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J. L. HARRIS

2,657,283

CONTROL DEVICE

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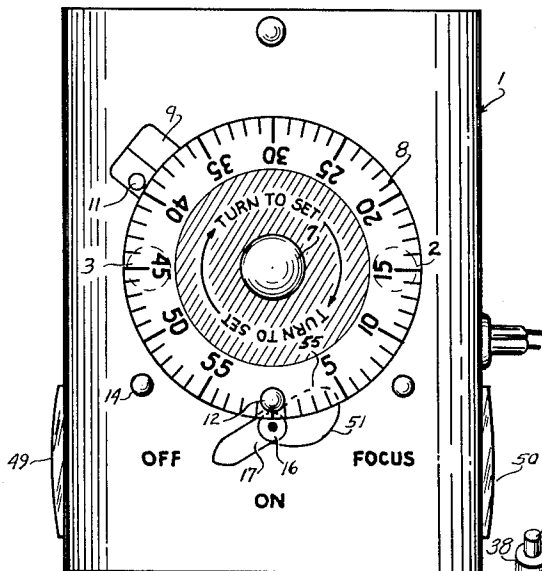


Fig. 1

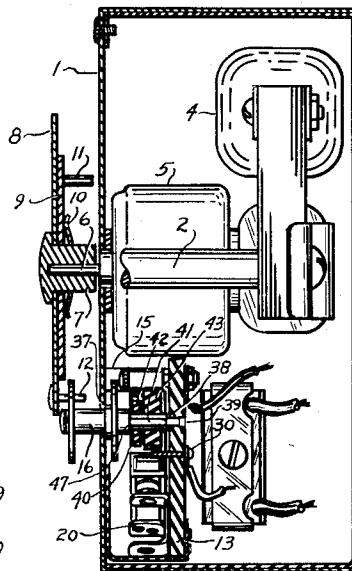


Fig. 2

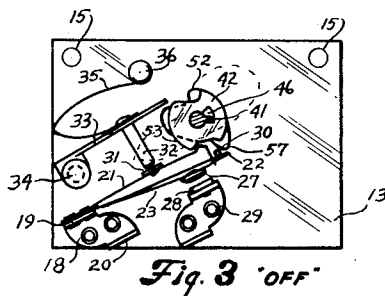


Fig. 3 "OFF"

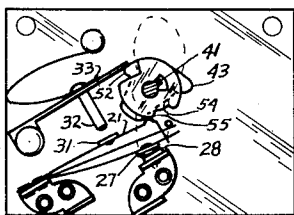


Fig. 4 "ON"

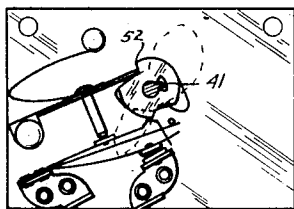


Fig. 5

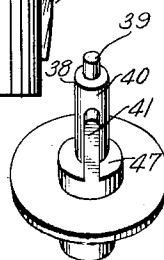


Fig. 9

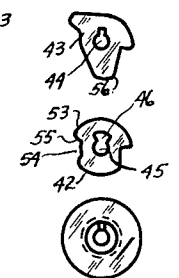


Fig. 8

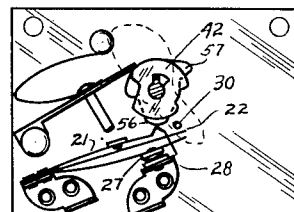


Fig. 6 "FOCUS"

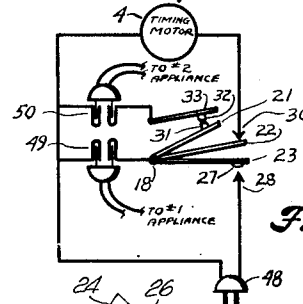


Fig. 10

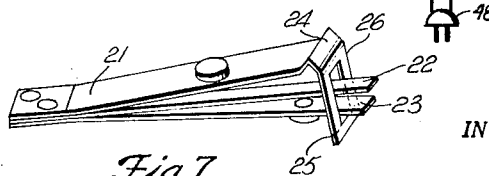


Fig. 7

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2,657,283

CONTROL DEVICE

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8 Claims. (Cl. 200—38)

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The present invention relates in general to a switching mechanism and more particularly to switches adapted for use in timing apparatus.

