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TAMPER PROOF ACTUATOR

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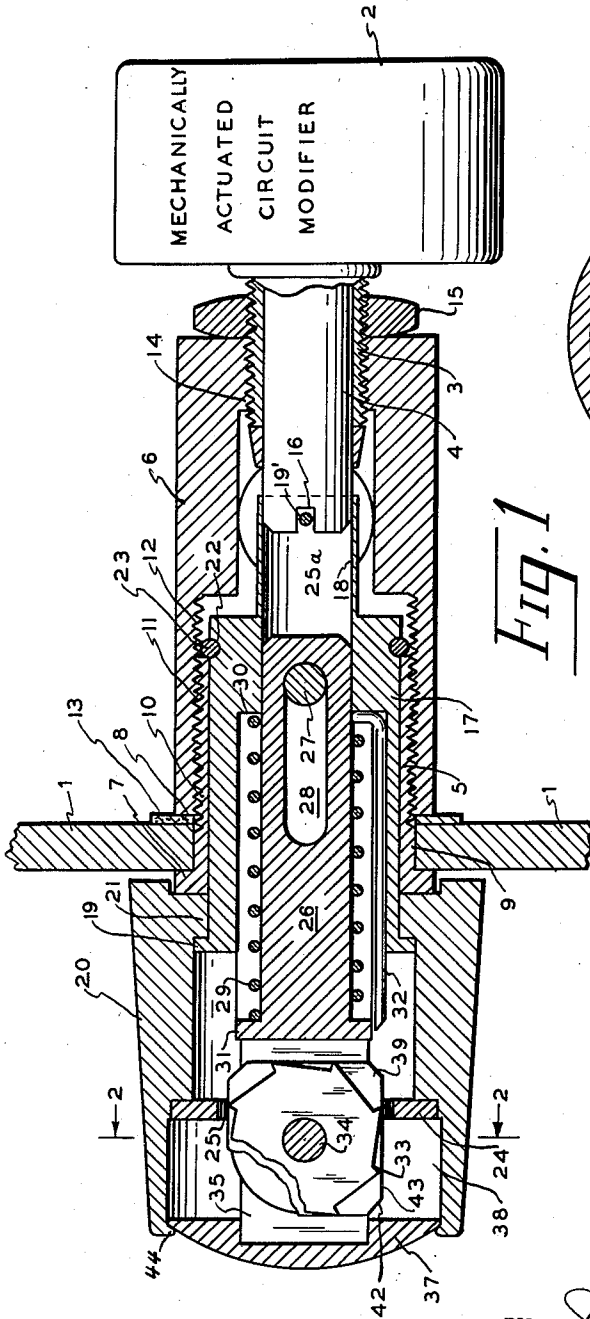


Fig. 1

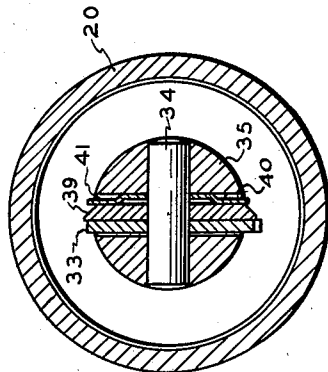


Fig. 2

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1

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TAMPER PROOF ACTUATOR

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13 Claims. (Cl. 74—548)

The present invention relates generally to mechanisms for rendering difficult unauthorized or unintentional tampering with a preset adjustment of a mechanically adjustable electrical circuit element.

Briefly described, in accordance with the invention, a mechanically adjustable electrical current element, such as a potentiometer, a tuning condenser, a variable resistor, or the like is provided with a drive mechanism comprising an actuating knob coupled to the mechanically adjustable circuit element by means of a clutch. The clutch possesses two alternative operating positions, in one of which it couples the actuating knob to the circuit element, and in the other of which the two elements are decoupled so that rotation of the knob has no effect on the setting of the circuit element. The alternative operating conditions of the shaft are selected by successive actuations of a push-button located for actuation in a direction co-axially of the knob.

