United States Patent

[11] 3,581,027

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[21] Appl. No. **789,288**
[22] Filed **Jan. 6, 1969**
[45] Patented **May 25, 1971**

[54] **PUSH BUTTON TIME CYCLE CONTROLLER**
10 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** 200/33, 200/38
[51] **Int. Cl.** **H01h 43/00**
[50] **Field of Search** 200/14, 33, 38; 318/31, 32, 33; 74/10.6; 334/7, 50, 54

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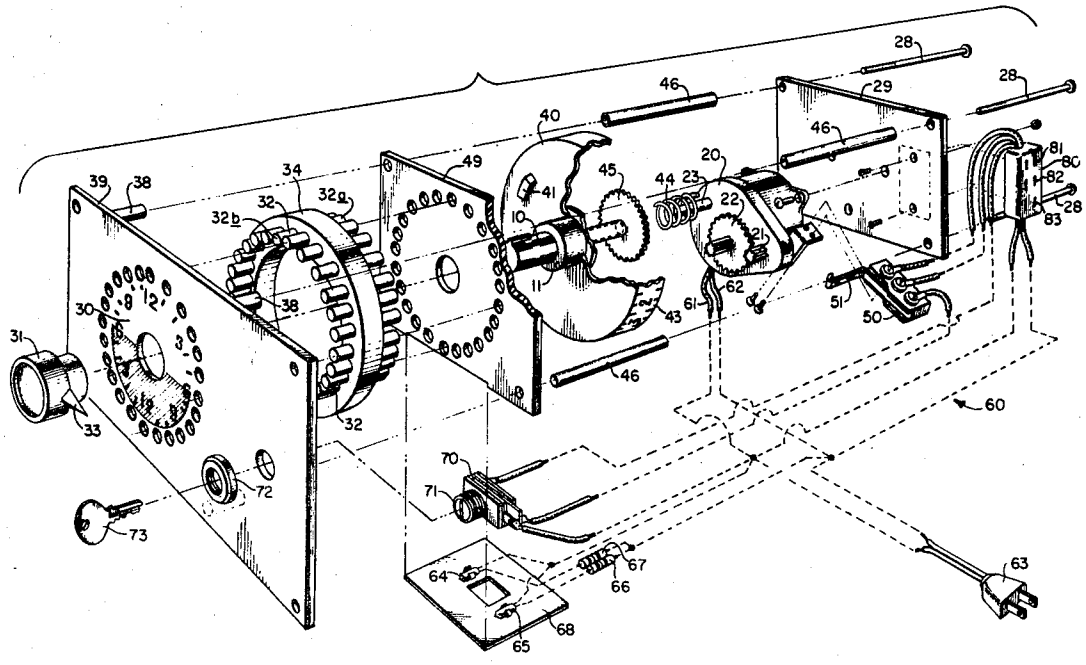
ABSTRACT: A pushbutton time cycle controller by virtue of which operations can be programmed, conducted, or carried out according to definitely timed sequences usually arranged over a 12-hour or 24-hour period. The controller comprises the combination of a dial face pushbutton assembly, the pushbuttons of which are arranged in patterns or orbitals for preselected setting in desired timed sequence, for activation of an electrical circuit by physical coaction between the pushbuttons and a displaceable synchronously rotating cam-disc or cam-disc assembly, which is brought into contact with a pressure responsive electrical switch in response to pushbutton settings. The pressure responsive electrical switch performs a preselected operation by energizing an external electrical circuit, or circuits.



