ABSTRACT: A program-controlled electrical switching mechanism comprising a motor driven rotor and a plurality of exchangeable and angularly adjustable actuation fingers are seated axially behind one another at the rotor. Further, an additional actuation finger is secured to the rotor in a selectable angular position and a program change-switching wheel cooperates with such additional actuation finger. The program change-switching wheel is provided with axially directed cam means and a counter element is resiliently biased against said axially directed cam means such that upon attaining at least a predetermined rotational position there is undertaken a relative axial displacement of the rotor with respect to the switching disk means seated upon a control shaft, whereby said switching disk means at said control shaft no longer cooperate with a first group of said actuation fingers at said rotor but with a second axially offset group of said actuation fingers so that a contact arrangement-actuation wheel means actuates its associated electrical contact arrangement according to a different program as a function of the momentary position of the rotor.
ELECTRICAL TIMER MECHANISM WITH IMPROVED CAM OPERATED ACTUATING MEANS

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved program controlled electrical switching or timer mechanism of the type incorporating a motor driven rotor destined to be rotated at a predetermined rotational speed. A plurality of axially randomly arranged switching or indexing wheel-actuation fingers are exchangeably secured to the rotor and adjustably mounted at the rotor in selectable angular positions. These actuation fingers cooperate with switching or control disks which are fixedly seated upon a switching or control shaft mounted adjacent and parallel to the rotor shaft. Furthermore, the control shaft, which additionally carries at least one rotatable contact-actuation wheel for a respective associated electrical contact arrangement, is constructed in such a manner that during each complete revolution of the rotor the aforementioned contact arrangement is actuated in accordance with a predetermined program as a function of the momentary rotational position of the rotor.

With the requirement, which incidentally is not obligatory, that the drive motor of the aforementioned rotor performs one complete revolution every 24 hours and a daily numerical disk indicates the momentary time of day as a function of the rotation position of the rotor, the invention provides a so-called daily timer, as such, for instance, can be used for the program control of heating and air conditioning installations.

Timers of this type have already been constructed in such a manner that during predetermined days of the week, for instance for the weekend, they actuate associated contact elements in accordance with an altered daily switching program.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide an improved program-controlled electrical switching mechanism which is relatively simple in construction, extremely reliable in operation, not readily subject to breakdown, and economical to manufacture. Another, more specific object of the present invention relates to an improved timer or switching mechanism which can be program-controlled, useful for many different applications, such as for the automatic switching-in and switching-out of certain functional operations desired to be performed in response to programmed information, and wherein the switching mechanism affords complete reliability and integrity in carrying out its functions.

In contrast to the known constructions of weekly timer switches of this type the previously defined switching mechanism of the invention is generally manifested by the features that there is also secured to the rotor, at a selectable angular position, an additional actuation finger which is destined and constructed to further index, during the course of a full rotation of the rotor, an associated program change-switching or indexing wheel through a predetermined fraction of a complete rotation. The program change-switching wheel is equipped with axially directed cam means constructed such that the program change-switching wheel in cooperation with a counterelement resiliently pressed against its axial cam means, upon reaching at least a predetermined rotational position, brings about a relative axial displacement of the rotor with respect to indexing or switching wheels seated upon a control shaft. This displacement is carried out in such a way that these switching disks or wheels, instead of cooperating with the first-mentioned group of actuation fingers at the rotor, cooperate with at least a second group of actuation fingers which are axially offset with respect thereto. This second group of actuation fingers is likewise secured at the rotor in selectable angular positions, so that by means of the contact actuation wheels arranged upon the control shaft their associated electrical contact elements can be actuated in accordance with a different program as a function of the momentary rotor position.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic plan view of a preferred embodiment of inventive program-controlled electrical switching mechanism;

FIG. 2 is a front view of the program change-switching wheel, as viewed in the direction of line 2-2 of FIG. 1;

FIG. 3 is a front view of the shaft-switching wheel, viewed in the direction of the line 3-3 of FIG. 1, or

