June 14, 1960 C. J. GOODHOUSE 2,940,317

SKIP MECHANISM FOR SWITCH ACTUATING TIMER

Filed May 17, 1957 2 Sheets-Sheet 1

Fig. 1.

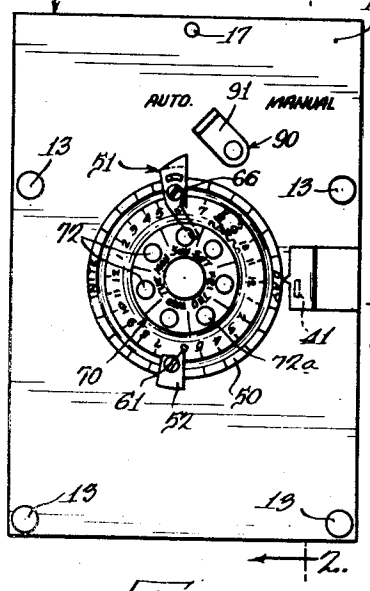


Fig. 2.

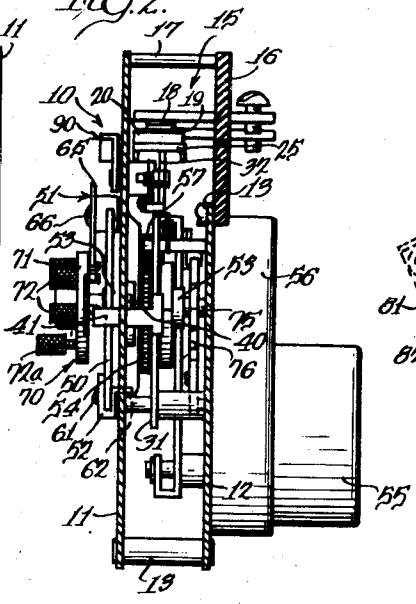


Fig. 5.

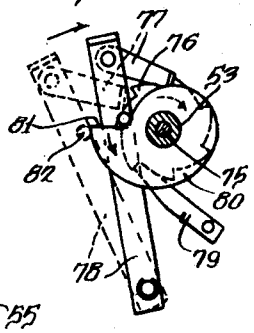


Fig. 3.

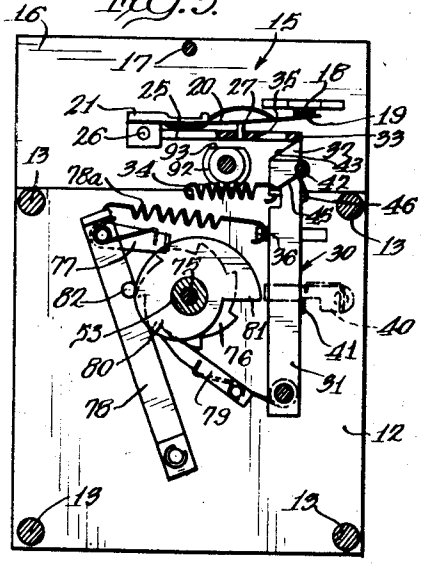
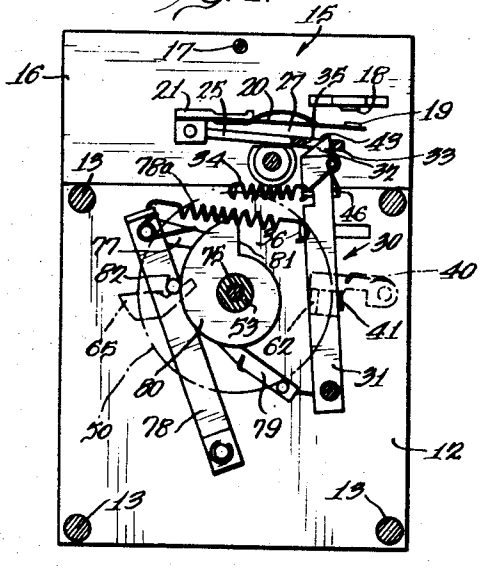


Fig. 4.



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Fig. 6a.

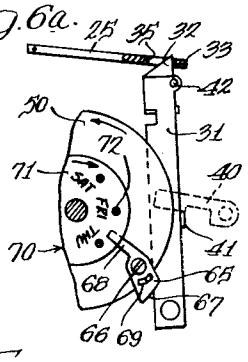


Fig. 6b.

