CAM OPERATED ELECTRICAL SWITCH AND WITH TANGENTIALLY AND RADIALLY THREADABLY ADJUSTABLE CAM FOLLOWER THEREFOR

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ABSTRACT

A cam operated electrical switch construction having a rotatable cam, an electrical switch provided with a moving plunger and a cam follower construction for operating the plunger in response to rotation of the cam relative to the cam follower construction. The cam follower construction has a support pivotally mounted relative to the cam and plunger. A cam follower is carried by the support and a pair of rotatable adjusting members are carried by the support for adjusting the cam follower substantially tangentially and radially of the cam to thereby provide for adjusting cam timing and switch tripping.

18 Claims, 4 Drawing Figures
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This invention relates to an improved cam operated electrical switch construction as well as to an improved cam follower construction for operating such an electrical switch construction or the like.

It is well known that electrical switches can have the operating plungers thereof operated in a timed sequence by a rotatable cam that is adapted to operate a plurality of pivotally mounted cam follower constructions in such a manner that the high or low lobes of the cam cause the cam follower to pivot and act on the switch plungers to either open or close the switches for predetermined periods of time.

In order to adjust each such prior known cam follower relative to the rotatable cam so that the cam follower construction is adjusted tangentially and radially of the cam to provide for adjusting cam timing and switch tripping, the cam follower construction was merely bent by hand at certain elbows thereof to provide such adjustments. Obviously, the difficulty of bending such cam follower construction did not lend itself to achieve a desired accuracy and where a bank of cam followers for a plurality of electrical switches require adjustment, the same required a relatively long period of time to accomplish the desired adjusting function.

However, according to the teachings of this invention, adjusting means are provided for simply and effectively providing the adjusting of the cam follower both tangentially and radially of the cam to accurately and simply adjust cam timing and switch tripping with a minimum of time and effort.

In particular, one embodiment of this invention provides a cam operated electrical switch construction having a rotatable cam, an electrical switch provided with a movable plunger and a cam follower construction for operating the plunger of the electrical switch in response to rotation of the cam relative to the cam follower construction. The cam follower construction has a support means provided with means pivotally mounting the support means relative to the cam and the plunger. A cam follower is carried by the support means. Rotatable adjusting means is carried by the support means for adjusting the cam follower substantially tangentially and radially of the cam to provide for adjusting cam timing and switch tripping. The adjusting means comprises a pair of threaded members for respectively adjusting the cam follower tangentially and radially of the cam by a simple threading and unthreading action.

Accordingly, it is an object of this invention to provide an improved cam follower construction having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide a cam operated electrical switch construction utilizing such a cam follower construction.

Other objects, uses and advantages of this invention are apparent from a reading of this description, which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a side view of a prior art arrangement illustrating a plurality of cam operated electrical switch constructions.

FIG. 2 is a fragmentary side view of the improved cam operated electrical switch construction of this invention.

FIG. 3 is a top view of the cam follower construction of the cam operated switch construction of FIG. 2.

FIG. 4 is an exploded perspective view of the parts of the cam follower construction utilized in the cam operated electrical switch construction of FIG. 2.

While the various features of this invention are hereinafter described and illustrated as being particularly adapted to provide a cam follower construction for operating an electrical switch, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide a cam follower construction for operating other devices as desired.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIG. 1, the prior art arrangement comprising upper and lower banks of cam operated electrical switch constructions is generally indicated by the reference numeral 10 and includes a plurality of cam operated electrical switch constructions each generally indicated by the reference numeral 11 and each comprising an electrical switch 12 having an axially movable actuator plunger 13, a rotatable cam 14 and a pivotally mounted cam follower 15.

The cams 14 are mounted to rotate about an axis 16 while the lower cam followers 15 are mounted to pivot or rotate about an axis 17 disposed parallel to the cam axis 16 while the upper bank of cam followers 15 are pivotally mounted to rotate or pivot about an axis 18 that is also parallel to the cam axis 16.

