

# United States Patent

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 [73] Assignee **General Electric Company**

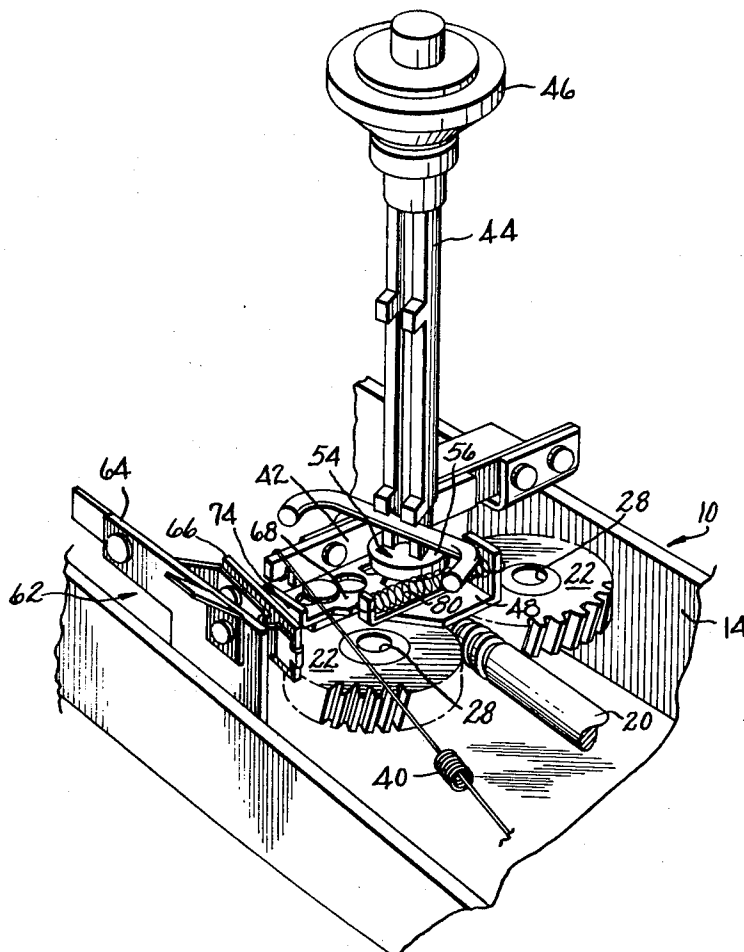
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[54] **SWITCH AND SPEED CONTROL MECHANISM**  
**5 Claims, 6 Drawing Figs.**

[52] **U.S. Cl.**..... **200/80,**  
 259/1, 259/102  
 [51] **Int. Cl.**..... **H01h 35/10**  
 [50] **Field of Search**..... **200/80;**  
 259/102, 1; 318/325; 310/50

**ABSTRACT:** The disclosure herein shows an improved switch and speed control mechanism for an electric power tool such as a food mixer to provide accurate speed control when the mixer is in operation and employing novel positive and audible snap-action structure for shutting down the control circuit when the mixer is inoperative.



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Fig. 1.