The clutch mechanism comprises an annular member having internal closely spaced serrations and a cooperating cam having a plurality of equally spaced raised points, any of which may mesh with one of the serrations, and intermediate the raised points are low points which do not so mesh. The annular member is arranged co-axially of the knob, and internally thereof. The cam is located internally of the annular member, and rotates on a shaft which extends perpendicular to a diameter of the annular member. The cam is actuated by a pawl and ratchet, responsive to successive actuations of the push button to bring alternately high and low points of the cam into collinearity with the serrations of the annular member. Since only the high points mesh with the serrations, the clutch couples in response to one actuation of the push button, and decouples in response to a succeeding actuation. When the clutch is decoupled the knob may be rotated without effect on the mechanically adjustable electric circuit element.

The push-button itself is spring-biased to unactuated position, but the unactuated position is arranged to be slightly different, for the coupled and uncoupled conditions of the clutch, so that the condition of the clutch is made evident to the initiated observer, but is rather unobvious to the uninitiated observer who is likely to tamper with the actuating knob.

It is a broad object of the present invention, accordingly, to provide a novel device for rendering ineffective any unauthorized or unintentional motion of a knob, utilized to actuate a mechanically actuatable electric circuit element.

It is a more specific object of the invention to provide a mechanism for alternately coupling and decoupling a knob with respect to a mechanically actuatable circuit element, in response to successive actuations of a push-button secured to the knob.

It is a more limited object of the invention to provide a novel clutch element, adapted successively to couple and decouple two shafts in response to successive identical

2

actuations of a control member, which may be in the form of a simple push-button.

Still a further object of the invention resides in the provision of devices for indicating, in an inconspicuous manner not apparent to the uninitiated, the condition of the clutch, i. e., whether in coupling or decoupling condition.

The above and still further features, objects and advantages of the invention will become apparent upon considerations of the following detailed description of a specific embodiment of the invention, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a view in longitudinal section of a device in accordance with the invention; and

Figure 2 is a section taken on the line 2—2 of Figure 1.

Referring now more specifically to the drawings, the reference numeral 1 identifies a portion of a wall, to which the device of the invention is secured. The reference numeral 2 is a mechanically actuated circuit modifying device, and may be specifically a condenser, a potentiometer, a variable resistance, or the like (not shown) within a casing. The device may include a cylindrical, externally threaded, and hollow mounting member 3, within which rotates a rotatable shaft 4. Rotation of shaft 4 actuates the circuit modifying device, in a manner known per se.

The entire mechanism is secured to wall 1 by means of two threadedly engaged hollow cylinders 5 and 6, having shoulders 7 and 8, respectively, which clamp about an aperture 9 in the wall 1 when the cylinders 5 and 6 are threadedly engaged.

The cylinder 5, provided with shoulder 7 abutting the wall 1, also includes an elongated portion 10 which extends through the aperture 9 and is externally threaded, with threads 11. The cylinder 6 is provided with an internally threaded portion 12, which threadedly engages the threads 11, to clamp wall 1 between shoulders 7 and 8.

A washer 13 is provided intermediate the wall 1 and the abutting end 8 of cylinder 6, but may obviously be omitted.

The cylinder 6, at that end thereof which is remote from wall 1, is provided with a portion of reduced internal diameter 14, which is internally threaded to receive the externally threaded mounting member 3, and the latter is locked to the cylinder 6 by a lock nut 15. The shaft 4 is, however, rotatable within the mounting member 3, and includes a transverse slot 16, for coupling purpose.

A further hollow cylinder 17 is provided, which is rotatable internally of the cylinder 5, and which includes a hollow thin walled extension 18, having a pin-anchor 19' for engaging the slot 16. The hollow cylinder 17 extends for the major portion of its length internally of the cylinder 6, but extends for a short distance outside the shoulder 7, and is there terminated with an annular shoulder of its own, spaced from shoulder 7, and identified by the numeral 19. The annular space between the shoulders 7 and 19 is used for mounting a knob 20, which has an inwardly extending annular flange 21 dimensioned to fit snugly in the space. Adjacent that end which is remote from the shoulder 19, the cylinder 17 is provided with an annular groove of semi-circular cross-section 22, within which is located a split ring 23, of radius equal to that of the groove. The ring 23, bears against the end of cylinder 11, and serves to secure the cylinder 17 against end play, while permitting rotation thereof.