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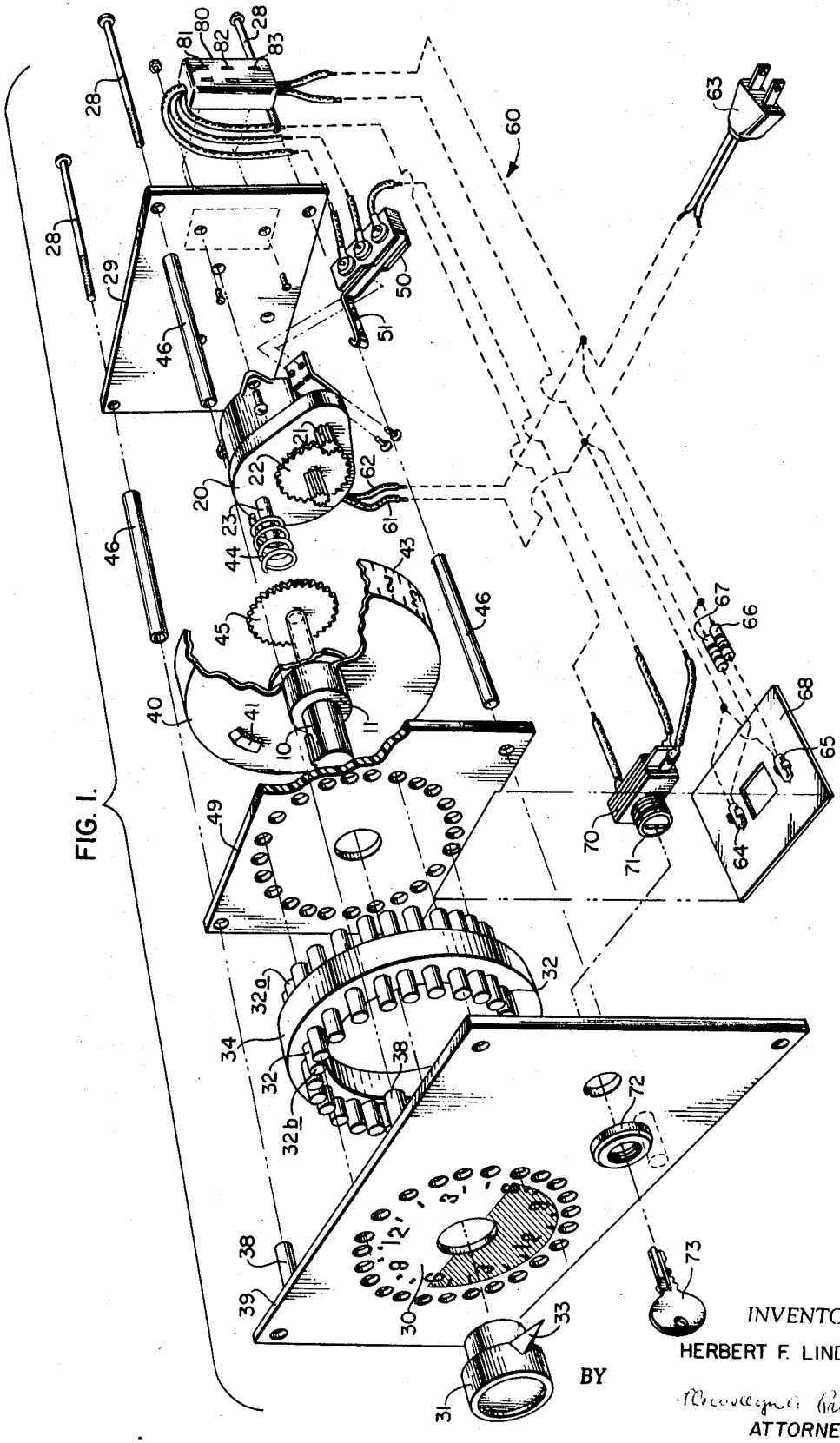

FIG. 1.