FIG. 4 is a front view of the control arrangement and the contact actuation element, viewed in the direction of the line 4-4 of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, and with particular reference at this time to the exemplary embodiment of inventive program-controlled switching mechanism or timer depicted in FIG. 1, there will now initially be considered the basic construction of this switching mechanism. As best seen by referring to FIG. 1, three sideplates 11, 12 and 13, disposed in substantial parallelism to one another, are fixedly secured to any suitable nonilluminated platform or support structure. Similarly, three contact springs or support members 140, 141, and 142, likewise arranged upon a stationary platform or support, collectively form the contact arrangement to be actuated in accordance with a given program. A timer motor 15 or any other suitable type of motor which operates continuously with a constant rotational speed is mounted at the sideplate 12. A speed reduction transmission or drive 16 is fixedly arranged between the sideplates 12 and 13. Speed reduction drive or gear 16 serves to transform the rotational speed of the power takeoff shaft 150 of the timer drive motor 15 such that the power takeoff shaft 150 of the speed reduction drive 16 always performs one complete revolution in a time span of 24 hours.

A rotor 17 is rigidly connected for rotation with this shaft 160. Rotor 17 supports a digit or instrument dial 170 at which it is possible to read off at least quarter-hour time periods. Finger disks 171, 172, 171', 172' are secured in any suitable known manner coaxially with respect to the rotor 17 and these finger disks are mounted relative to such rotor such that they can be at least fixedly positioned in incrementally selectable rotational positions. Further, the finger disks 171, 172, 171' and 172' are connected with a respective switching wheel-actuating finger 171a, 172a, 171'a, 172'a protruding radially over the periphery of the rotor 17. A switching or control shaft 20 consisting of the integrally connected shaft sections 21, 22 and 23 is mounted to be rotatable and axially displaceable to and fro in the three sideplates 11, 12 and 13 parallel to the shaft 150 of the timer motor 15 and the shaft 160 of the speed reduction drive 16 and the rotor 17. Control shaft 20 supports at its central region 22 a prebiased helical or spiral spring 30 surrounding the central portion 22 of this shaft 20, one end of this spring 30 being supported at the sideplate 12, the other end striving to displace the entire control or switching shaft 20 out of the position shown in FIG. 1 in the direction of the arrow D.

A hub sleeve member 40 retained to be axially nondisplaceable between the sideplates 12 and 13 and rigidly connected for rotation with the control shaft portion 22 piercingly extending through and in displacement through the control shaft 20 rigidly carries for rotation a star wheel or slotted disk 41. Disk 41 cooperates with a stationarily mounted counterlocking or ratching element 42 such that the control shaft can only assume stable discrete rotational positions according to the subdivision of the star wheel or ratchet disk 41. This ratchet disk 41 corresponds in its shape to the hereinafter to be described switch disk or wheel 51 illustrated in FIG. 3. This control
The shaft-switching wheel 51 is rigidly connected for rotation and axially fixedly connected with the control shaft section 23. In much the same manner, the switching wheel 52 axially spaced from the switching wheel 51 is operatively coupled with the control shaft section 23. At the outer end of the control shaft section 23 there is mounted to be freely rotatable a program change-switching wheel 53, shown in front view in FIG. 2, this control or switching wheel 53, however, being mounted so as to be axially fixedly connected with the shaft section 23.

Program change-indexing or switching wheel 53 supports at its end face confronting the control shaft-switching wheels 51 and 52 an axially acting cam profile portion 530. Cam profile portion 530 is subjected to the action of the prebias of the spring member 30 and is continuously pressed against a plate member 133 supported via the bolts 131 and 132 at the sideplate 13. When the plate member 133, during subsequent to be described rotational movement of the program change-switching wheel 53, moves from the illustrated normal position and travels on to an axially protruding cam section of the cam profile portion or element 530, the program change-switching wheel 53, and together therewith the entire control shaft 50 of all components fixedly connected thereto are axially displaced against the prebias force of the spring member 30 through a distance corresponding to the axial cam height and opposite to the direction of the arrow D. In so doing, the control or switching wheels 51, 52, which previously as shown in FIG. 1 were located adjacent the finger disks 171 and 172, respectively, are displaced adjacent the respective actuation fingers 171' and 172' of the cam profile 530 of the program change-switching wheel 53, the control shaft 20 and the indexing or switching wheels 51 and 52 being provided with axially directed cam means, a counterelement resiliently biased against said cam profile 530 of the program change-switching wheel 53, the control shaft 20 and the indexing or switching wheels 51 and 52 (fixedly seated second control shaft-switching wheel 52) being provided with axially displaced part of the disk 171 and 172 at the rotor 17 no longer are positioned adjacent the switching disks or wheels 51 and 52, rather a second group of actuation fingers 171a' and 172a' appropriately axially displaced with respect to the first radially displaced actuation fingers, and located at the disks 171' and 172' at the rotor 17. According to the second group of actuation fingers it is possible to freely adjust or regulate a different daily switching program for the contact blade or spring group arrangement 14. Moreover, it is of course readily possible to provide at the control shaft 20 a number of pairs of contact actuation wheels 60, 60' and a number of associated contact spring groups 14 in order to alternately switch-in and switch-out other current circuits in accordance with a desired program.

