed L-shaped end plate 7 connected to the plate 6 by a bolt 8 and a U-shaped strap 9. The strap 9 serves to clamp the switch 2 in position between the plate 6 and a spacing block 7a attached to the plate 7. The switch 2 is vertically adjustable by a pair of bolts 10 in the plate 6.

The plates 4 and 5 are provided with central bearing holes in which is mounted a rotatable selector or operating shaft 11 extending for the full length of the switch unit through aligned holes in the plates 6 and 7 and carrying at one end an operating handle 12. Intermediate the end plates 4 and 5 the operating shaft 11 carries a plurality of operating cams 13 keyed to the shaft and arranged to engage the actuating members 14 of the various position selector switches 1. At its opposite end and adjacent the inner side of the end plate 7, the operating shaft 11 carries a detent spring 15 keyed to the shaft and including a pair of radial spring fingers 15a biased into engagement with the end plate 7. As shown at Fig. 4, the plate 7 is provided with a plurality of pairs of oppositely disposed notches or depressions 16 and 17 positioned for cooperation with a pair of spring pressed balls 18 carried by the spring fingers 15a to provide a positioning detent for the operating shaft 11.

The detent spring 15 is loosely keyed to the shaft 11 so that it is longitudinally slidable but not rotatable with respect thereto. As shown at Fig. 4, the spring 15 carries a plurality of rearwardly extending projections 19. The projections 19 fit into a diametrical slot 20 in a clutching collar 21 carried by the shaft 11, thereby non-rotatably to connect the detent spring to the collar 21. The collar 21 is keyed to the shaft 11 so that it rotates therewith, but is loosely mounted for longitudinal sliding movement with respect to the shaft. Between the clutching collar 21 and the plate 6 the shaft 11 carries also a reversing cam 22 slidably and rotatably mounted upon the shaft and a second clutching collar 23 slidably and non-rotatably keyed to the shaft 11 in the same manner as the clutching collar 21. Thus, the detent spring 15 serves also as a clutch spring in that the inner ends of the spring fingers 15a press the collar 21 against the cam 22 and collar 23. The collar 23 rests against a boss 6a on the plate 6, so that the reversing cam 22 is frictionally held between the fixed collar 23 and the spring-pressed collar 21.

The reversing cam 22 is rotatable between two limiting switch operating positions defined by a pair of spaced abutments 24 on the cam arranged to engage a fixed stop 25 attached to the plate 6 and positioned between the abutments. The angular displacement between the abutments 24 on the cam 22 is nearly equal to the angular displacement between adjacent selector positions of the operating shaft 11. The reversing cam 22 is provided also with a plurality of spaced cam surfaces 26, 27, and 28 engageable with the actuating member 29 of the reversing switch 2 to operate the switch. The cam surfaces 26 and 28 engage the actuating member 29 in the two limiting cam positions, respectively, thereby to maintain the actuating member 29 in one or the other of its spaced switch operating positions. A third cam surface 27 intermediate the surfaces 26 and 28 is positioned to lie within the differential of the actuating member 29, so that it is ineffective to snap the switch 2 overcenter in either direction of movement of the cam.

In operation, my directional reversing switch operating mechanism functions in the following manner. Let it be assumed that, as viewed at Fig. 3, the shaft 11 has last been turned in the clockwise direction and is positioned in one of its selector positions. If, now, the shaft is moved in a counterclockwise direction, the reversing cam 22 will initially move with the shaft by reason of its frictional connection therewith through the clutching collars 21 and 23. As the cam rotates, the reversing switch actuating member 26 first rises from the cam surface 26 to the cam surface 27, but such movement is within the differential of the switch 2, so that the switch 2 is not snapped overcenter. Upon further movement of the shaft 11 toward the next selector position and beyond the midpoint between the two positions, the actuating member 26 rises from the cam surface 27 to the cam surface 28, and in so doing moves the switch 2 overcenter from its initial position to its reverse position. Shortly before the detent balls 18 fall into the next pair of notches in the plate 7, the cam 22 is stopped by engagement of its abutment 24 with the stop 25. The friction clutching connection between the cam 22 and the collars 21 and 23 will now permit unlimited travel of the shaft 11 in a counterclockwise direction without further movement of the cam 22.

If, now, the operating shaft 11 is moved in a clockwise direction, the cam 22 initially moves with the shaft as before. In so moving the switch actuating member 29 first falls from the cam surface 28 to the cam surface 27 without operating the overcenter switch 2. As clockwise movement continues beyond the midpoint between adjacent selector positions, the actuating member 29 falls from the cam surface 27 to the cam surface 26, thereby to snap the switch 2 overcenter from one controlling position to the other.