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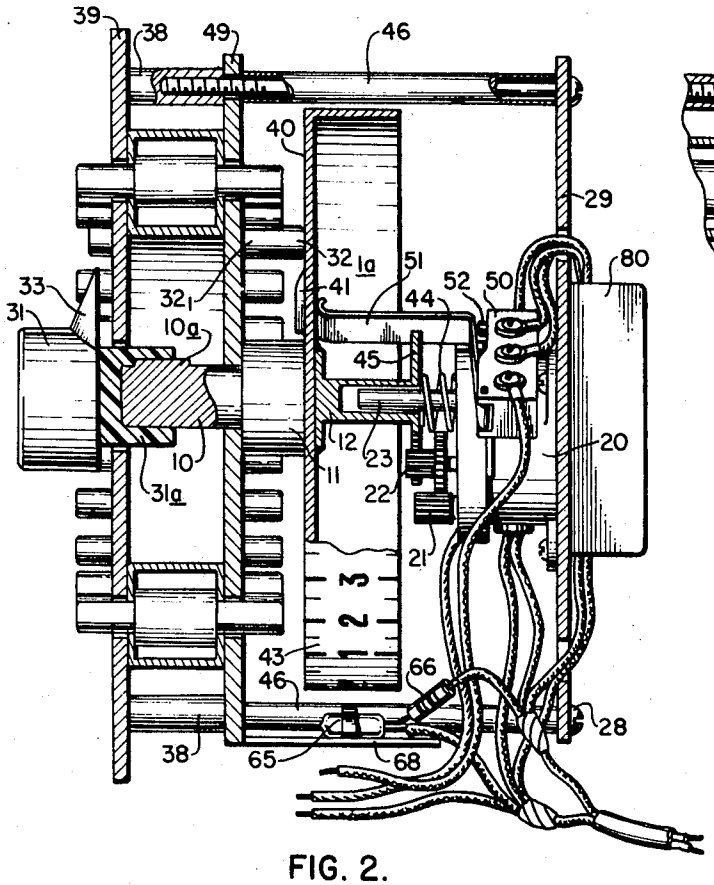

FIG. 2.

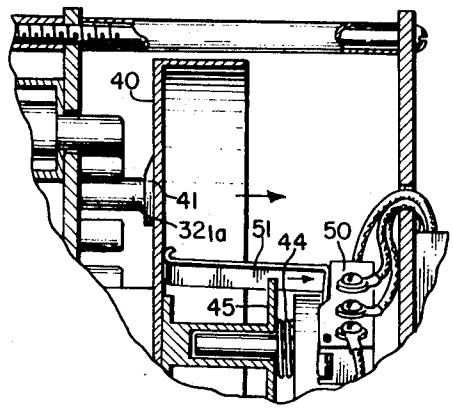

FIG. 3.

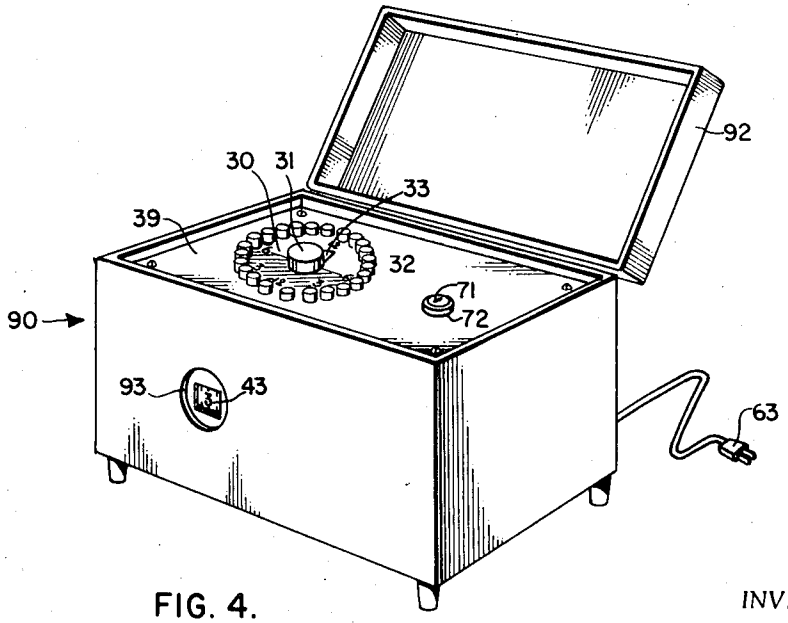

FIG. 4.