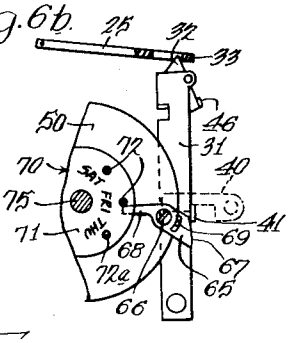


Fig. 6c.

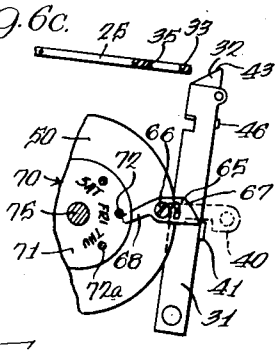


Fig. 6d.

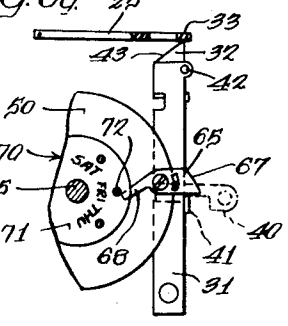


Fig. 7a.

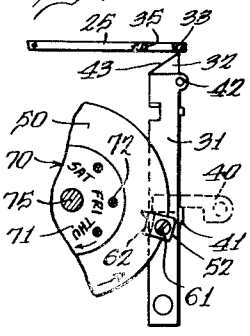


Fig. 7b.

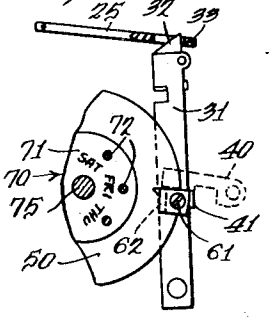


Fig. 8a.

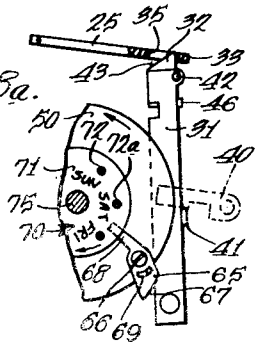


Fig. 8b

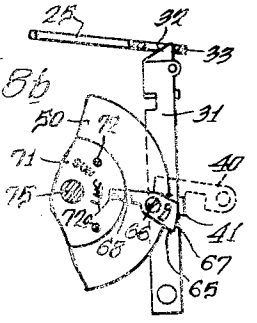
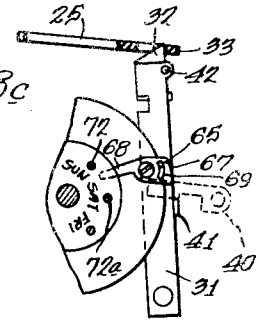


Fig. 8c



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SKIP MECHANISM FOR SWITCH ACTUATING TIMER

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Filed May 17, 1957, Ser. No. 659,939

6 Claims. (Cl. 74—3.52)

This invention relates to switch actuating timers and more particularly to a timer having a skip mechanism permitting switch actuation to be interrupted during selected timer cycles without disturbing normal operation during the remaining cycles.

Switch actuating timers have come into common use for automatically turning on and off devices such as air conditioners, lights, radios, etc. Such timers usually cycle each twenty-four hours, so that each day at the selected time the device is turned on, and, at another predetermined time, turned off. This mode of operation is quite satisfactory when daily operation is desired, but in many cases there is no need to repeat the cycle each day. Business establishments which are closed certain days of the week, for example, often prefer not to have equipment such as air conditioners automatically operating during those periods.

It is possible, of course, to disconnect a timer if subsequent operation is not desired, but this sacrifices the advantage of automatic operation and requires reconnection of the timer before automatic operation is resumed. Considering the example mentioned above of the air conditioner used in a business firm, such devices usually are controlled by a switch actuating timer so as to go on early in the morning in order to establish the desired temperature before the business day starts, and then are switched off at night. If the timer is disconnected to prevent this cycle of operation over the weekend, it must be reconnected Sunday evening or quite early Monday morning if the air conditioner is to function properly that day. Reconnecting the timer at such times is naturally quite inconvenient.