Each cam follower 15 has one or more ears 19 extending therefrom and having an opening 20 passing therethrough to telescopically receive a rod or shaft 21 which pivotally mounts the particular cam follower 15 on the axis 17 or 18 as the case may be. Each cam follower 15 is suitably bent to provide a first straight leg 22 adapted to engage its free end 23 against the plunger 13 of a particular electrical switch 12 when the leg 22 is permitted to be pivoted downwardly by a suitable spring force (not shown) acting on the cam follower 15 when a low edge 24 of the cam 14 is adjacent an arcuate elbow portion 25 of the cam follower 15.

Each cam follower 15 is also provided with substantially right angled elbows 26 and 27 so that the cam follower portion 25 thereof is positioned above the straight leg 22 by the elbows 26 and 27.

When high cam lobes 28 on the rotatable cam 14 engage against the elbow portion 25 of the respective cam follower 15, the leg 22 is pivoted away from the switch plunger 13 in the manner illustrated in the lower portion of FIG. 1 to permit the plunger 13 to open or close the circuit through the particular electrical switch 12. When the elbow portion 25 of the cam follower 15 is permitted to move against the lobe portion 24 of the cam 14, the switch plunger 13 of the particular switch 12 is moved inwardly in the manner illustrated by the upper switch 12 of FIG. 1 to open or close the switch 12 as the case may be.
Thus, it can be seen that as the cam 14 rotates, the high lobe 28 thereof when making contact with the elbow portion 25 of a particular cam follower 15 will determine just when the particular switch plunger 13 is permitted to move outwardly to change the operative condition of the respective electric switch 12. This switch tripping portion is determined by the radial position of the elbow 25 relative to the cam 14. Also, the time when such cam lobe 28 is to engage the elbow 25 of the cam follower 15, during the rotation of the cam 14 is determined by the tangential position of the elbow 25 relative to the cam 14 whereby the tangential position of the cam follower 15 relative to the cam 14 determines cam timing.

In order to adjust such switch tripping and cam timing for each prior known cam follower 15, a person would bend the cam follower 15 at the elbow 26 to adjust the elbow 25 radially to the cam 14 for adjusting the interval or switch tripping position and would bind the cam follower at the elbow 27 to adjust the tangential position of the elbow 25 relative to the cam 14 for cam timing adjustment, i.e., as to what rotational position the cam lobe 28 is to engage the elbow 25 of the cam follower 15 during the rotation of the cam 14.

Thus, it can be seen that the natural springback characteristics of the material of the cam follower 15 make such bending adjustment difficult and particularly when a fine adjustment is required for a most accurate operation of the switches 12 in connection with the rotation of the cam 14. Because of such difficulty, it has been found that where switch assemblies 10 have eight cam followers 15 to be adjusted it in the above prior art manner, the prior known adjusting procedure required several hours to accomplish the desired adjustment thereof whereas when the feature of this invention was utilized, it was found that a bank of eight cam followers of this invention required only three to five minutes to adjust the same to a desired condition thereof.

Accordingly, the improved cam operated electrical switch construction of this invention and the cam follower construction therefor will now be described.

Reference is now made to FIG. 2 wherein the improved cam operated electrical switch construction of this invention is generally indicated by the reference numeral 30 and comprises a rotatable cam 31, an electrical switch 32 having an operating plunger 33 and a cam follower construction of this invention that is generally indicated by the reference numeral 34.

The cam 31 is adapted to rotate about a fixed axis and has a high side or edge 35 which when engaged against the cam follower construction 34 in a manner hereinafter described will cause the plunger 33 to be held in its "in" position to maintain the electrical switch 32 in one of its operative conditions. However, the cam 31 is provided with a low side or edge 36 that falls off from the high side 35 between the points 37 and 38 as illustrated. Thus, when the cam follower 34 moves from the high surface 35 toward the low surface 36 of the cam 31, the switch plunger 33 is adapted to move outwardly by a spring force in the switch 32 and thereby change the operative condition of the electrical switch 32 when the plunger 33 moves out to a certain position depending upon the radial adjustment of the cam follower construction 34 relative to the cam 31 as will be apparent hereinafter.

