Aug. 7, 1956 M. A. CROUCH 2,758,181

CAM FOLLOWER MECHANISM

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Fig. 1

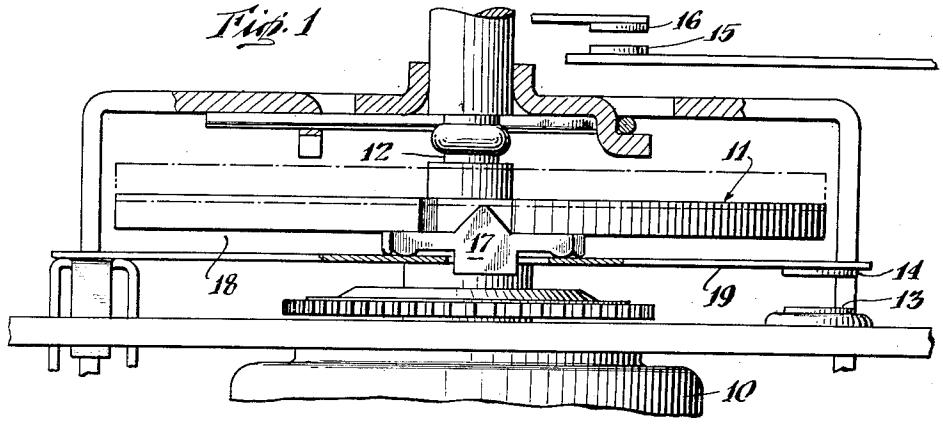


Fig. 2

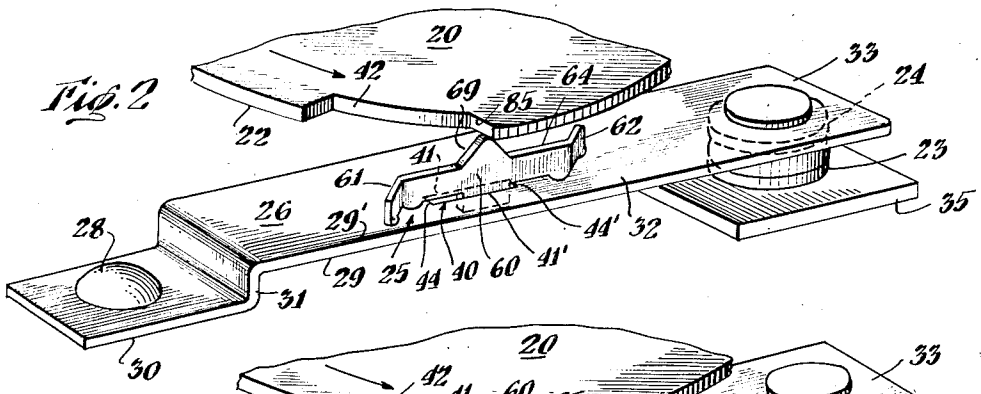


Fig. 3

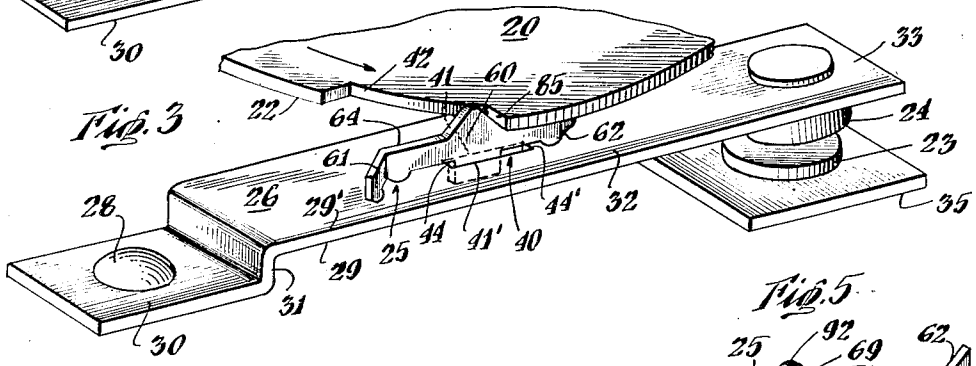


Fig. 5

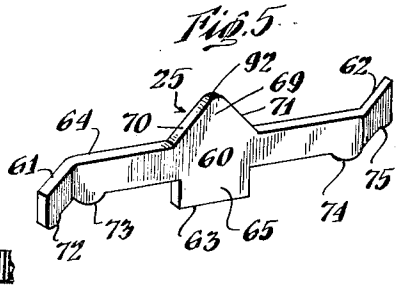
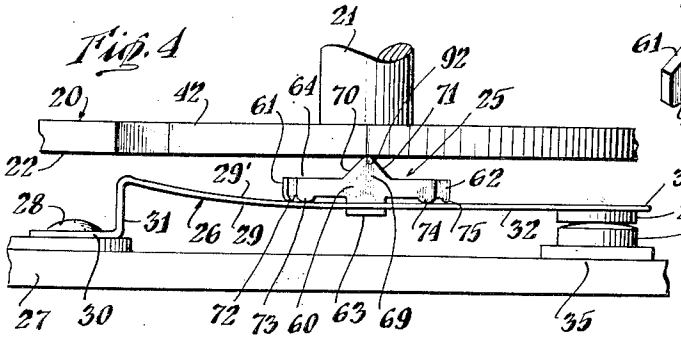


Fig. 4



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CAM FOLLOWER MECHANISM

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10 Claims. (Cl. 200—166)

This invention relates generally to apparatus for sequentially energizing and deenergizing a plurality of electric circuits and has specific pertinency to such devices utilizing cam mechanisms to move the contacts which close individual electrical circuits therein.

In timer devices which use cam followers, a spring arm is motivated or lifted by a cam follower for a time and extent dependent upon the duration of a portion of the cam surface. Inasmuch as it is necessary that rapid follow through take place in accordance with this cam surface setting, so that operation of other related circuits may not overlap, it is highly desirable in such devices to establish a quick break in the contact spring lifter and cam follower. Heretofore, such devices have used overload tensioning mechanisms, pivoting devices and the like. Such structures are cumbersome, expensive to construct and to assemble.

The present invention is directed to providing a combined quick breaking contact spring lifter and cam follower in timer devices. The invention provides a simple and inexpensively constructed slider which gives a quick break, and which eliminates and obviates the necessity for spring or tensioning means to throw the cam follower from one position to another.