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PUSH BUTTON TIME CYCLE CONTROLLER

Pushbutton time cycle controllers of various types have been known to the art for many years, and have been employed for many purposes including devices of this general character for turning on and off radios, alarms, lights, appliances, stoves, furnaces and the like. The manner of setting such controllers is often relatively simple, amounting in most instances to setting a pointer to preselect a single time at which some desired operation is to be performed. The internal functioning of such controllers, however, is not generally so simple, and mechanisms are all too often quite complex. To assure reliability, considerable care must be exercised in the production and assembly of these complex mechanisms. It is also often desirable to preselect multiple periods over which an operation, or series of operations, can be conducted over a unit time period.

The primary objective of the present invention is to provide a new and improved time cycle controller which will obviate the foregoing and other disadvantages.

A particular object is to provide a simplified pushbutton time cycle controller which can be manually set to open and close an electric circuit (or circuits), and thereby to turn on (or off), for a preselected definite time, an electrically operated device.

A specific object is to provide a controller of such type, integrated with a synchronous motor or other type of clock motor mechanism, so that desired functions can be programmed by pushbutton selection to operate an electrically operated device at any time interval as indicated by time selections made on the clock dial.

A more specific object is to provide a controller of such type integrated with a 12-hour or 24-hour clock mechanism for control of one or a plurality of electric circuits in response to on-off time settings, including the turning off of one circuit (or group of circuits) as another (or others) is turned on.

Yet another specific object is to provide such controller wherein switches and other important components are fully enclosed within a housing to eliminate fire hazards, as may be present in certain environments.

Other objects will be apparent in view of the following descriptions.

The invention, accordingly, is embodied in a pushbutton time cycle controller or apparatus combination which can be characterized as comprising, generally, the combination of a dial face pushbutton assembly, the pushbuttons of which are arrayed in patterns or orbitals for preselected setting in desired time sequence, for activation of an electrical circuit by coaction between the pushbutton ends and a displaceable synchronously rotating cam-disc, or cam-disc assembly, which is brought into contact with a pressure responsive electrical switch, or switches, in response to pushbutton settings.

The principal units of the controller thus comprise

a dial face, provided with time indicia markings and one or a plurality of pushbuttons spaced at preselected time intervals representing divisions of the unit time measured on the dial face,

a shaft operatively associated with, or geared to, a synchronous clock motor or other type of clock mechanism for rotating the shaft at a uniform angular velocity, a single rotation per unit time corresponding to the unit of time measured on the dial face,

a circular disc or equivalent member provided with a cam surface, concentrically disposed, integrally mounted upon, and vertically displaceable along the axis of the shaft, or with the shaft, by action of the lower pushbutton ends upon the cam, and

a switch, preferably a pressure responsive electrical switch, for controlling and energizing an electrical circuit, located adjacent to and within the displacement range of the circular disc.

The pushbuttons are arranged at desired intervals, generally in orbitals or patterns, around the circumference of the dial face to provide different time settings, these corresponding

with divisions of the unit time represented on the dial face. A time setting is selected by pushing in one of the buttons, or several time settings can be made by pushing in several of the buttons. In its function, the lower end of a pushbutton is thrust into the path of travel of the cam of the circular disc, so that on rotation the cam surface strikes the pushbutton end thereby causing the circular disc to be displaced downwardly into contact with the pressure responsive switch so as to activate and energize the external electrical circuit. The activation continues under the stimulus of the pushbutton end, or ends, until the cam has moved physically beyond its influence at which time the circular disc, by action of a tensioned spring, is displaced back into its original position out of contact with the pressure responsive electrical switch.

The invention, and its principle of operation, will be more fully understood by reference to the following detailed description of a specific embodiment, and to the attached drawings to which reference is made in the description. In the description, similar whole numbers are used to represent similar parts or components, and where numbers with subscripts are used in common with whole corresponding numbers, the whole numbers are used in generic sense and subscripts are used where there is a plurality of similar parts or components. Letter subscripts are used to denote a particular part or portion of a component.

