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CONTROL DEVICE

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This invention relates to control devices, and, more particularly, to automatic cyclic control switches of the type which are motor driven and which are also provided with manual means, such as a knob, for advancing the switch to shorten one or more of the periods of the cycle.

An object of the invention is to provide means for protecting such switches from being damaged in use.

Another object is to combine this protective means with means to secure the knob to the switch shaft in order to provide a simple and inexpensive mechanism.

I prefer to accomplish these objects by providing manual switch operating means including a one way drive device, whereby a careless or unskilled operator will be prevented from turning the switch mechanism backward although the manual control knob itself is free to turn backward.

In accomplishing the second object with the first, I provide an annular groove on the switch shaft having a flattened portion at the bottom of the groove terminating in an abutment, and I provide a knob which fits over the shaft and carries a pawl which is spring-pressed into the groove so as to secure the knob on the shaft and which engages said abutment to enable operation of the knob to turn the shaft in one direction but not in the other.

Other objects and desirable particular constructions will become apparent upon reference to the following detailed description of one embodiment of my invention shown in the accompanying drawing in which:

Fig. 1 is a plan view with cover removed of a cyclic switch embodying my novel improvements;

Fig. 2 is a sectional view on the line 2—2 of Figure 1;

Fig. 3 is a sectional view through the control knob on the line 3—3 of Figure 1; and

Figure 4 is an elevational view of a portion of the gearing of the switch of Figure 1.

Referring to the drawing there is shown a cyclic switch which may comprise a die cast housing 10 having a switch enclosure 12 at the forward end (left side as seen in Figure 1), and a gear enclosure 14 at the rearward end. The switch enclosure may have an opening at one side closed by a removable cover 15 of insulating material or the like.

A cam shaft 16 is mounted longitudinally in the switch enclosure and projects rearwardly into the gear enclosure and forwardly through the front wall of the said switch enclosure to re-

ceive a manual operating knob 17 in a novel manner to be more fully pointed out below. A plurality of cams 18 are secured to the shaft 16 in axially spaced relationship.

A switch for each cam is mounted on an insulating block 20 secured along one side of the switch enclosure. These switches may comprise spring fingers 22, carrying contacts 24 engageable with similar contacts 26 mounted upon a common contact carrying bar 28 secured to the insulating block 20 and underlying the spring fingers 22.

The ends of the spring fingers 22 may be bent inwardly toward the axis of the cams 18 to engage the peripheral surfaces of the cams. These surfaces are cut to raise and lower the spring fingers at timed intervals as the shaft 16 rotates to open and close the switches 22—28 to control elements connected in circuits with the said switches in predetermined sequence.

The switch is normally driven by a synchronous or other constant speed motor 30 secured to the rear end of the gear housing, and which is adapted to drive the cam shaft 16 at a rate e. g. of one revolution per hour through a plurality of speed reducing gears, some of which are shown in Figure 4, and a one-way drive device also shown in Figure 4. The cam shaft 16 is driven in the direction of the arrow in Figure 2.

Referring to Figure 4, the gearing may include a relatively large spur gear 32 (forming part of a train of gears from the motor 30) loosely mounted on a shaft 34. A pinion 36 is secured to said shaft, and a pair of flat spring pawls 38 secured to the gear 32 engage the teeth of the pinion 36 to form a one-way drive device. The direction of rotation of these parts are shown by the arrow.

The pinion 36, in turn, engages a large spur gear 40 secured to the end of the cam shaft 16 which projects into the gear enclosure 14.

The part of the cam shaft 16 which projects forwardly through the front wall of the switch enclosure 12 is formed with an annular groove 42 adjacent its end, and, in the bottom of this groove, a flat surface 44 is formed by milling, or the like, which terminates at one end in a substantially radial abutment 46.

The knob 17 is provided with an axial bore which fits closely over the end of the shaft 16, and is also provided with a lateral intersecting bore 48 which is axially aligned with the groove 42 on the shaft. Positioned in this bore are a pawl member 50 having a reduced diameter portion fitting into the groove 42 and engageable

with the abutment 46. This member 50 also has a larger cup-shaped portion fitting into the bore 48 and compressively receiving the end of a coil spring 52. The other end of a coil spring 52 is compressively received in a cup-shaped portion or socket formed in a threaded member 54 screwed into the outer end of the bore 48.