The cam follower of the present invention comprises a unitarily formed triangular shaped lifter and slider which is constructed to move laterally in a slot of the arm spring. The follower has a rectangular raised portion which is assembled through the slot in the cam spring and then staked so that it can not fall out but is free to move in the slot. The coefficient of friction between the cam and the cam follower is greater than the coefficient between the cam spring and the cam follower so that as the cam is turned, it is pushed to an extreme end of the slot until it reaches a cut-out in the cam. Then, as the cam continues to turn, a sharp triangular tip on the follower precipitously drops into the cam cut-out to abruptly drop the contact spring so as to open the contacts associated with the cam spring and thus to open the electrical circuit.

It is an object, therefore, of the present invention, to provide in a sequential switch, contact spring lifter and cam follower means having quick contact breaking characteristics.

Still another object of the present invention is to provide a slider mechanism in a cam follower mounted on a cam spring, said slider mechanism having a quick breaking characteristic thus allowing the quick actuation and deactivation of contacts on said spring.

Another object of the present invention is to provide a slidable cam follower loosely mounted in a slot of a cam spring adapted to be activated by a cam in a quick and fast breaking manner.

Yet another object of the present invention is to provide a contact spring member having a cam follower which is adapted to give the spring a vertical movement and which is adapted to move in a slidable manner in said spring member so as to provide a quick breaking action thereto.

The invention in another of its aspects relates to novel features of the instrumentalities described herein for teaching the principal object of the invention and to the novel principles employed in the instrumentalities whether or not these features may be used in the said object and/or in the said field.