In the drawings:

FIG. **1** is an exploded or disassembled view showing in detail the several basic units or principal parts of a preferred pushbutton time cycle controller of this invention;

FIG. **2** is a sectioned side view of the controller, showing the basic units of the foregoing figure, assembled and disposed in cooperating relationship;

FIG. **3** is a fragmentary view of the preceding figure, the two views taken together showing a progression of the means used for activation of the electrical circuit; and

FIG. **4** is an isometric view of the packaged unit in a preferred boxlike container.

Referring to the drawings, and specifically to FIG. **1**, the principal parts of the time cycle controller includes generally, first, a dial face pushbutton assembly, represented by the dial face **30** etched, painted, printed, or otherwise scribed upon the upper panel **39**, the pushbutton spacer ring assembly **34** and the intermediate panel **49**. In assembly, the upper pushbutton ends 32_B are projected through openings provided therefor in upper panel **39** and the lower pushbutton ends 32_A are projected through openings provided therefor in intermediate panel **49**, the number of openings in each panel **39,49** corresponding to the number of pushbuttons **32**. The cam-disc assembly is represented by the circular disc **40**, provided with a cam **41**, concentrically disposed and integrally mounted upon a rotatable vertically displaceable shaft **10**, which includes the collar **11** and shaft portion or extension **12**. The rotatable shaft **10**, and consequently the whole of the cam-disc assembly, is operatively geared to a clock motor **20**, mounted upon a base panel **29** alongside the pressure responsive electrical switch **50**. The circular disc **40** and shaft **10** are, in this specific embodiment, vertically displaceable, as a unit, when the cam **41** is contacted by a pushbutton **32**, displacement producing contact with the adjacent pressure responsive electrical switch **50**, for activation of an electrical circuit **60**, located adjacent to and within the displacement path of the circular disc **40**.

It will be generally observed that the cam-disc assembly is rotatably supported atop the clock motor **20**. The lower end of the cam-disc assembly, by virtue of an elongated annular opening within the shaft extension **12**, thus fits over the idler pin or stud **23** to which it is journaled. The upper end of the assembly is supported by passage of the shaft **10** through central openings within panels **39,49** which provides and houses the dial face pushbutton assembly. The cam-disc assembly is driven at constant angular velocity by the motor **20** via any suitable connecting means, e.g., friction discs, belts, chains, gears, or the like, means being specifically described hereafter.

At the center of the dial face **30**, provided with time indicia markings, a turn knob **31** is keyed to, or rigidly affixed upon, and movable with the rotatable shaft **10**. The turn knob **31** is provided with a pointer **33** which indicates the time of day, 24-hour markings being shown, this being used with a 24-hour clock as often preferred, and illustrated. The time indicated by the pointer **33** is set to correspond with the time shown in the window **93** (FIG. **4**) of the casing **90**, the time shown being read from indicia marks and numerals representing a clock scale **43** attached upon the peripheral edge of disc **40**.

Pushbuttons **32** can be mounted in any convenient number (e.g., 24), at any convenient intervals, around the circumference of the dial face **30**. These extend through a spaced-apart top and intermediate panel **39,49**, and the lower ends 32_A thereof terminate, in an unset position, just above the path of travel of the cam **41** of the disc **40**. It will be noted that the top and intermediate panels **39,49** are joined together and spaced by means of tubular spacers **38** located at the corners of the panels and by an open centered circular member or pushbutton spacer ring assembly **34** to which the top and intermediate panels **39,49** are glued or otherwise affixed. The panels **39,49** could thus be affixed together in any suitable manner and, in fact, a unitary panel could be substituted for this assembly.

By specific reference to FIG. **2**, it will thus be observed that the sum total of the pushbuttons **32** is set within individual openings within the spacer ring assembly **34** and the upper and intermediate panels **39,49**, respectively. The upper portions 32_B of the pushbuttons **32** extend through openings within panel **39**. The spacer ring **34** provides openings for the pushbuttons **32**, equal in number to those provided by panels **39,49**, respectively. The open lower end 31_A of the turn knob **31** fits over and mates with the top of shaft **10** to which it is keyed via a vertical slot which rides upon the bar or key member 10_A which prevents relative rotational movement between the two members. The turn knob **31**, with its pointer **33**, forms in effect an optional but desirable portion of the cam-disc assembly. Sufficient clearance is provided between the lower surface of turn knob **31** and the upper face of dial **30** for limited vertical movement of the cam-disc assembly.