In order to meet this problem, timers have been used which include separate On and Off devices for each day of the week. These mechanisms require individual setting of each such device to achieve uniform daily operation while skipping the weekends or other non-working days. Of necessity, such mechanisms must either be large and bulky, or have their time measuring scales so compressed that the setting of the devices for accurate switch operation becomes very difficult.

Accordingly, it is the general aim of the invention to provide a novel switch actuating timer affording adjustable On-Off switch control during a selected repeating cycle and which includes an adjustable skip mechanism permitting the timer to be selectively disabled during selected cycles while performing normally during the remaining cycles. With more particularity, it is an object to provide a switch actuating timer which will open and close a switch at selected times during each day but which can be set to automatically skip or avoid switch operation during any selected day or days of the week.

It is another object to provide a switch actuating timer of the type characterized above which is exceptionally simple and therefore economical to manufacture, requiring but a single geared connection and no complicated clockwork mechanisms. It is a collateral object to provide a switch actuating timer of this type that is

exceptionally sturdy, requiring no critical adjustments. It is another related object to provide such a timer that is unusually compact, permitting neat, inconspicuous installation.

It is a further object to provide a switch actuating timer of the type mentioned above that may be simply and easily adjusted, without requiring the use of tools, to disable the actuator during any particular cycle of its operation. It is a related object to provide such a timer which permits simultaneous disabling of an entire daily program of On-Off switch operation, no matter how involved, without disturbing the program setup so that the switch operating cycle can be quickly reestablished when desired. It is a more detailed object to provide a timer having the above characteristics which will actuate a switch in accordance with a desired program only on certain selected days of the week, but which does not require separate program calibration for each day of operation.

It is also an object to provide a timer of this type which is reliable and trouble free and which operates in a firm positive manner so that, once installed and set, it can be depended upon to function dependably and steadily for long periods of time.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description, and upon reference to the drawings, in which:

Figure 1 is a front view of a switch actuating timer constructed in accordance with the present invention.

Fig. 2 is a sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a sectional view of the timer shown in Fig. 1 taken beneath the front plate so as to show the operating mechanism.

Fig. 4 is similar to Fig. 3 with the parts in a somewhat different position.

Fig. 5 is a fragmentary detail view showing the operation of a portion of the structure appearing in Fig. 3.

Figs. 6*a* to 6*d* are fragmentary stop-motion views showing a typical operating cycle which occurs on selected days resulting in closing of the switch.

Figs. 7*a* and 7*b* are fragmentary stop-motion views showing the tripping of the switch into open position at a predetermined later time.

Figs. 8*a* to 8*c* are fragmentary stop-motion views similar to Figs. 6*a* to 6*d* but showing the idle movement which occurs on non-selected days.

While the invention will be described in connection with a preferred embodiment, it will be understood that I do not intend to limit the invention to that embodiment. On the contrary, I intend to cover all alterations, modifications, and equivalents as may be included in the spirit and scope of the invention as defined by the appended claims.

Turning first to Fig. 1, there is shown a switch actuating timer **10** embodying the invention and including a front frame plate **11** and a rear frame plate **12** separated, and rigidly connected, by a plurality of pillars **13**. The timer **10** is effective to operate a switch **15** which is supported on an insulated switch mounting plate **16** that is secured to the top of the back frame plate **12** and rigidly positioned by a pillar **17** extending rearwardly from the front frame plate **11**.

The switch **15** comprises a fixed contact **18** and a movable contact **19**. The movable contact **19** is carried by a resilient arm **20** firmly secured to the switch mounting plate **16** at the point **21** (see Fig. 3).

In order to operate the switch **15**, a pivoted switch operating lever **25** is provided which swings about the pivot **26** and carries an actuating stub **27** that bears against the underside of the resilient contact supporting arm **20**. It can be seen that when the operating lever **25** is swung

upwardly, as in Fig. 3, the stub 27 will bear against the arm 20 and resiliently urge the contact 19 upwardly into engagement with the fixed contact 18. However, when the operating lever 25 is allowed to drop downwardly, the stub 27 releases the pressure on the underside of the resilient arm 20 so that the arm may straighten and carry the movable contact 19 away from the fixed contact 18 and thus open the switch 15. In short, the resilience in the arm 20 thus tends to keep the contacts 18, 19 separated and the switch 15 open, but when the operating lever 25 is swung upwardly to overcome the resilient force in the arm 20, the contacts 18, 19 are brought into engagement and the switch 15 is closed.