Other objects of the invention and the nature thereof become apparent from the following description considered in connection with the accompanying figures of the drawing, wherein like reference characters describe elements of similar function therein and wherein the scope of the invention is determined rather from the dependent claims.

Referring now to the figures of the drawing:

Figure 1 is a cross-sectional view with parts in elevation of the sequential apparatus or timer including the novel spring lifter and slidable cam follower having quick break characteristics used to activate a series of electrical circuits in a predetermined cycle arrangement;

Figure 2 is a profile diagram of the quick break lifter and slider cam follower as adapted to motivate its cooperating cam spring and contacts, said contacts being in closed relationship;

Figure 3 is a profile diagram of the quick break lifter and slider cam follower of Figure 2, showing the position thereof as allowing for quick break operation to give an open relationship between the contacts;

Figure 4 is a cross-sectional view of the spring arm and its cooperating cam follower and lifter shown in Figure 2, as taken along line 4—4 thereof; and

Figure 5 is a detail illustration of the lifter and sliding cam follower of the present invention.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Generally speaking, the present invention provides a quick break mechanism in a cam follower. The cam follower instead of being a stationary mechanism is constructed of a unitarily formed slidable lifter. The lifter has a centrally formed triangular shaped extension which rides on a surface of the rotating cam. The lifter is mounted in a slot formed in its associated cam spring. It is held in a loose manner therein and is staked so that it cannot fall out but is free to move in the slot. The lifter has a greater coefficient of friction between it and the surface of the cam than between said lifter and the cam spring in which the lifter is slidably mounted. As a consequence, the follower-lifter will hold its position in accordance with the contours of the cam until such time as a cut-out or groove appears in the cam. When this happens, the knife edge of the triangular head of the lifter will abruptly drop the cam spring to release or open associated contacts governed by the cam spring.

Referring now to Figure 1, there is shown a sequential timer mechanism comprising generally a motor **10** adapted to turn a series of cams such as **11** on a shaft **12** as by means of suitable reduction gear assembly (not shown). The timer mechanism is adapted to control a series of electrical circuits upon the closing of suitable pairs of contacts **13**, **14** and **15**, **16**. In such a mechanism, the shaft is adapted to control or initiate the series of operations by the use of a pair of line switch contacts **15**, **16** dependent upon the in and out horizontal movement of the cam shaft. The device includes individual cams for controlling pairs of contacts which allow for the make and break of electrical circuits. This is done by having a cam follower **17** ride on the surface **18** of cam **11** and lift and drop a cam spring **19** bearing contacts **13** and **14** up and down, respectively. Inasmuch as different durations and periods may be necessary in the operation of the sequential program of the timer, it is necessary that when one operation is over, that it does not interfere with the subsequent operation of the program. As a

result it is necessary to open and break electrical circuits quickly and effectively.

In Figures 2–5, the quick breaking cam follower and its operation is disclosed. As seen, a cam 20 is adapted to rotate on a cam shaft 21. The cam surface 22 will determine when a pair of contacts 23, 24 will be closed or opened. This is accomplished by having cam follower and lifter 25 move cam spring 26 in a vertical direction so as to have contacts 23, 24 either meet or separate. Cam spring 26, having top and bottom surfaces 29, 29', respectively, is suitably mounted on a frame 27 as by means of rivet 28. Spring 26 comprises a flange portion 30, an extension 31 bent substantially 90° thereto, and a main spring section 32 having a free end 33 to which contact 24 is welded or joined. Opposite to contact 24 is fixed contact 23 suitably mounted on frame 27 at a point 35 thereof. A slot 40, having side walls 41, 41', and end walls 44, 44', is cut or formed substantially centrally in main spring section 32. The length of slot 40 is determined by the extent of lateral excursion desired for the movement of the novel cam follower or lifter. The movement will be defined by the cut-out portion, such as 42, formed in the cam. It is to be noted that the juxtaposition of follower 25 against its associated cam surface engenders a resilience in the spring of such nature that the spring is bowed or arched on engagement of the contacts. Upon release, the inherent resilience characteristic of the spring will aid in snapping the contacts open.