The clock motor **20**, mounted upon the base panel **29**, is geared via the shaft extension **12** to the lower portion of the shaft **10** upon which is affixed the circular disc **40**. The disc **40** is rigidly secured to the shaft **10** via the collar **11**, which is in turn rigidly secured to smaller diameter shaft extension **12**. The terminal portion of the shaft extension **12** is hollow, fits over and mates with the idler pin or stud **23**, but sufficient clearance is provided within the elongated annular opening of the shaft extension **12** to permit limited vertical movement of the cam-disc assembly. The turn knob **31**, shaft **10**, coupling collar **11**, shaft extension **12**, and the circular disc **40** thus comprise an assembly rotatably supported upon the stud **23** and vertically displaceable to a limited extend within the structure formed by the top, intermediate, and base panels **39,49,29** secured together by means of cylindrical shaped spacers **38,46** held in place by the bolts **28**.

The circular disc **40**, provided with an upwardly facing cam surface **41**, is concentrically mounted upon and rotatable with the complete cam-disc and shaft assembly. The circular disc **40** is normally maintained in raised position by the upward thrust of the tensioned helical spring **44**, but it is vertically displaceable downwardly from its elevated position into a lower position along with the shaft **10**. Downward displacement of the disc **40** by action of a set pushbutton is sufficient to press downwardly on the end of lever **51** of the pressure responsive switch **50**, e.g., a Microswitch, to activate the electrical circuit **60**. In this action, it will be apparent that the principle of operation is the same whether the disc is displaced downwardly with the shaft, as described, or relative to the shaft, to contact the Microswitch. Hence, the movement of the disc along the axis of the shaft is fully the equivalent of movement of the entire cam-disc shaft assembly, as specifically described.

The cam-disc assembly, and consequently the shaft **10**, is rotated by means of an electrically driven or spring wound clock motor **20** to which it is operatively associated via gears **21,22,45**, the former of which is mounted on the shaft of motor **20** and the latter of which is mounted on the peripheral end of shaft extension **12**. The spur gear **22** interconnects gears **21,45**. The axial end face of the shaft extension **12** is thus provided with an annulus of gear teeth **45** which surrounds the axis of rotation. The gear **45** is acted upon by the meshing spur gear **22** driven by gear **21** which is an annulus of gear teeth surrounding the drive shaft of the motor **20**. Preferably, an electrically driven clock motor is used, and the shaft **10** is uniformly rotated about its axis at 1 revolution per day; or, 1 revolution per 12-hour period where the unit time shown on the dial face is 12 hours. One revolution of the shaft **10** will thus correspond with 1 revolution of the disc **40**, and this in turn will correspond to the unit scale shown on dial face **30**. A 24-hour period is specifically illustrated.

The indicia marks on the dial face **30** thus represent a 24-hour scale, and the pushbuttons **32** are located for initiation of an operation at any hour, or fraction thereof, of the 24-hour period. The number of pushbuttons **32** employed is determined by the desired degree of selectivity and frequency of the desired operations.

The nature and function of a pushbutton **32** is that, in an unset position, its terminal end 32_A lies above the locus or path of travel of the cam **41**, of rotatable disc **40**. In set position, which occurs when a pushbutton **32** is pushed inwardly, the terminal end 32_1 is thrust into the path of travel of the cam **41**, of disc **40** to produce downward deflection of the cam-disc assembly, and shaft **10**. Consequently, any of several known types of pushbuttons can be used to perform this function. A convenient type of pushbutton is as commonly used on a ball point pen. To set a pushbutton all that is required is to press inwardly on the pushbutton. This causes the lower end of a pushbutton 32_A to be thrust downwardly and into the path of the cam. The pushbutton will so remain in this position as long as it is set. To unset the pushbutton, a second inward pressing causes the pushbutton end to be retracted out of the path of the cam.