One object of the invention is to provide a simple and positive drop off cam type switch mechanism in which a single cam is capable of providing an abrupt drop-off action of its cam follower upon movement in one direction and is also capable of lifting its cam follower upon movement in the opposite direction.

A further object of the invention is the provision of a switching mechanism which is simple and positive in construction and which provides a plurality of switching operations in a predetermined sequence.

Other objects of the invention will appear from the following description and the appended claims.

For a full disclosure of the invention, reference is made to the following detailed description and to the accompanying drawings in which:

Fig. 1 is an external front view of a timer embodying the invention;

Fig. 2 is a side view partly in section of the timer shown in Fig. 1;

Figs. 3, 4, 5 and 6 show the switch blades and cams in different positions assumed during operation;

Fig. 7 is a perspective view of a portion of the switch blade assembly;

Fig. 8 is an exploded view of the cam shaft assembly;

Fig. 9 is a perspective view showing the rear section of the cam shaft, and,

Fig. 10 is a wiring diagram illustrating one application of the invention.

Referring to Figs. 1 and 2, reference character 1 indicates a case section to which are secured motor mounting studs 2 and 3 which support a synchronous motor comprising a field core and coil assembly 4 and a gear train barrel 5. Extending from the front of the gear train barrel and through the front of the case is a final shaft 6 which carries a hub 7. This hub is provided with a shoulder at its front end and carries a dial 8 and an operating finger member 9. The dial 8 and finger member 9 are pressed against the shoulder of the hub by a spring clip 10. This arrangement provides a slip friction drive for the dial and finger member by the hub. It also provides a slip frictional engagement between the dial and finger member so that these parts may be relatively adjusted. The finger member is provided with a rearwardly extending pin 11 and the dial is provided with a rearwardly extend-

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ing pin 12. The function of these pins will appear as this description proceeds.

Located inside the case is a switch mounting plate 13. This plate may be secured to the case by means of screws 14 and spacers 15. The case and switch plate serve as bearings for a cam shaft 16, this shaft extending through the case and carrying a pointer 17 which operates the switch mechanism and indicates the position of such mechanism.

Referring to Fig. 3 the switch mounting plate 13 carries a bracket 18 which is generally U-shaped, having an out-turned blade carrying portion 19 and a lead terminal portion 20. This bracket carries a switch blade or cam follower 21, an intermediate switch blade 22 and an outer switch blade 23. As shown more clearly in Fig. 7, the cam follower blade is provided with an offset portion 24 and an out-turned portion 25. This out-turned portion is provided with an opening 26 through which the ends of blades 22 and 23 extend. This provides a lost motion connection between the cam follower blade and the switch blades. The switch blade 23 carries a contact 27 which cooperates with a stationary contact 28 mounted on a bracket 29 which is similar to the bracket 18. The switch blade 22 is adapted to engage a pin 30 which extends through the mounting plate 13. The switch blade 21 carries a contact 31 which cooperates with a contact 32 carried by a cam follower 33 which is pivoted to the mounting plate at 34. This cam follower is biased downwardly by means of a U-shaped spring member 35 secured to a post 36 carried by the mounting plate.

Referring to Fig. 2, the cam shaft 16 is provided with a shoulder 37 which bears against the inside of the case. This shaft is also provided with a shoulder 38 bearing against the plate 13. A reduced portion 39 of the shaft extends into a hole in the plate 13. The cam shaft is thus maintained between the case and the plate 13 by means of the two shoulders. The cam shaft 16 also includes a reduced portion 40 provided with a key 41. (This construction is shown more clearly in Fig. 9.) The cam shaft supports cams 42 and 43. The cam 43 is provided with an opening 44 which fits tightly on the cam shaft. The cam 42 is provided with an opening 45 which fits loosely on the cam shaft, this opening having a section 46 which is considerably larger than the key 41 on the shaft. This arrangement provides a lost motion drive between the cam 42 and the shaft. It will be noted that the cam 42 is held in place on the shaft between the cam 43

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and a shoulder 47. In assembly, the cam 43 is pressed on the shaft so as to provide a slight clearance for the cam 42 so as to allow cam 42 to ride freely on the shaft.