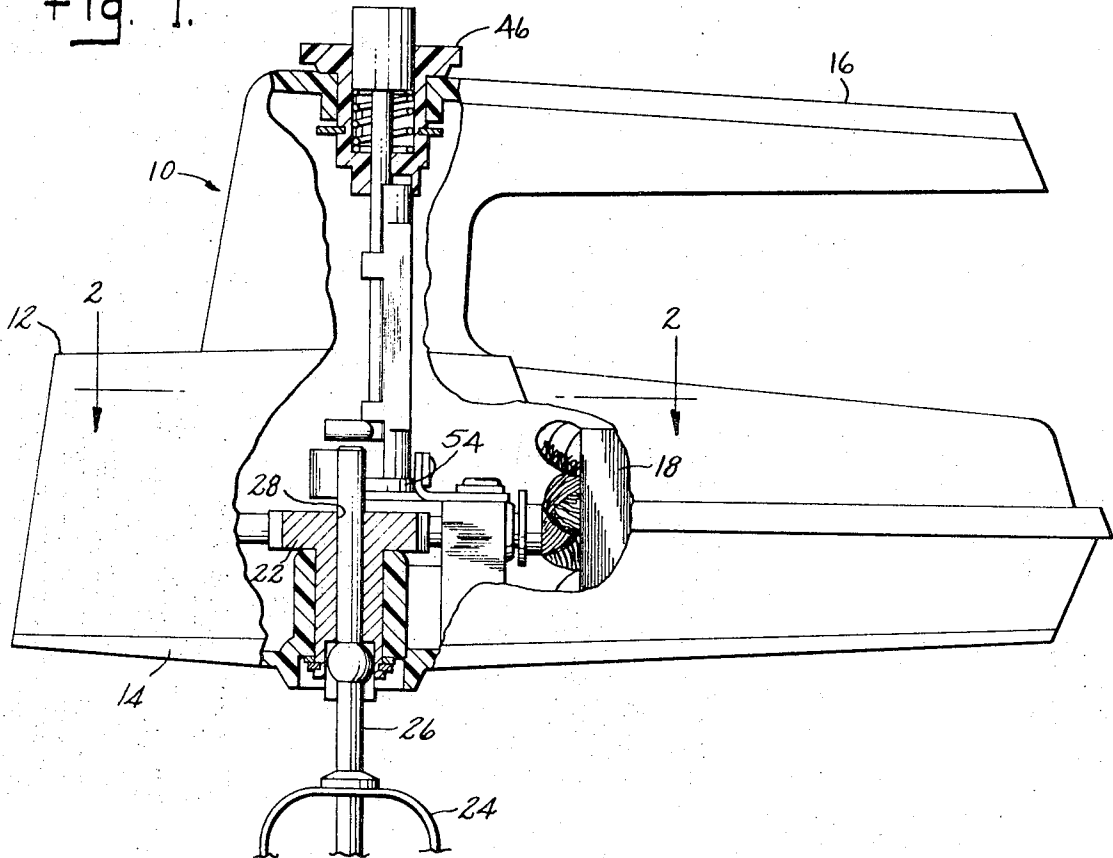
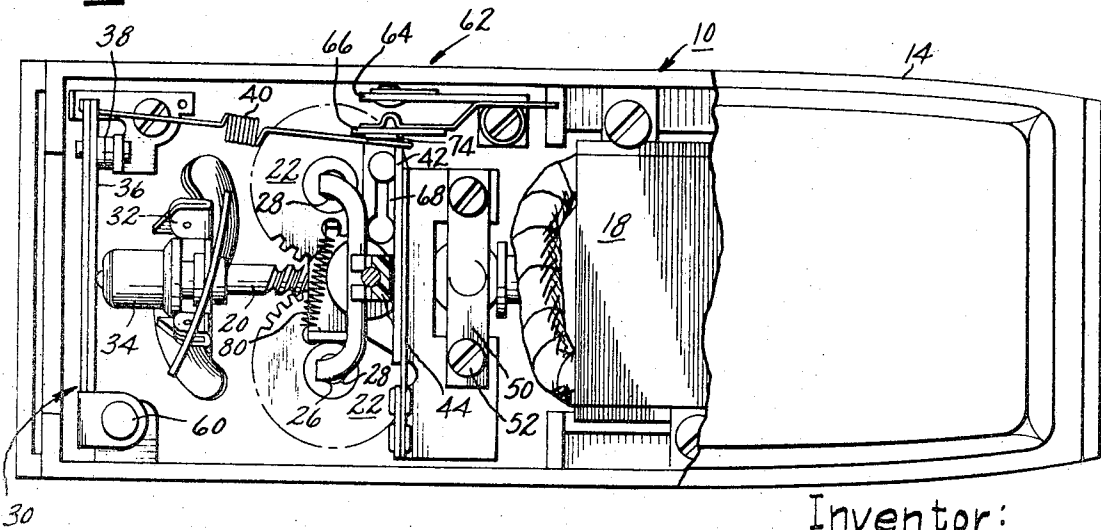


Fig. 2.



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Fig. 3.