In order to position the operating lever 25 and thus control the operation of the switch 15, an actuator, generally indicated at 30, is provided. It can be seen that the actuator comprises a spring-biased, pivoted arm 31 carrying a camming tip 32 which cooperates with an abutment 33, formed on the switch operating lever 25. The arm 31 is spring-biased toward a stop 36 at the left of the arm by a tensioned spring 34, and the abutment 33 is adjacent a hole or opening 35 formed in the operating lever 25. When the spring-biased arm 31 is pulled to the left against the stop 36, the camming tip 32 will be disposed within the hole or opening 35, so that the operating lever 25 will be free to move downwardly under the urging of the resilient arm 20 and the switch 15 will be opened (see Fig. 4).

For the purpose of raising the abutment 33 onto the camming tip 32 when the camming tip is disposed within the opening 35, or in other words, to move the operating lever 25 from a switch-open to a switch-closed position, the camming tip 32 is pivoted to the arm 31 at 42 so that it may idly wipe beneath the abutment 33 when the actuator arm 31 is swung to the right and the camming tip is also provided with an inclined edge 43 that will cam the abutment 33 upwardly onto the camming tip when the actuator arm 31 moves again toward the left. The tip 32 is biased into its normal upstanding position by a spring 45 which urges a lug 46 formed on the tip into engagement with the back of the actuator arm 31. The lug 46 prevents the tip from pivoting in a clockwise direction when the inclined edge 43 cams the abutment 33 upwardly, but permits the tip to swing in a clockwise direction to wipe past the abutment when the arm 31 moves to the right.

Thus, when the actuator arm 31 and its camming tip 32 are swung to the right, the tip 32 wipes past the abutment to a point beyond it. The subsequent partial return causes the abutment to be cammed upwardly to the position shown in Fig. 3. This closes the switch contacts 18, 19. To hold the actuator arm 31 in its right hand, or switch-closing position, a latch 40 is provided which is spring-biased downwardly to capture a lug 41 formed on the arm 31 and thus retain the switch actuator arm in its switch-closing position against the resilient force of the biasing spring 34.

With regard to tripping of the latch 40 it will be understood that when the switch 15 is closed and the abutment 33 is supported on the camming tip 32 (see Fig. 3), the switch 15 may be opened by swinging the latch upwardly to release the lug 41 and permit the spring 34 to move the arm 31 to the left, thereby moving the camming tip 32 beneath the abutment 33 and disposing it within the opening 35.

Cyclic operation of the actuator arm 31, and thus of the switch 15, is effected by means of a uniformly rotated timing disk 50 carrying a positionable camming clip 51 which turns the switch "On" and a positionable tripping clip 52 which turns the switch "Off." The disk 50 is fixed to a rotatable sleeve 53 on which is carried a gear wheel 54 (see Fig. 2). The disk is driven by a timing motor 55 through a gear box 56 which drives a pinion 57 in meshing engagement with the gear wheel 54. In the preferred embodiment, the motor 55 is a synchronous, constant speed motor which is effective to rotate the disk 50 at a uniform rate. The gear reduction in the gear box 56 is preferably selected so that the disk 50 rotates once every 24 hours.

The tripping clip 52 has a C-shaped configuration (see Fig. 2) allowing it to be fitted about the periphery of the disk 50, and it is locked into place by tightening a set screw 61. In order to release the latch 40 and thus open the switch contacts 18, 19, the tripping clip 52 is provided with a trip 62 extending axially inward from the back side of the disk 50. As the disk 50 revolves, the trip 62 describes a path of movement which brings it into contact with the end of the latch 40 (see Figs. 7*a* and 7*b*). Therefore, during each revolution of the disk 50 the trip 62 is effective to swing the latch 40 and release the actuator arm 31 so that it may move to the left and open the contacts of the switch 15.

In carrying out the invention, the camming clip 51 is similar to the clip 52 except that it is provided with a radially extending finger 65 rather than an axially projecting trip portion. The finger 65 is held on the clip 51 by means of a set screw 66 which may also be tightened to lock the clip 51 at a selected position on the disk 50, although the finger is at all times free for limited pivoting movement for reasons which will become clear. The finger 65 is provided with an arcuate camming edge 67 which is effective, as the finger is carried around by the disk 50, to engage the lug 41 formed on the actuating arm 31 to force the actuating arm to the right (see Figs. 6*a* to 6*d*).