The specific application of the embodiment of the invention shown is to control a photographic enlarger and name printer. In this type of apparatus it is desired to operate the enlarger for periods of adjustable duration. Approximately $1\frac{1}{2}$ seconds before the enlarger is turned off the name printer should be turned on, the name printer and enlarger being turned off simultaneously at the end of the timing period. Fig. 10 shows the wiring diagram employed for obtaining this function. As shown in this figure, the contact 38 is connected directly to one terminal of an appliance plug 48. The other side of the appliance plug is connected to a receptacle 49 for the enlarger, and also to an appliance receptacle 50 for the name printer. This line is also connected to one side of the timing motor 4. The other side of the name printer receptacle 50 is connected to the cam follower 33 while the other side of the enlarger receptacle 49 is connected to the bracket 18 supporting the three switch blades. The pin 30 is connected to the other side of the timing motor. The circuits for the various devices will be traced in the explanation of operation.

Operation

With the parts in the positions shown in Figs. 1 and 3 the device is in the "off" position. At this time the pointer 17 points to the word "Off" on the front of the case. In this position contacts 27 and 28 are open, the switch blade 22 is engaged with the pin 30 and the contacts 31 and 32 are closed. For operating the device the operator sets the finger member 9 on the dial for the timing desired. The operator then rotates the finger member in a clockwise direction until the pin 11 strikes the shaft 16. As the pin 11 approaches the shaft 16, it engages a cam section 51 on the pointer causing the pointer to revolve the shaft 16 in a counterclockwise direction to the "on" position. During the initial portion of the stroke the cam 42 remains stationary as the key 41 on the shaft is not engaged with the end of opening 46 in the cam. However, the cam 43 is fixed on the shaft and revolves immediately. This cam is provided with a drop off section 52 which slips under the cam follower 33 as appears in Fig. 4.

It will be noted that the cam 42 is provided with a raised portion 53 and a recessed portion 54 which are joined by a sloping portion 55. As cam 42 rotates counterclockwise, the inclined portion 55 engages the cam follower and causes it to move downwardly to the position shown in Fig. 4 in which the contacts 27 and 28 are engaged. At this point, it should be noted that switch blade 23 is biased in the direction for holding contacts 27 and 28 engaged. The cam follower blade, however, has the bias of blade 22, and thus force greater than the bias of blade 22, and thus holds the contacts open when in the position shown in Fig. 3. However, when the cam follower is depressed as shown in Fig. 4 it releases blade 22, permitting this blade to hold contacts 27 and 28 closed.

Preferably, the parts are proportioned so that on downward movement of the cam follower contacts 31 and 32 disengage before contacts 27 and 28 engage. This prevents the name printer from flashing on and off during the "off" to "on" stroke of the cam shaft.

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Summarizing the action in the "off" to "on" stroke, the cam 43 slips under the cam follower 33 before the lost motion of cam 42 is taken up. When the lost motion between cam 42 and the shaft is taken up, this cam drives the cam follower blade 41 downwardly, first breaking contacts 31 and 32 and then permitting contacts 27 and 28 to engage. The switch blade 22 remains engaged with the contact 30 during this entire portion of the stroke.

Referring to Fig. 10 it will be noted that closure of contacts 27 and 28 energizes the enlarger receptacle 49. Power also passes from the blade 23 through blade 22 and post 30 to the timing motor. The name printer receptacle 50 is deenergized due to contacts 31 and 32 being open.