One clutch member, in the form of a thin annular ring 24, having a large number of internal serrations 25, is fixedly secured to the knob 20, internally thereof, and co-axially therewith.

The cylinder 17 is provided with an internal bore 25a

3

of reduced diameter, adjacent the thin-walled extension 18, and having the same internal diameter as the latter. Within the bore 25a is located a rod 26, axially movable in the bore 25a, but not rotatable with respect thereto, by reason of pin 27 and longitudinal slot 28. The pin 27 extends transversely and freely through the longitudinal slot 28, in the rod 26, and is secured in the wall of the cylinder 17. Accordingly, the pin 27 permits relative axial motion, but prevents relative rotation, of rod 26 and cylinder 17.

Surrounding the rod 26, and within an extension of bore 25a which is of slightly larger diameter than the latter, is a helical compression spring 29. The spring 29 extends, under slight compression, between the shoulder 30 provided by the two differing diameters internally of the cylinder 17, and a shoulder 31 on rod 26.

An extension of spring 29, proceeding from adjacent shoulder 30, in a direction parallel to the axis of the helical spring 29, and terminating at a position adjacent the shoulder 31, but clearing the latter, establishes a pawl 32.

Cooperating with the pawl 32 is a ratchet 33, fixedly mounted for rotation on a pin 34, which extends diametrically through an extension 35 of rod 26. The extension 35 of rod 26 is terminated by a push-button 37, utilized to actuate rod 26 axially, and which rides freely within a suitable recess 38 in knob 20.

Mounted co-axially with the ratchet 33, on pin 34, is a cam wheel 39, which may be soldered to the ratchet 33, or otherwise secured irrotatably with respect thereto. The cam wheel 39 and the ratchet 33 rotate in a slot 40 provided for the purpose in extension 35, and are fixed in the slot 40 by a spring washer 41, mounted on pin 34, and which serves to press the cam wheel 39 and the ratchet 33 against one side of slot 40, and thereby to fix their positions.

The ratchet wheel 33 has eight teeth, in the present embodiment of the invention, and the cam 39 four high spots 42, and four low spots 43. The high spots are provided with edges of slight thickness, and adapted to mesh with the serrations 25. When so meshed rotation of the knob 20 will rotate the rod 26, via the cam wheel 39, and thereby rotate the shaft 4 and actuate the circuit modifier 2.

Successive actuations of push-button 37 produce successive angular motions of cam 33, and consequent successive rotations of cam 39 into and out of meshing or clutching positions.

When cam wheel 39 is in unclutched position rotation of knob 20 does not cause rotation of shaft 26, and hence does not disturb circuit modifier 2. Instead, the knob 20 idles, bearing on the annular groove formed by spaced shoulders 7 and 19. In clutched position, on the other hand, the knob 20 is provided with a mechanical coupling to shaft 4, and the rotation of the knob 20 effects corresponding rotation of cam 39 co-axially with shaft 26, and of shaft 18, cylinder 17, sleeve 25a and shaft 4.

In the unclutched position of the system, the cam wheel 39 passes freely through the annular disc 24, and the spring 29 accordingly presses the push button 37 to the left, as viewed in Figure 1, until the outer edge of the push button bears against an inwardly extending annular lip 44, provided in recess 38 of knob 20. This position of the push-button 37 signals that the mechanism is in unclutched condition. On the other hand, in the clutched condition of the mechanism, each high spot 42 of the cam 39 is so shaped that it does not pass fully within the serrations 25, but is stopped by the serrations, after the forward edge thereof has passed about half way through the thickness of the annular disc 24. Thereby, the push-button 37 is not permitted to reach the same position as in the uncoupled condition of the clutch, but is stopped short of the latter position. These

4

differences of position of push-button 37 are obvious to the initiated person, but not to be uninitiated, and serve to indicate the condition of the clutch, i. e., whether in coupling condition or not.

Persons who, by accident or predilection, tend to turn any knobs which are available, may be permitted to turn the knob 20, when it is unclutched, without untoward results. As the same time the general arrangement of the knob 20 and the button 37 make it entirely unobvious to the uninitiated person that rotation of the knob 20 is abortive, when the mechanism is in unclutched condition.

A suitable visual indicator for indicating the actuated position of circuit modifier 2 may be provided, if desired, and normally will be useful.