The arc length of the cam **41**, of disc **40**, and its distance from the axis of shaft **10** determine the time in which the shaft assembly, and consequently disc **40**, will remain in deflected position. Consequently, the arc length of the cam **41** and its radial distance from the center of shaft **10** are preselected so that an operation can be continued for any desired period within the span of time represented by adjacent pushbuttons. The span of time produced by the arc length of a cam, and its radial distance from the shaft axis, can be less than or equal to the span of time represented by the time span produced by the location of adjacent pushbuttons, as described. Where, as in this illustration, the pushbuttons **32** are spaced to provide 1-hour intervals, the arc length of the cam **41**, and its radial distance from the shaft axis, would be preselected to provide activation for a period of 1 hour or less. If an operation is to be initiated and continued for a longer period than 1 hour, without interruption, and the cams are of sufficient arc length to provide a full hour of operation on activation by a single pushbutton, a plurality of adjacent pushbuttons can be set, as desired, to continue the operation. In this manner, the disc **40** will remain in downwardly deflected position by continued action of the adjacent pushbutton upon the cam **41**. On the other hand, an operation can be performed repetitiously at different time periods during a day, and the operations will be continued from day to day unless the pushbuttons are reset. Alternatively, pushbutton selections can be made to discontinue operations within certain time periods, while operations are performed in unset pushbutton periods.

In an operation best described by reference to FIGS. **2** and **3**, a pushbutton 32_1 is pressed inwardly and set for an operation to take place at some future time, e.g., 10 o'clock. The disc **40** turns throughout the time intervening between the time of setting and 10 o'clock. As the hour of 10 o'clock is ap-

proached, the cam 41 of disc 40 approaches the terminal end of the pushbutton 32_{1A} and the latter begins to ride over the inclined edge of the cam 41. The action causes the disc 40, and shaft 10, to begin to move downwardly and as it does so lever 51 of Microswitch 50 is gradually depressed. Rotation of the disc 40 continues as spring 44 is compressed and tensioned. On reaching the high point or plateau of the cam 41, as shown by reference to FIG. 3, the lever arm 51 of Microswitch 50 closes upon the contact 52 to activate the electrical circuit 60 and activation continues as long as the top of the cam 41 continues to move along or ride upon the lower end of the pushbutton 32_{1A}. On reaching the opposite side of the pushbutton end 32_{1A}, the action of the latter on the cam 41 is discontinued and the disc 40, and shaft 10, under action of the tensioned spring 44, is thrust back into its former upward position. As this happens, the lever 51 of Microswitch 50 is raised and contact 52 no longer touches against the lever 51. Electrical contact is broken, and electrical circuit 60 is deenergized. So long as the pushbutton 32_1 remains set at this time, the action is repeated every 24-hour period. Multiple settings would produce a series of such actions at preselected intervals during the 24-hour period.

The several parts of a typical electrical circuit 60 is best described by specific reference to FIG. 1. Power is continuously supplied to motor 20 via leads 61,62 by insertion of the male plug 63 into a socket of a suitable source. Power, reduced in quantity by use of resistances 66,67, is also continuously supplied to the bulbs 64,65 affixed on the panel 68 conveniently mounted on the side of the structure by attachment to intermediate and base panels 49,29. An on-off keyed switch 70, mounted within the upper panel 39 by threadable connection between the shank portion 71 and washer 72, controls the power supply to the Microswitch circuit. A flick of key 73 thus permits cutting off the flow of electricity to Microswitch circuit 60. Conversely, a flick of key 73 activates the Microswitch circuit 60. Activation of the Microswitch circuit, in turn, is also contingent on the on or off position of lever 51 of Microswitch 50 activated by displacement of circular disc 40. Receptacle 80 permits electrical connection between the Microswitch circuit 60 and external circuits.