The timing motor now drives the dial and finger member in a counterclockwise direction. As the end of the timing period approaches, the pin 12 on the dial engages the upper extension 55 of the pointer and begins to rotate the shaft 16 in a clockwise direction. During the initial portion of this clockwise stroke, the cam 42 remains stationary as the lost motion between the cam and shaft in this direction has not been taken up. The cam 43, however, begins to rotate immediately and the drop off 52 on this cam permits the cam follower to drop thereby permitting contacts 31 and 32 to engage. This stage of the cycle is shown in Fig. 5. Contacts 31 and 32 now energize the name printer. As the dial continues to rotate the cam shaft likewise continues to rotate, taking up the lost motion between the cam 42 and the shaft. The cam then rotates until the cam follower rides down the sloping portion 55 of the cam. Inasmuch as the lost motion drive now permits free rotation of the cam 42 in the clockwise direction, the cam snaps forwardly under the driving action of the cam follower, permitting the cam follower to reach the bottom section 54 of the cam. During this movement the cam follower blade 21 pulls the switch blade 23 upwardly so as to break contacts 27 and 28. This movement of the blade 31 also lifts the cam follower 33 upwardly clear of the drop off section 52 of the cam 44. This movement of cam follower 33 results from the bias of cam follower toward the cam being greater than that of cam follower 32. The parts thus reassume the positions shown in Fig. 3.

At times it is desirable to turn on the appliance without having it turn off automatically. For example, when an enlarger is being focused, the time desired for this operation may be in excess of the maximum timing provided by the timer. To obtain this result, the pointer is turned to "Focus" and the parts then assume the position shown in Fig. 6. In this position the cam 43 has rotated so that its enlarged portion 56 has carried the cam follower blade 21 away from the cam 42 to a position in which it presses the switch blade 22 away from contact with the pin 30. This breaks the timer motor circuit while maintaining the main contacts 27 and 28 in closed position. The appliance thus remains energized until the pointer 17 is moved away from the "focus" position.

It should be noted that the pin 30 cooperates with the cam 43 for limiting rotation of the cam shaft. Thus the extension 53 of the cam 43 strikes the pin 30 for limiting the travel of the shaft in the counterclockwise direction. The extension 57 of the cam 43 strikes the pin 30 for limiting clockwise rotation of the shaft. (See Fig. 3.)

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Referring to Fig. 3, it should be noted that the free end of the cam follower is positioned to one side of the cam shaft center so that the arc of travel of the free end of the cam follower is on an angle of about 45° with the arc of travel of the cam surfaces. With this arrangement the rotation of the cam has a direct lift component on the cam follower. This reduces the friction between the cam and cam follower and permits the cam follower to operate the switch with a minimum of force.

From the foregoing description it will be apparent that the present invention provides the simple switch mechanism in which the switch may be set by rotation of the shaft in one direction while still obtaining abrupt drop off action when the shaft is rotated in the opposite direction to a predetermined point. It will be further apparent that the invention provides a simple and positive sequence switching mechanism. While the invention has been described specifically as applied to an enlarger timer, the general principles of the invention are applicable for many other uses. Also, many changes may be made in construction without departing from the spirit and scope of the invention. It is, therefore, desired to be limited only by the scope of the appended claims.

What is claimed is:

1. In a switch construction, the combination of, a rotatable shaft, a first cam loosely mounted on said shaft, lost motion drive means between the first cam and said shaft, a second cam rigidly mounted on said shaft, contact mechanism, a first cam follower arranged for actuation by said first cam for controlling said contact mechanism, and a second cam follower arranged for actuation by the said second cam for also controlling said contact mechanism.

2. In a switch construction, the combination of, a rotatable shaft, a first cam loosely mounted on the shaft, lost motion drive means between the first cam and said shaft, a second cam mounted on the shaft, switching means including first and second cam followers, the first cam follower riding the first cam on one side of the shaft and the second cam follower riding the second cam on the opposite side of the shaft, both of the cam followers being biased toward the shaft and the first cam follower being biased sufficiently to overcome the bias of the second cam follower, the first cam having a relatively high portion and a relatively low portion connected by a sloping portion arranged so that the first cam follower can ride from the low portion to the high portion as the cam is rotated in one direction by the shaft, the lost motion drive means between the first cam and the shaft permitting snap movement of the cam when rotated in reverse direction by the shaft, said second cam having an abrupt drop off, and means whereby snap movement of the first cam follower toward the shaft causes movement of the second cam follower away from the shaft sufficiently to clear said abrupt drop off.