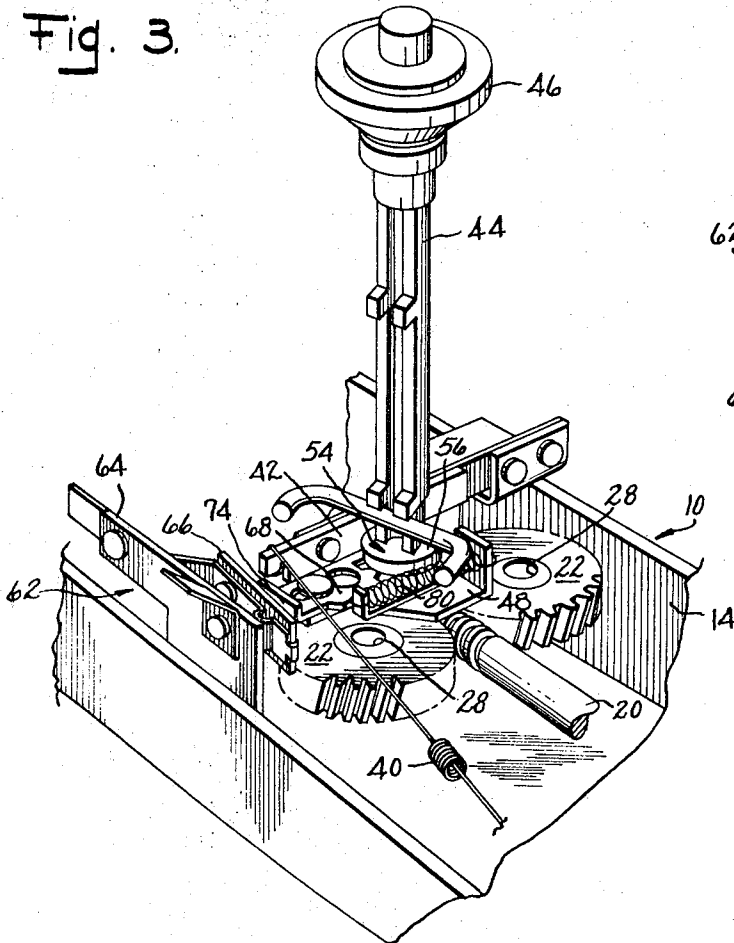


Fig. 5.

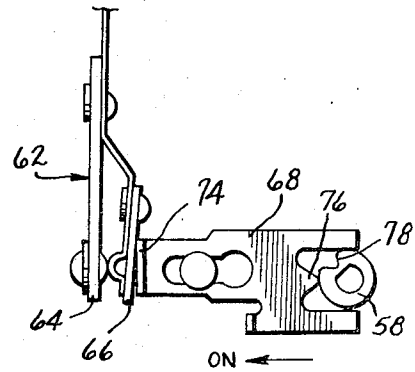


Fig. 6.

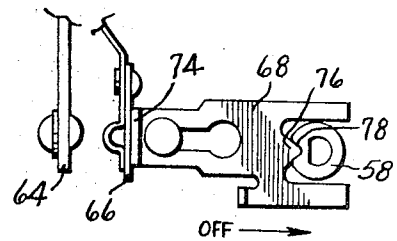
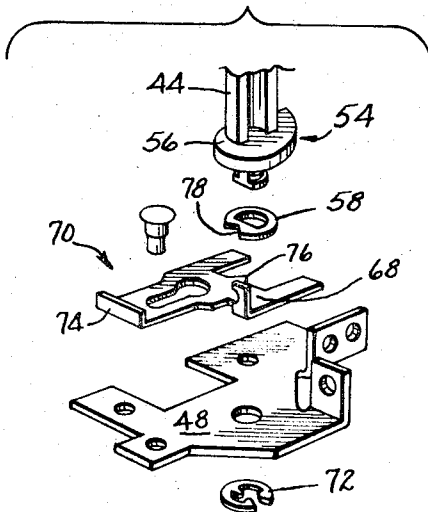


Fig. 4.



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# SWITCH AND SPEED CONTROL MECHANISM

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The invention herein is an improvement in the structure disclosed in Pat. No. 3,497,650 dated Feb. 24, 1970 of common assignment which pertains to a switch and speed control mechanism for an electric power tool such as a food mixer which mechanism uses a dual cam governor control structure to provide accurate low speed operation by having a spring operating in combination with other structure to provide better spring action through the speed range. To this combination, the present application discloses a modification that includes an improved circuit switch means mechanism that is an improvement on the structure of the above application.