As stated, in the efficient operation of timer devices, separate, distinct and rapid movement of the contacts must be obtained. Cam follower 25 has been so constructed in accordance with the coefficient of frictions established between (1) it and the cam surface and (2) it and its associated spring surface as it is loosely mounted in the slot thereof, that it will provide abrupt disengagement between the contacts. The cam follower (Fig. 5) comprises a unitarily formed thin step-shaped structure comprising a main portion 60 and two dependent portions 61, 62 extending in opposite directions at each end thereof. The lifter comprises edge surfaces 63 and 64. Substantially midway on portion 60 is a rectangular neck extension 65. This extension is adapted to fit within slot 40 of spring 26 and to be supported therewithin by means of deforming its edge 63 so as to stake the same in said slot by means of the overflow of the material on the surface 29 of the cam spring 26 so as to substantially provide guide surfaces thereon. Opposite said neck portion, on edge surface 64, a triangular head portion 69 is unitarily connected having sides 70 and 71 and a sharp edge 92. Further, bearing surfaces 72, 73, 74 and 75 are provided for sliding said lifter along said surface 29' of cam spring 26. Each of these bearing surfaces is hemispherical or cupola-like in shape and is unitarily formed on surface 63 of the lifter at the ends of the dependencies 61, 62 and main portion 60 thereof, respectively.

In the operation of the quick breaking cam follower lifter, as hereinabove described, the coefficient of friction between the cam and the aforesaid cam follower is greater than that between the cam spring and the cam follower. Thus, as the cam is turned counter-clockwise, the cam follower is pushed to one extreme portion of the slot until it reaches the cut-out portion of the cam.

As shown in the figures, the top or sharp edge 92 of the cam follower 25 moves to the very brink 85 of the cut-out 42 and as the cam continues to turn on its shaft, the sharp edge 92 of the cam follower will abruptly drop into the cut-out or groove 42 in the cam. The cam then causes cam follower 25 to move to the other end of slot 40 by an amount determined by the shaped portion of the groove 42 cut in the cam. The abrupt action by which the top of the cam follower or lifter falls precipitously into the groove causes the contact to open quickly and the electrical circuit connected thereto is

immediately broken. Thus, there is provided an extremely efficient and quick acting combination slider and lifter mechanism adapted to break and deenergize electrical circuits without developing arcing or other residual electrical effects.

The invention of the novel combination lifter and cam follower hereinabove described is taken to be merely illustrative and not exhaustive and the scope of the protection to be afforded thereto is to be established by the scope of the claims here appended.

What is claimed is:

1. A contact make and break device comprising a fixed contact, a contact spring having a second contact adapted to be moved in relation thereto, a slot formed in said spring, and a slider mounted within said slot adapted to move in a rotation free manner therein, a portion of said slider adapted to meet a moving member having a cut-out of a determined width, said slider adapted to move said spring in a vertical direction and to slide therein in accordance with the length of said cut-out.

2. A contact make and break device comprising a fixed contact, a contact spring having a free end, a contact placed at said free end adapted to be moved in relation to said fixed contact, a slot formed substantially centrally in said spring, and a slider mounted within said slot adapted to be mounted and to be moved in a rotation free manner therein, a tip portion of said slider adapted to meet a moving member having a cut-out of a determined width, said slider adapted to move said spring in a vertical direction and to slide therein for a distance dependent on the length of said cut-out.

3. A contact make and break device comprising a fixed contact, a contact spring having a free end, a contact placed at said free end adapted to be moved in relation to said fixed contact, a narrow slot formed substantially centrally in said spring, a slider mounted in a rotation free manner within said slot adapted to be mounted so as to be moved therein along its length, and a tip portion of said slider adapted to meet a moving cam having a predetermined cut-out of a determined width, said slider adapted to drop said spring in a vertical direction and to move therein in accordance with the length of said cut-out.