While we have described and illustrated one specific embodiment of our invention, in conformance with the statutes relating to Letters Patent of the United States, it will be clear that variations in detail and arrangement thereof may be resorted to, without departing from the true spirit of the invention as defined in the appended claims.

We claim:

1. In combination; a mechanically actuated circuit modifying device, a rotatable shaft for actuating said device, a rotatable hollow knob, an annular clutch member having internal serrations and secured internally of said hollow knob, a cam wheel having alternate high and low points arranged and adapted respectively to mesh and fail to mesh with said serrations, means securing said cam wheel to said rotatable shaft, and a device for actuating said cam wheel into mesh and out of mesh with said serrations.

2. The combination in accordance with claim 1 wherein is further provided a push-button located internally of said hollow knob, and wherein said device includes said push-button.

3. In a clutch for selectively coupling and uncoupling two co-axial shafts, a ring co-axial with said shafts and secured to one of said shafts, a device secured to the other of said shafts, said device including a member having a plurality of positions attainable by rotation of said member, means mounting said device for said rotation on an axis at right angles to the axis of said co-axial shafts, said member arranged to couple with said ring in selected ones of said discrete positions only, an actuator, and means for successively coupling and decoupling said member with said ring in response to successive motions of said actuator in a given sense.

4. In combination, a first shaft, a second shaft co-axial with said first shaft, a clutch actuatable selectively into coupling and uncoupling relation to said shafts, a push-button actuatable in a direction co-axial with said shafts, and means responsive to successive actuations of said push-button in a given direction for successively actuating said clutch into said coupling and uncoupling relation to said shafts.

5. In combination, a mechanically actuatable circuit modifying device, a rotatable shaft for actuating said device, a rotatable knob, a clutch coupling said knob and said rotatable shaft, a push-button mounted in said knob for successively coupling and decoupling said clutch in response to successive actuations of said push-button, and means for returning said push-button to a different unactuated position in accordance with whether said clutch is coupled or decoupled.

6. In combination, a mechanically actuated circuit modifying device, a rotatable shaft for actuating said device, a rotatable knob, a clutch adapted to couple said knob and said rotatable shaft, and means including a push-button mounted in said knob for selectively coupling and decoupling said clutch in response to successive actuations of said push-button in a given direction followed by release of said push-button.

5

7. The combination in accordance with claim 6 wherein said knob has a longitudinal axis about which it is rotatable, and wherein said push-button is actuatable in the direction of said axis.

8. In combination, a hollow rotatable actuator, a rotatable shaft, a clutch for selectively coupling and decoupling said shaft and said actuator, said actuator having an axially extending recess, means actuatable axially of said recess for controlling said clutch selectively to couple and decouple said shaft and said actuator in response to successive identically directed motions of said axially actuatable means.

9. In combination, a rotatable shaft, a rotatable knob, a clutch coupling said knob and said rotatable shaft, a push-button mounted in said knob for successively coupling and decoupling said clutch in response to successive actuations of said push-button, and means for returning said push-button to a different unactuated position in accordance with whether said clutch is coupled or decoupled.

10. In combination a rotatable shaft, a rotatable hollow knob, an annular clutch member having internal serrations and secured internally of said hollow knob, a cam wheel having alternate high and low points arranged and adapted respectively to mesh and fail to mesh with said serrations, and a device for actuating said cam wheel into mesh and out of mesh with said serrations.

11. The combination in accordance with claim 10 wherein is further provided a push-button located inter-

6

nally of said hollow knob, and wherein said device includes said pushbutton.

12. In a clutch for selectively successively coupling and uncoupling two relatively rotatable coaxial shafts, a clutch element secured to one of said shafts for rotation therewith, a device secured to the other of said shafts, said device including a member having a plurality of positions attainable by rotation of said member, means mounting said device for said rotation on an axis at right angles to the axis of said coaxial shafts, said member arranged to couple with said clutch element in selected ones of said positions only, an actuator, and means for successively coupling and decoupling said member with and from said clutch element in response to successive motions of said actuator in a single sense.

13. The combination in accordance with claim 4 wherein is further provided means for moving said actuator to a different unactuated position in accordance with whether said member and clutch element are coupled or decoupled.

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