### 2. Description of the Prior Art

In the small appliance field, such as portable food mixers, two main controls govern mixer operation and these are the speed control and the beater ejector control. It is desirable to have the various control units as convenient as possible for operation of the mixer by either hand. Thus, a concentric and centrally disposed arrangement is suggested. This comprises a speed control selection knob centrally disposed on the handle at the top with an inner ejector knob so that either a right or left-handed person can control the speed selection knob with his index finger or thumb and eject the beaters with his thumb. Additionally, the beaters must not be ejected while the mixer is in operation for safety purposes. A structure for attaining beater ejection consistent with these objectives is disclosed in Pat. No. 3,443,795 dated May 13, 1969 of common assignment. Further, it is desirable to provide a speed control mechanism using as much of the common beater ejector structure as possible and providing operation over a wide range of speeds. Such speed controls generally comprise a flyweight governor system mounted on a rotatable shaft and a force balancing control spring operating in conjunction therewith to rapidly make and break the motor circuit to cause the motor to operate at a selected speed. The flyweights develop a force proportional to the speed of shaft rotation and move an actuator axially to cause a cantilevered arm carrying one of the circuit contacts to open the energizing circuit. The cantilevered arm is biased by the control spring in a direction opposed to the flyweight force such that the force developed by the control spring determines the actuator force needed to move the cantilevered arm to momentarily deenergize the circuit. A linkage between the control knob and the governor control spring provides the means for varying the governor control spring force by cam action or other suitable means to achieve the desired speed. The flyweight force and the governor control spring force balance one another to maintain the selected speed. It is desirable to provide a compact dual cam and switch arrangement with spring control mechanism for accurate control over the speed range and the aforementioned '650 patent discloses a structure for doing this. It is necessary that the motor circuit be positively and audibly shut off when the beater ejectors are operative. It has been found that an improved switch structure in the combination of the '650 application is necessary to provide for a clean break and a snap-action or sharp audible click to positively shut down the circuit and give the user a "feel" that the switch is off. Also, for safety reasons, the actual switch contacts should be biased in an open position so that they are normally off and it is to this end of an improved motor circuit switch means in the general combination of the above '650 patent application that the invention is directed.

## SUMMARY OF THE INVENTION

Briefly described, the present invention is directed to an improved motor circuit switch means for use in the combination of an electric tool, such as a food mixer, which has a casing and a motor therein operable under the control of a force balancing governor system with a driven spindle controlled by

the governor. A make-break switch is actuated by the spindle and a rotatable speed control shaft, having cam means including first and second adjacent cams, is connected to a supporting bracket on the casing. A spring-biased follower is provided to control speed and is actuated by the first cam. The second cam operates a motor circuit switch means by opening the circuit when the follower is in a neutral or off position. In this general combination of the prior copending '650 application, the present invention discloses an improvement in the motor circuit switch means which comprises a pair of switch contacts that are normally biased open or in a fail-safe condition. The operating means for the switch contacts takes the form of a slider supported on the bracket between it and the first cam and connected with the second cam so that, on rotation of the control shaft, the slider is actuated by the second cam to close the switch contacts and complete the motor circuit. For breaking the circuit, the connecting means between the slider and the second cam is designed to create an audible snap-action opening of the contacts and this action may be enhanced by a spring between the slider and the bracket to bias the slider away from the contacts and add an additional force to the normal force present due to the biasing open of the contacts so there is a cumulative action providing a sharp and audible click. The slider may conveniently be supported between the first cam and bracket so the cam performs the dual function of supporting and camming. The audible snap-action is further ensured by a novel connection between the slider and cam members using a tooth on one member and a socket on the other to provide abrupt camming or sudden seating between the two. Thus, a variable spring force on the governor system is provided over at least part of the speed range and the motor circuit is audibly clicked and biased open when the follower is in the neutral or off position. The main object of the invention therefor is to provide an improvement in the motor circuit switch means to give the user a "feel" and to provide a normally open circuit and one that is positively and abruptly snapped open with an audible click when the control shaft is turned to off position.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational side view of the drawing partially broken away of a mixer;