It will now be evident that, in either direction of movement of the operating shaft 11, my invention provides for operation of the reversing switch 2 upon the completion of more than one-half, and preferably about two-thirds of the movement between adjacent selector positions. Such differential between forward and reverse switch operating positions of the reversing cam 22 is provided by so arranging the intermediate cam surface 27 that the switch 2 will operate in opposite directions only at opposite ends of this intermediate surface. This adjustment is made by the bolts 10. In this way, my mechanism provides for delay in operation of the reversing switch until the selector shaft has passed the midpoint between positions, thereby to allow appreciable overtravel of the shaft 11 beyond its desired position without causing an undesired reversing operation of the switch 2 upon return of the shaft.

While I have described only a preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art and I, therefore, wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

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

1. A directional switch operating mechanism comprising an operating member movable between two predetermined spaced positions, a snap-action switch including a movable actuating member having a predetermined differential

between two spaced-apart switch operating positions, and camming means operatively connected to said operating member for moving said actuating member and including an intermediate cam surface positioned within the differential range of said actuating member thereby to delay operation of said switch beyond the mid-position of said operating member in both directions of movement.

2. A directional switch operating mechanism comprising an operating shaft rotatable between two angularly spaced positions, a snap-action switch including an actuating member having a predetermined differential between spaced switch operating positions, and cam means frictionally connected to said shaft for moving said actuating member and including spaced-apart cam surfaces each positioned to maintain said actuating member in one of said switch operating positions and an intermediate cam surface positioned within the differential range of said actuating member thereby to delay operation of said switch beyond the mid position of said operating shaft in both directions of movement.

3. A directional position selector mechanism comprising a reversible operating member having a plurality of spaced controlling positions, a double throw switch including a movable actuating member having a predetermined differential range between spaced switch operating positions, cam means for moving said actuating member between said switch operating positions, said cam means having an intermediate cam surface arranged to maintain said actuating member within said differential range, means for limiting movement of said cam means in both directions, and clutch means connecting said cam means for movement by said operating member while permitting overtravel of said operating member in either direction.

4. A directional position selector mechanism comprising a rotatable operating member having a plurality of spaced controlling positions, an overcenter switch including an actuating member movable through a differential range between two spaced switch operating positions, cam means frictionally connected to said operating member and arranged to move said actuating member in either direction from one of said switch operating positions to an intermediate position and from said intermediate position to the other of said switch operating positions as said operating member is moved between adjacent controlling positions, said intermediate position being within said differential range in each direction of movement, and means for limiting movement of said cam means.

5. A directional position selector mechanism comprising a rotatable operating member having a plurality of spaced controlling positions, a snap action reversing switch including an actuating member movable through a differential range between two predetermined spaced switch operating positions, cam means for moving said actuating member in either direction from one of said switch operating positions through an intermediate position within said differential range to the other of said switch operating positions, a friction clutch connecting said cam means for movement by said operating member, and stop means for limiting movement of said cam means.

6. A directional position selector switch comprising an operating shaft rotatable between a plurality of spaced controlling positions, a snap-action reversing switch including an actuating member rectilinearly movable through a predetermined differential range between spaced switch operating positions, an operating cam slidably and rotatably mounted on said shaft and having spaced apart cam surfaces each positioned to maintain said actuating member in one of said switch operating positions and an intermediate cam surface positioned to retain said actuating member within said differential range, stop means for restricting rotation of said cam to less than the angular spacing between adjacent controlling positions of said shaft, and a friction clutch connecting said cam for rotation by said shaft.

7. A directional position selector switch comprising a base, an operating shaft rotatable between a plurality of spaced controlling positions, a snap-action reversing switch including an actuating member rectilinearly movable through a predetermined differential range between spaced switch operating positions, an operating cam slidably and rotatably mounted upon said shaft and having spaced apart cam surfaces each positioned to maintain said actuating member in one of said switch operating positions and an intermediate cam surface positioned to retain said actuating member within said differential range, stop means for restricting rotation of said cam to the less than the angular spacing between adjacent controlling positions of said shaft, a pair of clutch collars slidably and non-rotatably mounted upon said shaft upon either side of said cam, and a detent spring slidably and non-rotatably mounted upon said shaft between said base and one of said collars for determining said controlling positions and holding said cam in frictional clutching engagement with said shaft.

CHARLES W. WOOD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,229,981	Mann	Jan. 28, 1941