External electrically operated devices can thus be connected to the pushbutton time cycle controller by suitable male plugs thrust into sockets 81,82,83 of receptacle 80. The double-acting Microswitch can simultaneously make one contact and break another in response to an on-off time setting, or settings, of the controller and hence activate or turn one external device on as another is deactivated or turned off. Alternatively, a single-acting microswitch can be used to turn a device on and off in response to an on-off time setting, or settings, of the controller.

A feature of the invention is that the several components of the controller, particularly an electrical switch, or switches, can be readily located within a housing, this being particularly desirable where the controller is to be used in an atmosphere which may introduce a fire hazard. The several parts of the time cycle controller can thus be contained in a boxlike casing or housing 90 as shown by reference to FIG. 4. The receptacle 80, plug 63, a portion of the key switch 70, dial face 30, turn knob 31, pointer 33 and pushbutton 32 are projected outside the housing 90 suitably supported on a plurality of legs. A window 93 in the front of the housing 90 provides direct time readings without lifting the hinged lid 92 to read the time from the position of the pointer 33.

As will be understood, these and various other modifications can be made within the spirit and meaning of this invention.

Having described the invention, what I claim is:

1. A pushbutton time cycle controller for performing preselected operations by energizing an electrical circuit comprising, the combination of

a dial face, provided with time indicia markings representing divisions of a unit of time, and a plurality of pushbuttons spaced at preselected time intervals around the dial face,

a clock motor mechanism,

a shaft operatively associated with said clock motor mechanism, the latter for continuously rotating the said shaft at a uniform angular velocity, a single rotation per unit time corresponding to the unit of time measured on the dial face,

a circular disc provided with a cam surface, concentrically integrally disposed on the shaft, rotatable therewith and vertically displaceable by action of the lower pushbutton ends which can be selectively moved into the path of the rotating cam for contact therewith,

an electrical switch, for energizing said electrical circuit, located adjacent to and within the displacement range of the circular disc for contact and activation thereby,

whereby a preselected time setting made by pressing inwardly upon a pushbutton on the dial face causes the terminal end of the pushbutton to be projected downwardly into the path of the cam surface of the rotating circular disc so that, at a time corresponding to the preselected time setting, the pushbutton end will press against the cam and cause the disc to be displaced into contact with the switch to energize the said electrical circuit for performing preselected operations.

2. The apparatus of claim 1 wherein the unit of time measured on the dial face, and the time required for a single uniform rotation of the shaft, is 12 hours.

3. The apparatus of claim 1 wherein the time measured on the dial face is divided into a 24-hour period, and pushbuttons are located around the dial face for setting at intervals representing periods ranging up to 1 hour, and greater.

4. The apparatus of claim 3 wherein the cam surface is of such arc length and radial distance from the axis of the shaft that, upon setting a pushbutton to produce activation of the electrical circuit by contact of the disc with the pressure responsive switch, the operation continues without interruption for the set period.

5. The apparatus of claim 1 wherein the downwardly displaced circular disc activates at least one pressure responsive electrical switch, a switch controlling at least one separate external electrical circuit.

6. The apparatus of claim 1 wherein the pressure responsive electrical switch is a Microswitch.

7. The apparatus of claim 1 wherein the dial face and pushbuttons are located upon the external surface of an outer panel, the pushbuttons extend through the outer panel and an intermediate panel spaced-apart from and rigidly adjoined to the outer panel, the rotatable shaft extends through both the said outer and intermediate panel and is operatively geared to the shaft of a motor mounted upon a base panel upon which is also mounted the pressure responsive electrical switch and portions of the electrical circuit.

8. The apparatus of claim 7 wherein a turn knob is located upon a terminal end of the rotatable shaft at the center of the dial face and a pointer is provided thereon to indicate the time at any given moment.

9. The apparatus of claim 7 wherein the several components are contained with a boxlike casing.

10. The apparatus of claim 9 wherein the boxlike casing is provided with a window, the peripheral surface of the circular disc is provided with time-indicia marks corresponding to those shown on the dial face, and the time-indicia marks which are framed within the window correspond to the time indicated by the pointer located on the turn knob at the dial face.