FIG. 2 is a partial top sectional view on the line 2-2 of FIG. 1 showing the invention;

FIG. 3 is a partial perspective view of the internal switch and speed control mechanism;

FIG. 4 is a partial exploded perspective view of the slider-cam-bracket structure of the invention;

FIG. 5 is a partial view of the improved switching structure in the closed or "on" position; and

FIG. 6 is a view, similar to FIG. 5, showing the switch in the open or "off" position.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a food mixer is indicated at 10 and is generally made of two mating casings 12 and 14. Upper casing 12 has handle 16 on which the mixer is tilted when not in use. To operate the mixer, there is a power unit or motor 18 that drives a spindle 20 proportional to the speed. Spindle 20 extends between a pair of adjacent gears 22 that hold a pair or more of beaters 24 by their beater shafts 26. Each gear 22 has a central aperture 28 receiving shafts 26 therethrough which are held in position in the mixer by suitable known means. The novel ejector mechanism and operation thereof is completely described in said '795 patent.

To provide a structure using as much of the common ejector mechanism present as well as providing accurate wide range speed control and a fail-safe switch-off feature during ejection so the beaters cannot be ejected when the mixer is running, there is provided a suitable known coil spring means to permit a flexible variable balancing force on the governor system over at least part of the speed range. This may be used in com-

bination with unique control mechanism that uses a dual cam and switch arrangement as fully described in said '650 patent to provide the accurate speed control. In this arrangement, it is desirable to have a force balancing governor system generally indicated at 30 in FIG. 2. This may comprise a flyweight mechanism 32 operating through actuator cap 34 which actuates cantilevered arm 36 to operate contact 38 to make-and-break the electrical circuit and control the speed. Different speeds are provided by varying the spring force on arm 36 by means of spring 40 that is connected to a resilient cam follower 42 which operates as will become apparent. Except for the use of a pivoted cantilevered arm 36, the governor system just described is generally known except as it may form part of the present switch and speed control mechanism.

Referring to FIG. 3, a rotatable speed control shaft 44 is disposed to extend out of the mixer handle for rotation by knob 46 to vary the speed by changing the spring force on arm 36. Shaft 44 is substantially parallel with beater shafts 26 so that it extends vertically to the plane of rotation of gears 22 and upward to the handle 16 where it is rotatable at the handle front as seen in FIG. 1. Support for the rotatable shaft 44 may be provided by a bracket 48 that is supported within the casing conveniently as part of the bearing structure 50 for one end of the power unit. The bracket and bearing structure may be secured to suitable casing bosses (not shown) by screws 52. Support of shaft 44 in the bracket is provided by a switch control cam means, generally indicated at 54, on one end adjacent and above the bracket as shown. The cam means is designed to anchor and limit axial movement of the shaft 44 in the bracket and thus support the shaft in addition to performing dual cam duties.

Cam means 54 may be considered as a dual cam with two spaced surfaces or as two parts adjacent one another with a first cam 56 and a second cam 58 as best seen in FIG. 4. Thus, the terms first and second cam are intended to cover a single cam means with two camming surfaces or the equivalent structure of adjacent cams as shown in FIG. 4. It can be seen, in FIG. 3, that rotation of knob 46 turns first cam 56 against resilient cam follower 42 to change spring force 40 and thus the force required by actuator 34 to make-and-break contacts 38. Since accurate control at low speeds is more difficult due to the inertia of the system, it is necessary to reduce the inertia and to this end, arm 36 is rotatable about pivot 60 so that resistance to rotation or inertia movement of arm 36 is extremely low. Thus, spring 40 is immediately reactive on arm 36 without using some of its restoring force to bend the usual cantilever type arm 36. Substantially no resistance is therefor offered by arm 36. In order for the follower 42 to contact first cam 56, the follower is resiliently connected by contact as by the cantilever connection shown. When cam 56 does not actuate follower 42, the follower is thus in its neutral or off position. Thus, rotation of knob 46 actuates follower 42 from its neutral or off position by first cam 56 to increase the spring force resulting in higher speeds.