It is readily to be understood that with the described arrangement it is possible to preselect, in a very simple manner, different program switching sequences in electrical current circuits at predetermined days of the week. Changes of the individual daily programs require a new setting of the finger disks 171, 172, 171', 172' at the rotor 17. Furthermore, changes of the weekly program are possible by changing the cam positioning or distribution at the program change-indexing wheel 53 or by changing such wheel or disk for a different one equipped with other cam distributions or designs. In special situations, it is also possible to control a given week day for a special program by changing the adjustment of the switching wheel 53 at the control shaft 20. A primary advantage of the illustrated and described exemplary embodiment resides in the fact that the time of day at which the further indexing of the program change-switching wheel 53 is always to occur by means of the finger disk 173 at the rotor 17, is freely selectable in such a manner that there is not associated therewith any malfunctioning or disturbance of the current circuit controlled by the switching mechanism. This would be, for example, the case if at the time of indexing of the program change-switching wheel according to the previous program a current circuit would have to be switched in which then must be switched in again after the program change.

It should be apparent from the foregoing detailed description, that the objects set forth at the outset to the specification have been successfully achieved. Accordingly, what is claimed is:

1. A program-controlled electrical switching mechanism comprising a motor driven rotatory motor including a rotor shaft rotatable at a predetermined rotational speed, a control shaft mounted substantially parallel to said rotor shaft, a switching disk means fixedly seated at said control shaft, a plurality of actuation fingers seated axially behind one another at said rotor, said actuation fingers being exchangeably secured at said rotor and being selectively adjustable with respect to their angular position, said actuation fingers cooperating with said switching disk means for stepwise indexing of said control shaft, at least one electrical contact arrangement, at least one contact arrangement-actuation wheel means carried by said control shaft for each said electrical contact arrangement, said actuation wheel means cooperating with said electrical contact arrangement, such that during each full revolution of said rotor said control arrangement is actuated in accordance with a predetermined program as a function of the momentary rotational position of said rotor, an additional actuation finger secured to said rotor in a selectively angular position, a program change-switching wheel cooperating with said additional actuation finger such that during the full revolution of said rotor said program change-switching wheel is indexed through a predetermined fraction of a complete revolution by said additional actuation finger, said program change-switching wheel being provided with axially directed cam means, a counterelement resiliently biased against said
axially directed cam means such that upon attaining at least a predetermined rotational position there is undertaken a relative axial displacement of said rotor with respect to said switching disk means seated upon said control shaft, whereby said switching disk means at said control shaft no longer cooperate with a first group of said actuation fingers at said rotor but with a second axially offset group of said actuation fingers so that said contact arrangement-actuation wheel means actuates its associated electrical contact arrangement according to a different program as a function of the momentary position of said rotor.

2. A program-controlled electrical switching mechanism as defined in claim 1, wherein said program change-switching wheel is mounted to be freely rotatable upon a portion of said control shaft and coaxially with respect to said control shaft-switching disk means arranged nonrotatably upon said control shaft, said program change-switching wheel further being axially nondisplaceably mounted with respect to said switching disk means such that the axial displacement of said program change-switching wheel relative to said rotor and the thereon seated actuation fingers imposed upon said program change-switching wheel by virtue of predetermined rotational positions thereof due to the arrangement of its cam means is transmitted to said control shaft-switching disk means.

3. A program-controlled electrical switching mechanism as defined in claim 2, wherein said rotor performs one complete revolution every 24 hours and said program change-switching wheel possesses means enabling it to assume seven discrete rotational positions so that at certain predetermined days of the week a second switching program for the contact arrangement becomes effective.

4. A program-controlled electrical switching mechanism as defined in claim 1, wherein said program change-switching wheel is mounted to be exchangeable.

5. A program-controlled electrical switching mechanism as defined in claim 1, wherein said axial cam means provided at said program change-switching wheel are arranged to be selectively positionable.

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