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FLEX-SHAFT SWITCH

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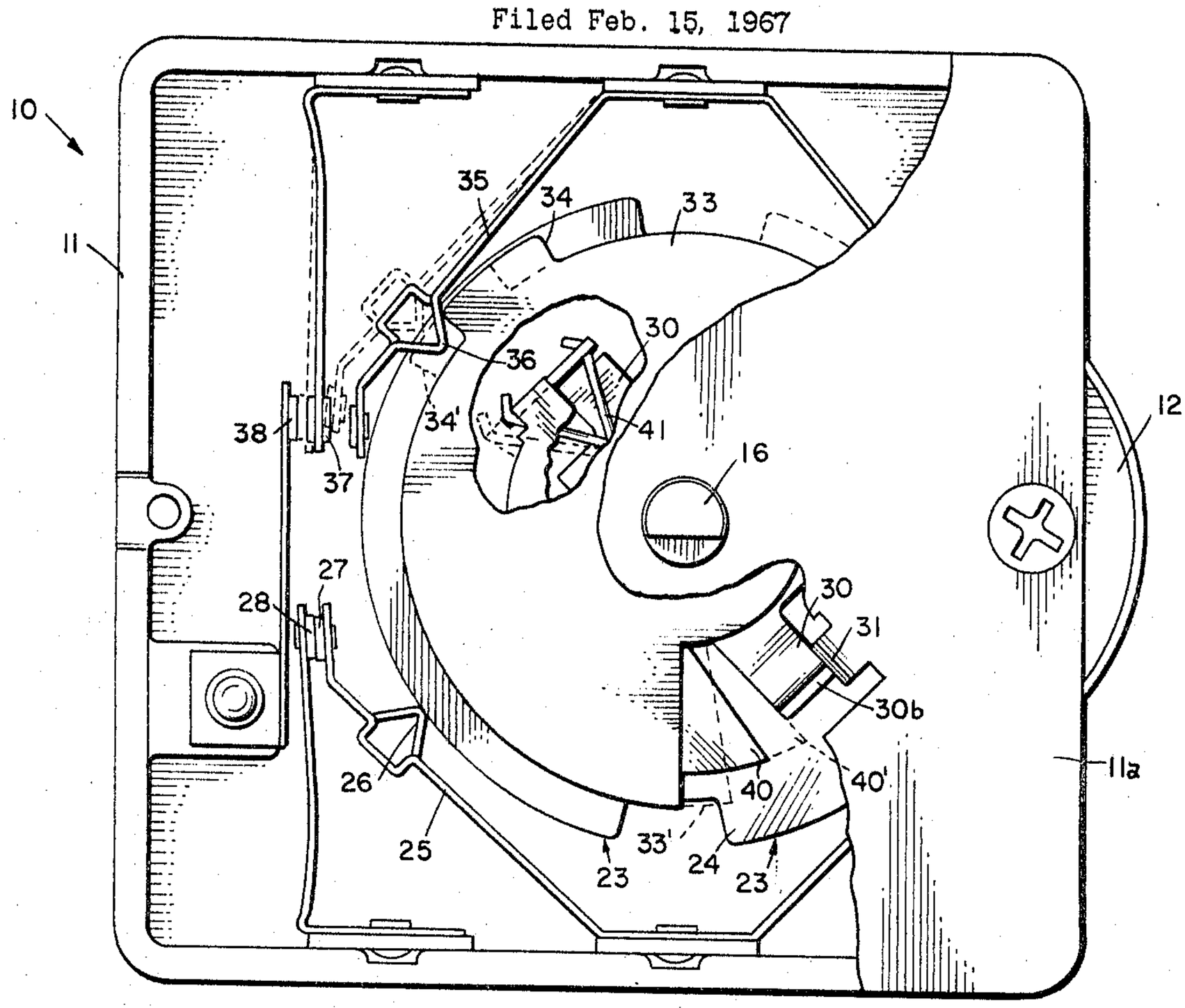