It can be seen that both the camming clip 51 and the tripping clip 52 can be adjustably positioned about the periphery of the disk 50 so that the switch 15 may be turned On and Off at slected times during each revolution of the disk 50. If desired, suitable indicia may be inscribed on the outer surface of the disk 50 to aid in positioning the clips 51, 52 (see Fig. 1). It will also be understood that any number of such clips may be employed about the periphery of the disk 50 in order to operate the switch 15 several times during each 24-hour cycle of the timer 10.

In accordance with the present invention, the timer 10 is provided with a step cycling member operating on a cycle which is an integral multiple of the cycle of the disk and which advances one step at the end of each cycle of the disk, the step cycling member carrying positionable means for causing the cam finger 65 to be "abled" during selected cycles of the disk for operation of the switch 15 and "disabled" during the remaining cycles. In the preferred embodiment, the finger 65 is provided with a tail 68 extending radially inward from the screw 66 on which it is freely pivoted. Cooperating with the tail 68 is a step cycling member generally indicated at 70 which includes a drum 71 having a plurality of thumbscrews 72 spaced about its periphery. By means of a stepping mechanism to be described, the disk 71 is stepped forward one step for each cycle of the timing disk to bring the thumbscrew positions successively opposite the switch operating lug 41, which latter position may be referred to conveniently as the active position. When the screw in the active position is screwed in, the shank portion thereof projects into the path of movement of the tail 68 of the finger. Thus, as the finger is about to act upon the lug 41, the screw forms an abutment which resists the reactive force accompanying the "throwing" of the lug 41 so that the finger is effectively "abled" or rigidified for operation of the switch. Conversely, when the screw in the active position is screwed out, the shank thereof is withdrawn from the path of movement of the tail portion 68. This permits the finger 65 to rotate about its pivot so that the finger idly wipes past the lug 41 without operating the switch during the corresponding cycle of the disk.

To control the limits through which the finger 65 may swing about its pivot 66 so that it cannot jam the mech-

anism, a cooperating pin and slot connection 69 is interposed between the finger and the actuator arm 31. The slot of the connection 69 permits the finger to swing freely when idly wiping past the lug 41 but retains the finger in position so that its tail end 68 will properly engage the next extended thumbscrew.

In the preferred embodiment, there are seven thumbscrews 72 equally spaced about the periphery of the drum 71 and the drum is indexed once for each revolution of the disk 50. It will thus be apparent that the drum 70 makes a complete revolution once every seven days. In this way, every 24 hours, a subsequent thumbscrew 72 is positioned where it may serve as an abutment for the finger 65 and permit operation of the switch.

It is a feature of the invention that the intermittently cycling mechanism 70 is driven by the timing motor 55 which rotates the timing disk 50. In the present embodiment this is accomplished by mounting the drum 71 on a shaft 75 which extends through the sleeve 53 and is journaled in the back frame plate 12. The sleeve 53 is shorter than the shaft 75 and a ratchet 76 is fixed to the shaft at a point beyond the sleeve 53 (see Figs. 2 and 5). The ratchet 76 is provided with seven teeth which cooperate with a spring-biased indexing pawl 77 pivoted to a ratchet arm 78 which is resiliently urged to the right by a spring 78*a*. It will be apparent that as the arm 78 is moved back and forth between its left and right hand positions, the indexing pawl 77 will engage successive teeth on the ratchet 76 and thus rotate the shaft 75 and the drum 71 in discrete steps. To prevent the ratchet 76 from backing up, a spring-biased pawl 78 is provided as is common in such devices.

To permit the timing motor 55 to move the ratchet arm 78 back and forth, a cam 80 having a single drop-off portion 81 is secured to the sleeve 53 in position to cooperate with a pin 82 fixed to the ratchet arm 78. It will therefore be seen that as the cam 80 rotates in a counterclockwise direction, being driven by the timing motor 55 through rotation of the sleeve 53, the pin 82, and thus the ratchet arm 78, will be forced to the left until the pin rides off the drop-off portion 81 of the cam 80. When this happens, the spring 78*a* which biases the ratchet arm 78 to the right will be effective to move the arm to the right and thus cause the pawl 77 to advance the ratchet in a clockwise direction the distance of one tooth or 1/7 of a single revolution.