In order to provide a clean break or snap-action to open the motor circuit and provide an "off" feel and to do this in a fail-safe manner, it is desirable to break the circuit with an audible and definite click in the neutral position of follower 42. To this end, and in accordance with the invention, cam means 54 makes use of its second cam 58 whose surface is axially and angularly displaced from the first cam 56 as required by the minimum speed of the mixer. A motor circuit switch means, generally indicated at 62 in FIG. 5 is provided to control the on-off condition of the mixer. The switch means 62 comprises a pair of switch contacts 64 and 66 that are normally biased in the open position as best seen in FIG. 6. This is done by making the switch contact 66 of spring material to urge it in the direction shown by the arrow of FIG. 6. Thus, positive force is required to close the contacts which tend to remain open.

Switch means 62 is operable by second cam 58 acting through a slider 68 that rides on bracket 48 and is guided thereon by any suitable arrangement such as the slot and rivet connection generally shown at 70 in FIG. 4. Thus, slider 68

moves in a plane parallel to and on the surface of bracket 48 as moved by second cam 58. It will be apparent that slider 68 is operated independently of cam follower 42 by reason of its contact with second cam 58 which may be angularly displaced on shaft 44 as desired by the orientation of the D-slot as shown. Shaft 44 may be secured on bracket 48 by any suitable means such as retainer 72 and is conveniently supported between the bracket and first cam 56. Slider 68 is provided with an upstanding tab 74 to contact or bear against switch contact 66 which, because of the open bias, tends to push slider 68 to the right as seen in FIGS. 3-6.

The desired snap-action and audible clicking sound is obtained by a novel connection between slider 68 and second cam 58 in the form of a tooth and socket connection on either member as shown in FIGS. 4-6. As shown, slider 68 is provided with an opening at one end having a tooth 76 that cooperates with socket 78 in cam 58. Due to the abrupt camming between the tooth and socket when aligned, slider 68 snaps sharply into engagement with an audible click to assume the open position shown in FIG. 6. This is the condition desired whereby contacts 64 and 66 break sharply and there is no time delay between the slow speed running of the mixer and the off position. The main closing force between the cam and slider is provided by the biasing force of contact 66. In order to enhance or provide a cumulative effect on the force exerted by contact 66, the detent action and sound intensity may be controlled, as seen in FIG. 3, by the addition of spring 80 connected between the slider and the bracket. The spring biases the slider away from contact 66 and tends to pull it into the off position of FIG. 6.

In summary, the motor circuit switch means disclosed herein and shown in the operative or "on" position of FIG. 5 and the inoperative or "off" position of FIG. 6 provides a positive snap-action and adjustable audible click while using structure that is inherently fail-safe because of the normally open condition of the circuit due to the biasing action of contact 66. This is an improvement over the softer switch structure in said '650 patent.

While there has been shown a preferred form of the invention, obvious equivalent variations are possible in light of the above. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described and the claims are intended to cover such equivalent variations.

#### I claim:

1. In an electric tool such as a food mixer having a casing and motor therein including a force balancing governor system with a driven spindle controlled thereby, a make-break switch actuated by said spindle, a rotatable speed control shaft with cam means thereon connected to a shaft-supporting bracket on said casing and including a first cam, a spring-biased follower to control speed actuated by said first cam, a second cam adjacent the first, and operating motor circuit switch means whereby said second cam operates to open the circuit when the follower is in neutral off position, the improvement in said circuit switch means comprising:

a pair of switch contacts biased open;

a slider on said bracket connected with said second cam and abutting one of said contacts and moveable on rotation of said control shaft to complete the motor circuit; connecting means between said slider and second cam creating a snap-action opening of said contacts; and whereby there is created a variable spring force on the governor system over at least part of the speed range and the motor circuit is clicked and normally biased open when the follower is in the neutral off position.

2. Apparatus as described in claim 1 wherein a spring is connected between said slider and bracket to bias said slider away from said contacts and increase the snap action to open said circuit.

3. Apparatus as described in claim 1 wherein the connection between the slider-cam members is a tooth on one member and socket in the other to provide an abrupt camming or seating for the snap-action.

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4. Apparatus as described in claim 3 wherein a spring is connected between said slider and bracket to bias said slider away from said contacts and increase the snap action of the tooth in

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the socket to open said circuit.

5. Apparatus as described in claim 4 wherein said slider is supported between said first cam and bracket.

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