FIG. 1

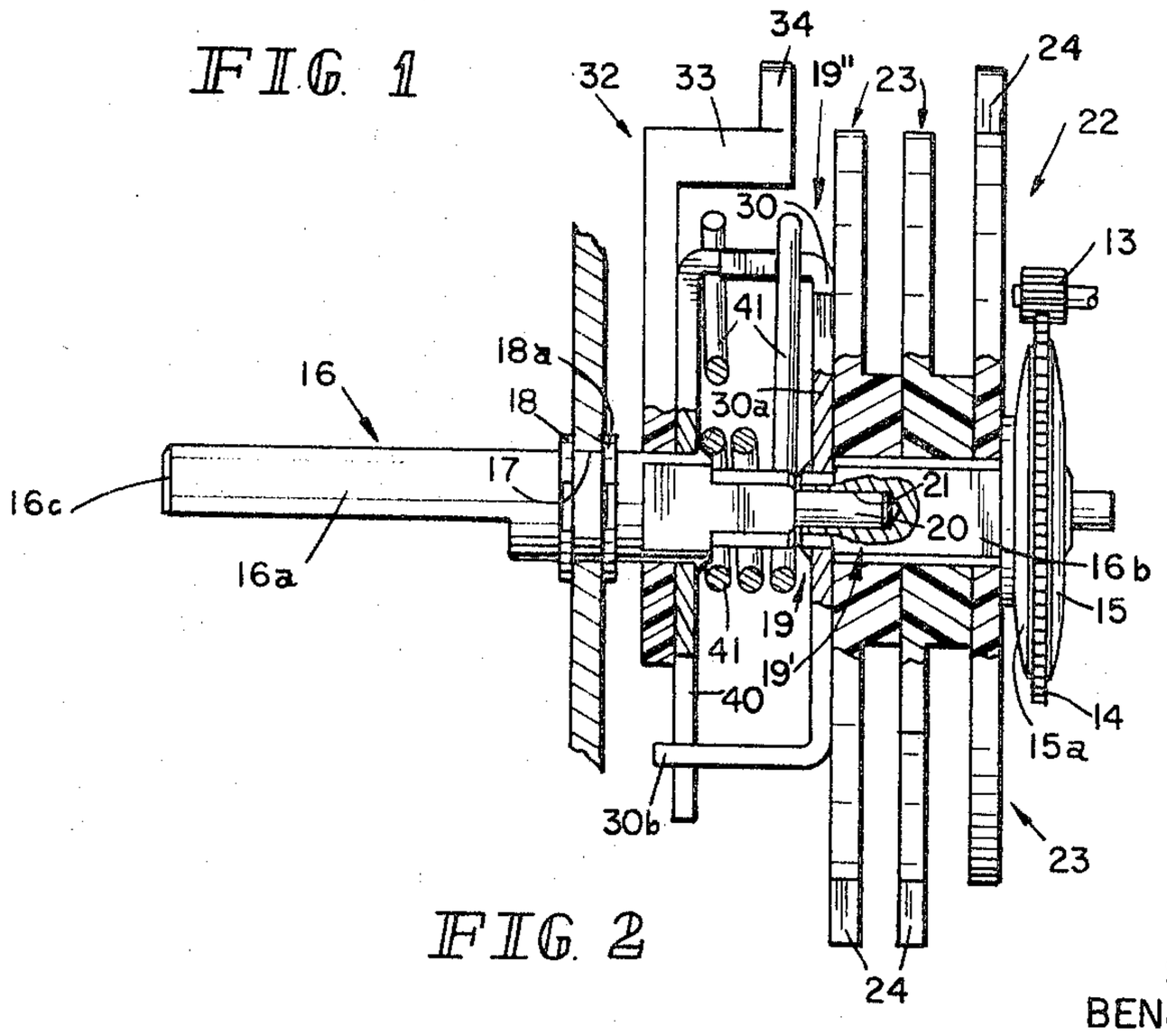


FIG. 2

INVENTORS
STEPHEN F. MURRAY
BENJAMIN F. CHESTNUT
BY
ATTORNEY

United States Patent Office

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FLEX-SHAFT SWITCH

Stephen F. Murray and Benjamin F. Chestnut, Indianapolis, Ind., assignors to P. R. Mallory & Co. Inc., Indianapolis, Ind., a corporation of Delaware

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7 Claims

ABSTRACT OF THE DISCLOSURE

A drive shaft has two concentric sections each capable of independent rotation from the other. Programming means are attached to one of the sections, with momentary contact initiating means attached to the other. Means are provided to prevent rotation of one section while the other is rotated.