It will be noted that both the cam 80 and the timing disk 50 are secured to the sleeve 53, and in the preferred embodiment the relative angular position of these two members is selected so that the drop-off portion 81 is presented to the pin 82 when the 12 o'clock midnight position on the disk 50 is adjacent the lug 41 formed on the actuator arm 31.

It will be appreciated from the foregoing that during each twenty-four hours the timing disk 50 will make a complete revolution, and during that single cycle the finger 65 and the tripping clip 52 will be effective to close and then open the contacts of the switch 15. At the end of each twenty-four hour cycle of the disk 50, the cam 80 will be effective to advance the ratchet 76 a single tooth length and thus index the intermittently cycling member 70 to bring a successive thumbscrew abutment 72 into position opposite the lug 41 formed on the arm 31. Therefore, each day a subsequent thumbscrew 72 is presented adjacent the lug 41 and since there are seven thumbscrews, each one represents a particular day of the week. By backing off a particular thumbscrew 72 so that there will be no projecting portion extending from the rear surface of the drum 71, cyclic operation of the switch 15 is prevented during that particular twenty-four hour cycle of the timing disk 50. If it is desired to prevent operation of the switch 15 at all times, each of the thumbscrews 72 may be backed off.

For the purpose of briefly summarizing the operation of the timer 10, reference will now be made to the stop motion views shown in Figs. 6, 7 and 8. In Fig. 6*a*, the step cycling member 70 is turned so that the pin 72 labeled "Friday" is opposite the lug 41 in the "active" position and the finger 65, carried by the disk 50, approaches the lug. Friday being a normal workday, the thumbscrew 72 has been screwed into the drum 71 so that its shank portion is in the path of movement of the tail end 68 of the finger 65.

In Fig. 6*b*, the finger 65 has engaged both the thumbscrew 72 and the lug 41 on the actuator arm and has commenced to cam the actuator lug outwardly and thus urge the arm 31 to the right. In Fig. 6*c* the finger has completed its camming movement so that camming tip 32 of the actuator arm 31 is positioned at the right of the abutment 33. In Fig. 6*d* the lug 41 has been released and the spring-biased arm 31 returned to the left and latched in its switch-operating position with the abutment 33 supported on the camming tip 32.

At a later time during the day, trip 62 will be carried by the timing disk 50 into engagement with the latch 40, as shown in Fig. 7*a*, and contiuued movement of the trip 62 will move the latch 40 upwardly to release the arm 31 and allow it to move to the left. This will move the camming tip 32 from under the abutment 33 and the operating lever 25 will drop downwardly to open the switch.

Following completion of the 24 hour cycle of the timing disk 50, the step cycling member 70 is indexed one step so as to bring the thumbscrew labeled "Saturday" opposite the lug 41 on the actuating arm 31. Since "Saturday" is a normal non-working day the thumbscrew 72*a* will be backed off so that its shank portion does not project into the path of movement of the tail end 68 of the finger 65. Thus, as the finger is carried by the timing disk 50 from the position shown in Fig. 8*a* to the position shown in Fig. 8*b*, where the finger first engages the lug 41, the finger exerts no camming force against the lug and it merely idly wipes past without operating the actuator arm 31. Thus, during the 24 hour cycle associated with the "Saturday" position of the step cycling member 70, the switch 15 will not be operated.

In order to close the contacts of the switch 15 so that they will remain closed and not be opened when the trip 62 engages the latch 40, a manual switch operating control 90 is provided. The control 90 includes a positioning lever 91 journaled on the front of the front frame plate 11 and connected to rotate a cam 92 secured on the back of the plate 11. The cam 92 underlies the switch operating lever 25 and is provided with a flattened portion 93 which provides sufficient clearance to permit the operating lever 25 to be raised and lowered under the control of the actuator arm 31 for opening and closing the switch contacts 18, 19. However, when the operating lever is swung to the right, the cam 92 is similarly rotated to bring the underside of the operating lever 25 up onto the rounded portion of the cam 92 so as to raise the operating lever and close the contacts 18, 19. When the operating lever is in this upraised position, it will be apparent that movement of the actuator arm 31 under the control of the finger 65 and trip 62 will have no effect on the switch 15, and the contacts 18, 19 will remain closed until the positioning lever 91 is swung back to the left into the automatic operating position.