3. In a switch construction, the combination of, a rotatable shaft, a first cam loosely mounted on the shaft, lost motion drive means between the first cam and said shaft, a second cam mounted on the shaft, switching means including a first set of contacts and a second set of contacts, a first cam follower riding the first cam on one side of the same and arranged to control both sets of contacts, a second cam follower riding the second cam on the side of the

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shaft opposite said first cam follower, said second cam follower being arranged to control one of said sets of contacts conjointly with the first cam follower, both of the cam followers being biased toward the shaft and the first cam follower being biased sufficiently to overcome the bias of the second cam follower, the first cam having a relatively high portion and a relatively low portion connected by a sloping portion arranged so that the first cam follower can ride from the low portion to the high portion as the cam is rotated in one direction by the shaft, the lost motion drive means between the first cam and the shaft permitting snap movement of the cam when rotated in reverse direction by the shaft, said second cam having an abrupt drop off, and means whereby snap movement of the first cam follower toward the shaft causes movement of the second cam follower away from the shaft sufficiently to clear said abrupt drop off.

4. In a switch construction, an electric timing motor, a shaft arranged to be rotated in one direction by the timing motor, manual means for rotating the shaft in the opposite direction, a cam freely supported by said shaft, a cam follower biased against the cam, a switch for controlling the timing motor comprising a stationary contact and a flexible switch blade biased toward said stationary contact and away from the cam follower, a lost motion connection between the cam follower and switch blade, the bias of the cam follower being greater than that of the switch blade whereby the cam follower on motion toward the cam causes the switch blade to disengage the stationary contact, lost motion drive means between the cam and shaft, said cam having a relatively low portion and a relatively high portion connected by a sloping portion arranged so that the cam follower can ride from the low portion to the high portion as the cam is rotated in one direction, said lost motion drive means between the cam and shaft permitting snap movement of the cam when rotated in the reverse direction by the shaft, said snap movement of the cam being caused by the bias of the cam follower acting on the sloping portion of the cam.

5. In a switch construction, an electric timing motor, a shaft arranged to be rotated in one direction by the timing motor, manual means for rotating the shaft in the opposite direction, a cam freely supported by said shaft, a first stationary contact, a first flexible switch blade cooperating with said first stationary contact, a second stationary contact, a second switch blade cooperating with the second stationary contact, a cam follower biased against the cam, lost motion connecting means between the cam follower and said switch blades, lost motion drive means between the cam and shaft, said cam having a relatively low portion and a relatively high portion connected by a sloping portion arranged so that the cam follower can ride from the low portion to the high portion as the cam is rotated in one direction, said lost motion drive means between the cam and shaft permitting snap movement of the cam when rotated in the reverse direction by the shaft, said snap movement of the cam being caused by the bias of the cam follower acting on the sloping portion of the cam.

6. In a switch construction, the combination of, a rotatable cam means, means for rotating said cam means in either direction, a first cam follower on one side of the cam means and biased against the same, a second cam follower on the

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other side of the cam means and biased against the cam means with a force greater than the first cam follower, contact means controlled by said cam followers, said cam means being provided with drop off portions arranged so that upon rotation of the cam means in one direction the first cam follower drops off and upon continued rotation of the cam means in the same direction the second cam follower drops off, means actuated by dropping off of the second cam follower for lifting the first cam follower clear of the cam means, and means for holding said cam follower in said clear position upon reverse movement of the cam means.

7. In a switch construction, a first stationary contact, a first switch blade biased against said first stationary contact, a second stationary contact, a second switch blade biased against said second stationary contact, said switch blades being biased in opposite directions, a cam, a cam follower biased against the cam with a force sufficient to overcome the bias of one of said switch blades, and lost motion connecting means between the cam follower and both of said switch blades.

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8. In a switch construction, a first stationary contact, a first switch blade biased against said first stationary contact, a second stationary contact, a second switch blade biased against said second stationary contact, said switch blades being biased in opposite directions, a cam, a cam follower biased against the cam with a force sufficient to overcome the bias of one of said switch blades, lost motion connecting means between the cam follower and both of said switch blades, a second cam arranged to operate said cam follower, an actuator for both of said cams, and lost motion drive means between one of said cams and said actuator.

JOHN L. HARRIS.

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