Within the broad field of time switch mechanisms there exists a multiplicity of machine control applications wherein a particular time cycle must be faithfully reproduced in response to the command of the machine operator. Examples of such control requirements can be found in a host of commercial, industrial, and domestic devices and appliances. A typical domestic application, for example, is found in the ordinary clothes dryer. In such cases there is a demand for obedient repetition of a particular desired timing program, the initiation of each cycle being ideally executed with a minimum degree of manual effort.

The present invention is concerned with a novel switch mechanism and has as one of its objects the provision of such a switch which can be manually pre-set to a desired cycle time, while thereafter permitting initiation and unerring repetition of that pre-programmed cycle through rotation of a single drive shaft.

Another object of the invention is the provision of such a switch wherein the pre-programming means and the initiation means are independently operable off of a single drive shaft.

Another object of the invention is the provision of such a switch wherein the single drive shaft is divided into two independently rotating, concentric sections held together by a pilot interlock connecting means.

Still another object of the invention is the provision of such a switch wherein the pre-programming means is connected to one of such shaft sections and the initiation means is connected to the other of such shaft segments.

Yet another object of the invention is the provision of such a switch wherein the pre-programming means comprises actuator cams having discrete steps for locking the electrical circuit contacts in the closed position during the programmed cycle.

Another object of the invention is the provision of such a switch wherein the initiating means comprises a momentary contact switching means.

Still another object of the invention is the provision of such a switch wherein the momentary contact switching means comprises an actuator cam having a discrete step for closing an electrical circuit contact.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in a novel switching mechanism substantially as described herein and more particularly defined by the appended claims.

For illustrative purposes the invention will be described in connection with the accompanying drawings in which:

FIGURE 1 is a top view of the novel switch with a portion of its cover being removed to show the relationship of its various component parts; and

FIGURE 2 is a cross section of the drive shaft of the switch with its associated programming means and initiating means.

Generally speaking, the objects of the invention are accomplished by providing a time switching mechanism which can be manually pre-set to a desired cycle time, while thereafter permitting initiation and unerring repetition of the pre-programmed cycle through rotation of a single drive shaft. Accordingly, there is included in the present time switching mechanism a supported drive shaft divided into two concentrically aligned sections coupled by a pilot interlock connecting means such that the sections may be independently rotated, a driving mechanism to provide time driven rotation of programming cams connected to one of the shaft sections, means to prevent the programming cams from rotating past their pre-set position, and an actuator cam connected to the other of the shaft sections and having a discrete step for momentraily closing an electrical circuit contact. Termination of a cycle program occurs when the programming cams deflect their associated reaction members which releases electrical contacts from their closed position. The drive shaft may thereafter be rotated to index the programming cams for repetition of the same cycle program.

Referring now to the drawings, the time switch mechanism is generally indicated with reference numeral **10**. The switch is in general contained within a phenolic plastic housing **11** except for constant speed driving means such as synchronous motor **12** which is positioned outside the housing. To the output shaft of drive motor **12** is attached motor pinion **13** which projects through an aperture in the housing. Motor pinion **13** meshes with drive gear **14** which carries a friction actuated clutch consisting of spring washers **15** and **15***a* connected to the gear. The gear and clutch assembly are connected to drive shaft means **16** which is journalled through an aperture in the housing at the motor end. At the other end of the housing the shaft means **16** is journalled through aperture **17** by retaining rings **18** and **18***a* which also prevent axial movement of the shaft.

Shaft means **16** is divided into first and second concentric sections **16***a* and **16***b* which are connected by connecting means **19**. Connecting means **19** comprises pilot means **19'** and interlock means **19''** which cooperatively form a pilot interlock means for connecting the sections such that they can be independently rotated and such that the timer switch can be programmed and the program held in place while the timer is initiated through momentary contact means.

Pilot means **19'** comprises an extension **20** journalled in recess **21**. As will become apparent, the two shaft sections **16***a* and **16***b* are capable, because of the pilot means, of being rotated independently of each other. A suitable knob (not shown) is attached to the end **16***c* of section **16***a* of the shaft means for manual rotation thereof.

Interlock means **19''** comprises tang means **30** and **40** each connected to a section of shaft means **16**, and torsion spring **41**. Torsion spring **41** surrounds shaft means **16** and is positioned between the two tang means and is cooperatively engaged with such tang means. The spring, in conjunction with the tang means, serves as a resilient interlock betwen the two shaft sections **16***a* and **16***b*. As will be hereinafter explained, it is this construction which allows the programmed cycle of the time switch mechanism to be pre-set and thereafter permit initiation and unerring repetition of the cycle with the complete operation being carried out on a single shaft means.