I claim as my invention:

1. In a timer for an air conditioning unit or the like the combination comprising a controllable element, a timing disk having means for driving the same on a 24-hour cycle, means including a clip having a pivotable finger selectively positionable on said disk for operating said element incident to disk rotation, a cyclically stepped disk mounted concentrically with said timing disk and having a cycle which is an integral multiple of the cycle ot said timing disk, said stepped disk having a plurality of abling elements arranged thereon and cooperating with said finger so that said finger is made effective to operate

said element during selected ones of the cycles of said timing disk.

2. In an actuating timer, the combination comprising, a steadily driven timing member, an actuator positioned adjacent said timer, a pivoted finger carried by said member for operating said actuator, means for supporting and presenting a series of abutments effective for blocking rotation of said finger as it operates said actuator, said means including an indexing device to successively present a subsequent abutment to the finger each time the finger is carried by the member into position to operate the actuator, and means permitting the selective withdrawal of individual ones of said abutments relative to their support so that if an abutment has been withdrawn when presented to said finger, the finger will be permitted to idly rotate without operating said actuator.

3. In an actuating timer, the combination comprising, a uniformly rotated timing disk, an actuator positioned adjacent said disk, a pivoted finger adjustably positioned on said disk for operating said actuator upon rotation of said disk, means for supporting and presenting a series of abutments effective for blocking rotation of said finger as it operates said actuator, said means including an indexing device to successively present a subsequent abutment to the finger each time the finger is carried by the disk into position to operate the actuator, and an adjustable mounting for each of the abutments permitting the selective withdrawal of individual ones of said abutments relative to their support so that if an abutment has been withdrawn when presented to said finger, the finger will be permitted to idly rotate without operating said actuator.

4. An actuating timer comprising, in combination, a timing disk and means to rotate the disk through a cycle at uniform speed, an actuator positioned adjacent the periphery of said disk, a lug adjustably positioned on the disk and supporting a pivoted finger which is effective, when extended outwardly of said disk, to operate said actuator, a drum mounted for rotation concentrically with said disk, a series of abutment pins mounted at equally spaced positions about the periphery of said drum, means including an indexing device for rotating said drum step-by-step so that the pins are successively positioned opposite said actuator each time the disk rotates, said pins being effective, when opposite said actuator, to block rotation of said finger and maintain the finger extended outwardly of the disk so that the actuator is operated as the disk rotates, and means to withdraw selected pins relative to said drum so that they will not be effective to block rotation of said finger when the finger seeks to operate the actuator, thus permitting the finger to idly rotate and the timer to skip operation of the actuator during those cycles of rotation when a withdrawn pin is opposite the actuator.

5. An actuating timer comprising, in combination, a timing disk and means for uniformly cycling said disk, an actuator positioned at the periphery of said disk, a positionable lug mounted on said disk at a selected point for operating said actuator at a desired time during the disk cycle, said lug including a finger pivoted at its central portion and having an actuator engaging tip and an opposite tail end, a plurality of abutment elements for engaging the tail end of said finger as the latter is brought around by the disk into engagement with the actuator, each of said elements being effective for resisting the reactive force of the actuator and thus permitting the finger to operate the actuator, means for successively advancing said elements into finger engaging positions with a subsequent element being advanced every cycle of said disk, and means for manually removing selected ones of said elements from the movement path of the tail end of said finger so that the latter is disabled during those cycles in which the finger cannot engage an element.

6. An actuating timer comprising, in combination, a timing disk and means for uniformly cycling said disk, an actuator positioned at the periphery of said disk, a positionable lug mounted on said disk at a selected point for operating said actuator at a desired time during the disk cycle, said lug including a finger pivoted at its central portion and having an actuator engaging tip and an opposite tail end, a plurality of abutment elements for engaging the tail end of said finger as the latter is brought around by the disk into engagement with the actuator, said finger being effective to operate said actuator when the finger tip engages the actuator and the finger tail end engages an abutment element, each of said elements being effective for resisting the reactive force of the actuator when the finger operates the actuator, means for intermittently advancing said elements through a cycle which is a multiple of said disk cycle with a subsequent abutment element being advanced into finger engaging position for each cycle of said disk, and means for manually removing selected ones of said elements from the movement path of the tail end of said finger so that the latter is disabled during those disk cycles in which the finger cannot engage an element.

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