The cam follower construction 34 comprises a support plate 39 having a pair of ears 40 extending from opposed side edges 41 and 42 thereof with each ear 40 having an opening 43 passing transversely therethrough to respectively receive a rod or shaft 44 whereby the support plate 39 is pivotally mounted on the rod 44 to pivot relative to the cam 31 and switch 32.

The right hand end of the support plate 39 is upwardly turned to define a right angled flange 45 having a threaded opening 46 passing therethrough and receiving a threaded adjusting member 47 as illustrated. The threaded adjusting member 47 has an unthreaded portion 48 loosely received in an opening 49 passing through an upturned flange 50 of a cam follower plate 51 disposed on top of the support plate 39 as illustrated, the cam follower plate 51 having an arcuate cam follower 52 formed intermediate the ends thereof and being disposed to one side of a rectangular cutout 53 formed in the plate 51 in order to compensate for another cam member disposed adjacent the cam 31 and being adapted to act on a cam follower construction of an upper bank of switches if desired. Of course, the arcuate cam follower 52 could extend completely across the cam follower plate 51, if desired.

The left hand end of the support plate 39 has a threaded opening 54 passing transversely therethrough and receiving another threaded adjusting member 55 having a flat lower end 56 engageable against the plunger 33 of electrical switch 32.

The left hand end of the cam follower plate 51 has an elongated slot 57 passing therethrough and receiving the threaded adjusting member 55 therein. A washer 58 is disposed over the threaded member 55 to rest against the cam follower plate 51 and a lock nut 59 is threaded on the adjusting member 55 to bear against washer 58 and, thus, compact the left hand ends of the plates 51 and 39 together when the nut 59 is tightened for a purpose hereinafter described.

From the above description of the cam follower construction 34 of this invention, it can be seen that the cam follower construction 34 is formed from relatively few parts formed in a simple manner and that the same is provided with a pair of adjusting means or members 47 and 55 which will require merely rotation thereof to provide the tangential and radial adjustment of the cam follower construction 34 relative to the cam 31 for the purpose previously described.

In particular, when it is desired to adjust the cam follower construction 34 of this invention relative to the cam 31 to provide for the adjustment of the cam timing and switch tripping, the operator loosen the lock nut 59 on the threaded fastening member 55 and the tangential position of the arcuate cam follower 52 relative to the cam 31 will be accomplished by turning the threaded fastening member 47 to cause the same to thread to the left or to the right in the opening 46 of the upturned flange 45 of the support plate 39 and such axial movement of the threaded fastening member 47 will cause the cam follower plate 51 to shift to the left or the right on the support plate 39.

If it is desired to also adjust the radial position of the arcuate cam follower 52 relative to the cam 31 for adjusting the switch tripping, the operator merely rotates the threaded fastening member 55 to cause the same to thread into or out of the threaded opening 54 in the support plate 39 to thereby cause the support plate 59 and, thus, the cam follower plate 51 to pivot on the rod 44 toward or away from the cam 31 as the end 56 of
the threaded fastening member 55 is resting on the top of the plunger 33 of the switch 32.

Once the above adjustments have been made by the adjusting members 57 and 55 for one of or both the tangential and radial adjustment of the cam follower 52 relative to the cam 31, the lock nut 59 is tightened on the threaded fastening member 55 to lock not only the cam follower plate 51 to the support plate 39 so that sliding movement therebetween can not be provided, but also to lock the threaded fastening member 55 in its set threaded relation with the support plate 39.

Thus, it can be seen that the cam follower construction 34 of this invention can be readily adjusted by adjusting means 47 and 55 to provide for the aforementioned cam timing and switch tripping adjustments which the prior known cam follower construction required to be accomplished by a physical bending operation of the cam follower construction.

Thus, it can be seen that this invention not only provides an improved cam operated electrical switch construction, but also this invention provides an improved cam follower construction.

While the form of the invention now preferred has been described and illustrated as required by the patent statutes, it is to be understood that other forms can be utilized and all come within the scope of the appended claims.