Attached to section **16***b* of the drive shaft there is shown programming means **22**. Programming means **22** comprises at least one actuator cam **23** having a discrete arcuate step **24** for engaging a reaction member **25**,

through wedge shaped contact means **26**. Engagement of the contact means with the step **24** causes the reaction member to be deflected so as to close electrical contacts **27** and **28**. As shown in the drawings there are three such actuator cams each having discrete steps cooperating with corresponding reaction members and electrical contacts. It is to be understood that the number of such cams as well as the length of the arcuate steps may be varied in accordance with the desired program. As shown in the drawings, the cams and their associated steps are programmed for drying cycles of automatic dryers.

As previously noted, atached to section **16***b* is tang means **30** for preventing the programming means from rotating past its set programmed position. Tang means **30** is in the shape of a cup having a base **30***a* and a rim means **30***b*. Manual rotation of shaft means **16** causes rotation of programming means **22**. Continued rotation causes positive programming of the machine cycle through the relationship of the discrete steps **24** and the reaction members **25**. When the machine has been programmed, tang means **30** prevents further rotation of the programming means by having rim **30***b* of the tang means engage tab **31**. Tab **31** is formed by bending a cut portion of metal front plate **11***a* of housing **11**. Thus section **16***b* of shaft means **16** is prevented from further rotation.

Attached to section **16***a* of shaft means **16** is momentary contact initiating means **32**. Initiating means **32** comprises an actuator cam **33** having a discrete arcuate step **34** for engaging reaction member **35**. Continued rotation of shaft means **16** causes the discrete step **34** to engage wedge shaped contact means **36** thus deflecting reaction member **35** so as to close electrical contacts **37** and **38**, the new position of the cam and the arcuate step being shown by the dotted portions **33′** and **34′**. Again, as previously noted, attached to section **16***b* of the shaft means **16** is tang means **40** to prevent the momentary contact initiating means from rotating past its initiating setting. Upon closing contacts **37** and **38**, tang means **40** is brought to a stop by engaging rim **30***b* of tang means **30**, the new position of tang means **40** being shown by the dotted lines **40′**. Simultaneously, torsion spring **41** is spread as indicated by the dotted portion **41′** so as to build up energy to return tang means **40** to its original position. Thus upon release of the manually operated shaft means **16**, arcuate step **34** will return to its original position.

Upon closing contacts **37** and **38**, an electrical circuit to the machine motor (not shown) is completed and the machine is started. A centrifugal switch associated with such motor is then actuated which completes an electrical circuit to synchronous motor **12**. In the case of an automatic dryer, the pre-programmed drying cycle is then carried out. Upon completion of the programmed cycle, the machine motor is shut off, thus breaking the electrical circuit to the synchronous motor **12**. The cycle can then be repeated by again programming the machine as previously described.

Functionally, therefore, this invention provides a time switch mechanism which may be used on a machine or device wherein the device must function in accordance with a pre-programmed cycle. The use of the two-sectioned drive shaft means, having the sections connected by a pilot interlock connecting means, enables the programming means to be set and held in place while the momentary contact is being made because of the ability of the sections to be independently rotated. Further rotation of the shaft means provides for a momentary contact which initiates starting of the machine. The momentary contact is readily achieved through the torsion spring-biasing of the tang means which insures that the actuator cam can be returned to its original position upon release of the shaft means.

Thus there is described a novel time switch mechanism which is able to pre-set a programming cycle, and initiate its operation from a single drive shaft. In addition the switch is simple in construction and therefore more reliable. Thus it will be readily apparent to those skilled in the art that this invention provides a new and useful time switch.

What is claimed is:

1. In a time switch mechanism wherein a programmed cycle can be pre-set to close cooperating electrical circuits and thereafter permit initiation and unerring repetition of the programmed cycle, a rotatable drive shaft means supported by a housing for said switch, said shaft means having two independently rotatable sections, means connecting said sections, with switch programming means carried by one of said sections and momentary contact initiating means carried by the other of said sections whereby said switch can be programmed and initiated through simple rotation of said drive shaft means.