4. A contact make and break device comprising a first contact, a contact spring having a free end, a contact placed at said free end adapted to be moved vertically in relation to said first contact, a narrow slot of a predetermined length formed substantially centrally in said spring, a slider having a rectangular section mounted and staked within said slot adapted to move therein, and a tip opposite a section of said slider adapted to abut a surface of a moving member having a cut-out of a determined width in its periphery, said slider adapted to move said spring and said second contact in a vertical direction against said first contact and to maintain them together as it slides within said slot for a time in accordance with the length of said cut-out.

5. A contact make and break device comprising a first electrical contact, a contact spring having a free end, a contact placed at said free end adapted to be moved vertically in relation to said first contact, a narrow slot of a predetermined length formed substantially centrally in said spring, a slider having a rectangular section mounted and staked within said slot adapted to move therein, and a tip opposite said section of said slider adapted to abut a surface of a moving member having a cut-out of a determined width in its periphery, said slider adapted to move said spring and said second contact in a vertical direction against said first contact and to maintain the same thereagainst in accordance with the friction characteristic established between said slider and said surface of said moving member and to slide therein in accordance with the length of said cut-out.

6. A contact make and break device comprising a fixed contact, a contact spring having a free end, a contact thereat adapted to be moved vertically in relation to said

fixed contact, a narrow slot having sides formed centrally in said spring, and a slider penetrating said spring staked between said sides within said slot and adapted to move therein, a raised portion of said slider having a knife edge adapted to ride on the surface of a moving member and to maintain a position of said contacts, said member having a cut-out in the periphery thereof of a determined width, said slider adapted to move said spring from said first position sharply in a vertical direction at the beginning of said cut-out and to remain therein in accordance with the length of said cut-out.

7. A cam follower and contact lifter adapted to be used with a contact spring having a slot formed therein comprising, a thin strip, said strip having top and bottom edges respectively, a rectangular neck portion formed on one of said edges thereof and depending vertically therefrom, and a head section formed on said other edge opposite said neck portion, said neck portion adapted to fit within said slot of said contact spring so as to loosely mount and slide the same therewithin.

8. A cam follower and contact lifter adapted to be used with a contact spring having a slot formed therein comprising a thin strip, said strip having top and bottom edges respectively, a neck portion formed substantially centrally on one of said edges thereof, a tapered head section formed integrally on said other edge opposite said neck portion, said neck portion adapted to fit within said slot of said contact spring so as to loosely mount said portion in said slot on the surface of said spring so that the lifter may move therewithin, a pair of oppositely disposed perpendicular portions bent from said strip at each end thereof, and bearing surfaces formed thereon whereby said lifter is adapted to move along the surface of and to be guided within said slot of said contact spring.

9. A cam follower and contact lifter adapted to be

used with a contact spring having a slot formed therein comprising a strip, said strip having top and bottom edges respectively, a rectangular neck portion formed substantially centrally on one of said edges thereof, and a tapered head section formed integrally on said other edge opposite said neck portion, said rectangular portion adapted to fit within said slot of said contact spring, said rectangular portion having an edge deformed so that portions thereof overflow the sides of said spring slot to loosely mount said portion in said slot on the surface of said spring so that the lifter may move therewithin.

10. A cam follower and contact lifter adapted to be used with a contact spring having a slot formed therein comprising, a thin unitarily formed strip, said strip having top and bottom edges respectively, a rectangular neck portion formed substantially centrally on one of said edges, a triangular head section formed integrally on said other edge opposite said neck portion, said rectangular portion adapted to fit within said slot of said contact spring, said rectangular portion having an edge deformed so that portions thereof overflow the sides of said spring slot to loosely mount said portion in said slot on the surface of said spring so that the lifter may move therewithin, a pair of oppositely disposed perpendicular end portions made in said strip, and bearing surfaces formed at each end of said portions whereby said lifter is adapted to move and be guided within said slot of said contact spring.

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