What is claimed is:

1. A cam follower construction for operating a plunger of an electrical switch comprising support means for being pivotally mounted relative to a cam and said plunger, a cam follower carried by said support means, and rotatable threaded adjusting means carried by said support means for separately adjusting said cam follower substantially tangentially and radially of said cam to thereby provide for adjusting cam timing and switch tripping.

2. A construction as set forth in claim 1 wherein said cam follower is movable relative to said support means.

3. A construction as set forth in claim 3 wherein said adjusting means moves said cam follower relative to said support means when adjusting said cam follower tangentially of said cam.

4. A construction as set forth in claim 3 wherein said support means carries means for securing said cam follower from movement relative to said support means after the desired tangential adjustment has been made.

5. A construction as set forth in claim 1 wherein said adjusting means comprises two separate rotatable adjusting means respectively for adjusting said cam follower tangentially and radially.

6. A cam follower construction for operating a plunger of an electrical switch comprising support means for being pivotally mounted relative to a cam and said plunger, a cam follower carried by said support means, and rotatable adjusting means carried by said support means for adjusting said cam follower substantially tangentially and radially of said cam to thereby provide for adjusting cam timing and switch tripping, said adjusting means comprising two separate rotatable adjusting means respectively for adjusting said cam follower tangentially and radially, said rotatable adjusting means comprising a pair of threaded members.

7. A construction as set forth in claim 6 wherein one of said threaded members is adapted to engage said plunger and thereby provide said radial adjustment of said cam follower.

8. A construction as set forth in claim 7 wherein the other of said threaded members is rotatably mounted to said cam follower and threaded to said support means, said follower being movably mounted to said support means whereby rotation of said other threaded member moves said cam follower relative to said support means and thereby provide said tangential adjustment.

9. A construction as set forth in claim 8 wherein said one threaded member has lock nut means thereon for securing said cam follower from movement relative to said support means after the desired tangential adjustment has been made by said other threaded member.

10. A cam operated electrical switch construction comprising a rotatable cam, an electrical switch having a movable plunger and a cam follower construction for operating said plunger of said electrical switch in response to rotation of said cam relative to said cam follower construction, said cam follower construction having support means provided with means pivotally mounting said support means relative to said cam and said plunger, a cam follower carried by said support means, and rotatable threaded adjusting means carried by said support means for separately adjusting said cam follower substantially tangentially and radially of said cam to thereby provide for adjusting cam timing and switch tripping.

11. A construction as set forth in claim 10 wherein said cam follower is movable relative to said support means.

12. A construction as set forth in claim 11 wherein said adjusting means moves said cam follower relative to said support means when adjusting said cam follower tangentially of said cam.

13. A construction as set forth in claim 12 wherein said support means carries means for securing said cam follower from movement relative to said support means after the desired tangential adjustment has been made.

14. A construction as set forth in claim 10 wherein said adjusting means comprises two separate rotatable adjusting means respectively for adjusting said cam follower tangentially and radially.

15. A cam operated electrical switch construction comprising a rotatable cam, an electrical switch having a movable plunger and a cam follower construction for operating said plunger of said electrical switch in response to rotation of said cam relative to said cam follower construction, said cam follower construction having support means provided with means pivotally mounting said support means relative to said cam and said plunger, a cam follower carried by said support means, and rotatable adjusting means carried by said support means for adjusting said cam follower substantially tangentially and radially of said cam to thereby provide for adjusting cam timing and switch tripping, said adjusting means comprising two separate rotatable adjusting means respectively for adjusting said cam follower tangentially and radially, said rotatable adjusting means comprising a pair of threaded members.

16. A construction as set forth in claim 15 wherein one of said threaded members is adapted to engage said plunger and thereby provide said radial adjustment of said cam follower.

17. A construction as set forth in claim 16 wherein the other of said threaded members is rotatably
mounted to said cam follower and threaded to said support means, said follower being movably mounted to said support means whereby rotation of said other threaded member moves said cam follower relative to said support means and thereby provides said tangential adjustment.

18. A construction as set forth in claim 17 wherein said one threaded member has lock nut means thereon for securing said cam follower from movement relative to said support means after the desired tangential adjustment has been made by said other threaded member.

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