2. In a time switch mechanism wherein a programmed cycle can be pre-set to close cooperating electrical contacts and the mechanism initiated through simple manual rotation of a drive shaft and thereafter permit unerring repetition of the programmed cycle, a manually rotatable drive shaft means supported by a housing for said switch, said shaft means having two independently rotatable sections, pilot interlock means connecting said sections, one of said sections carrying programming means, said other section of said shaft means carrying momentary contact means for initiating said mechanism and a driving mechanism coupled to said drive shaft means for imparting time-driven rotation thereto.

3. In a time switch mechanism wherein a programmed cycle can be pre-set to close cooperating electrical contacts and the mechanism initiated through simple manual rotation of a drive shaft and thereafter permit unerring repetition of the programmed cycle, rotatable drive shaft means supported by a housing for said switch, said shaft means being divided into first and second concentric independently rotatable sections, pilot interlock means connecting said sections, programming means carried by said second section of said shaft means, reaction members responsive to said programming means for locking circuit contact means in contiguity, momentary contact initiating means carried by said first shaft section, a reaction member responsive to said momentary contact means for closing an electrical circuit contact means, and a driving mechanism coupled to said drive shaft means for imparting time-driven rotation thereto.

4. In a time switch mechanism wherein a programmed cycle can be pre-set to close cooperating electrical contacts and the mechanism initiated through simple manual rotation of a drive shaft and thereafter permit unerring repetition of the programmed cycle, a manually rotatable drive shaft means supported by a housing for said switch, said shaft means having two independently rotatable sections, means connecting said sections, said connecting means including pilot means, and interlock means including spring loaded tang means connected to each of said sections, one of said sections carrying programming means, said other section of said shaft means carrying momentary contact initiating means for initiating said mechanism.

5. In a time switch mechanism wherein a programmed cycle can be pre-set to close cooperating electrical contacts and the mechanism initiated through simple rotation of a drive shaft and thereafter permit unerring repetition of the programmed cycle, a manually rotatable drive shaft means supported by a housing for said switch, said shaft means being divided into first and second concentric independently rotatable sections, means connecting said sections, said connecting means including pilot means, and interlock means including spring loaded tang means connected to each of said sections, programming means carried by said second section, reaction members responsive to said programming means for locking circuit contact means in contiguity, momentary contact initiating means carried by said first shaft section, a reaction

member responsive to said momentary contact means for closing an electrical circuit contact means, and a driving mechanism coupled to said drive shaft means for imparting time-driven rotation thereto.

6. In a switch mechanism

(a) drive shaft means supported by a housing for said switch mechanism, said drive shaft means being divided into first and second independently rotatable concentric sections,

(b) means to manually rotate said shaft means,

(c) programming means connected to said first section and reaction members responsive to said programming means and for locking circuit contact means in contiguity,

(d) momentary contact initiating means connected to said second section and a reaction member responsive to said momentary contact means for closing electrical contact means,

(e) connecting means for connecting said sections, said means including pilot means through which one of said sections can be rotated against the other, and interlock means comprising tang means connected to said first section having rim means, said rim means being adapted to engage a tab means formed in said housing after said programming has been set, tang means connected to said second section and being adapted to engage said first tang means after said momentary contact means has engaged its reaction member, and torsion spring means to disengage said momentary contact means from its reaction member, and

(f) a driving mechanism coupled to said drive shaft means for imparting time-driven rotation to said shaft means.

7. In a time switch mechanism:

(a) drive shaft means supported by a housing for said switch, said drive shaft means being divided into first and second independently rotatable concentric sections,

(b) means to manually rotate said shaft means,

(c) at least one actuator cam connected to said second section and having a discrete arcuate step for programming said time switch,

(d) at least one reaction member responsive to said actuator cam, and electrical contacts responsive to said reaction members,

(e) a momentary contact actuator cam connected to said first section and having a discrete arcuate step,

(f) a reaction member responsive to said actuator cam and electrical contacts responsive to said reaction member,

(g) connecting means for connecting said shaft sections, said means including pilot means through which one of said sections can be rotated against the other, and interlock means comprising tang means connected to said first section and having rim means, said rim means being adapted to engage a tab means formed in said housing after said actuator cam has has been set, tang means connected to said second section and being adapted to engage said first tang means after said momentary actuator cam has been set, and a torsion spring surrounding said shaft means and being axially positioned between said tang means and being cooperatively engaged therewith, and

(h) a driving mechanism coupled to said drive shaft means for imparting time-driven rotation thereto.

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ROBERT K. SCHAEFER, *Primary Examiner.*

H. O. JONES, *Assistant Examiner.*