The arrangement of the pawl 50, spring 52 and member 54 with the sockets compressively receiving the spring is an important minor feature of the invention which enables these elements to be removed and replaced as a unit, thereby facilitating the removal and replacement of the knob 17 when necessary. By compressively receiving I mean that the spring is initially larger than the sockets so that it must be forced into them, preferably by a screwing action which tends to wind up the spring and reduce its diameter.

In operation, the control device is often arranged so that one of the switches 22—28 closes a circuit through the switch motor, so that, to start the switch the cam shaft 16 must be manually advanced a short distance by means of the knob 17 until that switch is closed. Thereafter it may be desirable to shorten one of the periods of the cycle of the switch. This may be done manually by means of the knob 17. In each case of manual operation the cam shaft overruns the motor and gearing by means of the one-way mechanism provided by the pawls 38 and the pinion 36.

If the knob 17 were positively connected to the shaft 16, an ignorant or unskilled operator might attempt to turn the knob in the wrong direction (i. e. counter-clockwise as seen in Figure 3) with probable damage to the delicate switch fingers 22. With my novel arrangement, no damage would result, as the pawl would ride up the incline provided by the flat surface 44, compressing the spring 48. Continued turning would cause the pawl to slide around the groove 42 and drop over the edge of the abutment 46 into its original position.

The force necessary to cause this relative motion between the knob 17 and the shaft 16 is calculated to be less than that required to damage the switch.

It will be observed that, whenever the switch knob 17 is turned in the proper direction and if it has previously been turned backwards out of position, it will always return to the position shown in Figure 2 relative to the shaft 16. Thus the knob may be employed as an indicator, relative to indicia secured to some fixed portion of the machine, to indicate the part of the cycle in which the switch is operating.

While one preferred embodiment of my invention has been described in detail, it is not my intention to be limited to that embodiment, or otherwise than by the terms of the appended claims.

I claim:

1. In a control device having switch means, rotatable cam means for operating the switches, a motor, and connections between the motor and the cam means for driving the cam means in one direction including a one-way drive de-

vice, a manually rotatable indicating knob, and connections between the knob and the cam means including a one-way drive device for driving the cam in the same direction, said indicating knob also being rotatable by said motor through said cam means.

2. In a control device having switch means and rotatable cam means for operating the switches, a motor, and connections between the motor and the cam means for driving the cam means including a one-way drive device which permits manual advancement of the cam means independently of the motor means, a manually rotatable indicating knob connected to the cam means for manual advancement of the cam means, and one-way drive means between the cam means and the knob for preventing manual turning of the cam means backwards, said indicating knob also being rotatable by said motor, said knob and motor conjointly controlling the circuit of said motor.

3. In a control device having switch means, a one-way rotatable cam means for operating the switch means, a motor and connections between the motor and cam means for driving the cam means including a one-way drive device, the combination of a shaft connected to said cam means and formed adjacent its end with a partial flat having a perpendicular abutment at one side thereof, an indicator knob normally rotated by said shaft to indicate the position of said cam means but adapted also to rotate said shaft by manual power, said knob being formed with intersecting bores one of which received the end of the shaft, and a spring pressed pawl in the other of said bores pressing against said flat to form a one-way driving connection between the knob and the shaft.

4. In a control device, a cam shaft, a plurality of pairs of electric contacts sequentially closed and opened by the rotation of said cam shaft, an electric motor having its operating circuit closed and opened by a set of said contacts, said motor being connected for driving said shaft, an indicator manually rotatable in either direction also connected for driving said shaft, an overrunning connection between the shaft and the motor whereby the shaft may be manually advanced in the same direction of rotation as that in which it is rotated by the motor, a one-way connection between the indicator and the shaft whereby the shaft may be rotated in one direction only by the manual rotation of the indicator, the first manual movement of the indicator in one direction serving to rotate the shaft to close the circuit of the motor, the operation of the motor serving to rotate the shaft to rotate said indicator in the same direction and to operate said pairs of contacts sequentially and finally to open said motor operating circuit, said indicator being adapted to be placed manually in any one of its rotative positions whereby at the end of the cycle of the shaft an indication may be had of the amount of shortening of the cycle which has been effected by the manual advance of the indicator and the shaft.

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