Dec. 15, 1959 M. JUHAS 2,917,591

SWITCH ACTUATING TIMER

Filed May 10, 1957 3 Sheets-Sheet 1

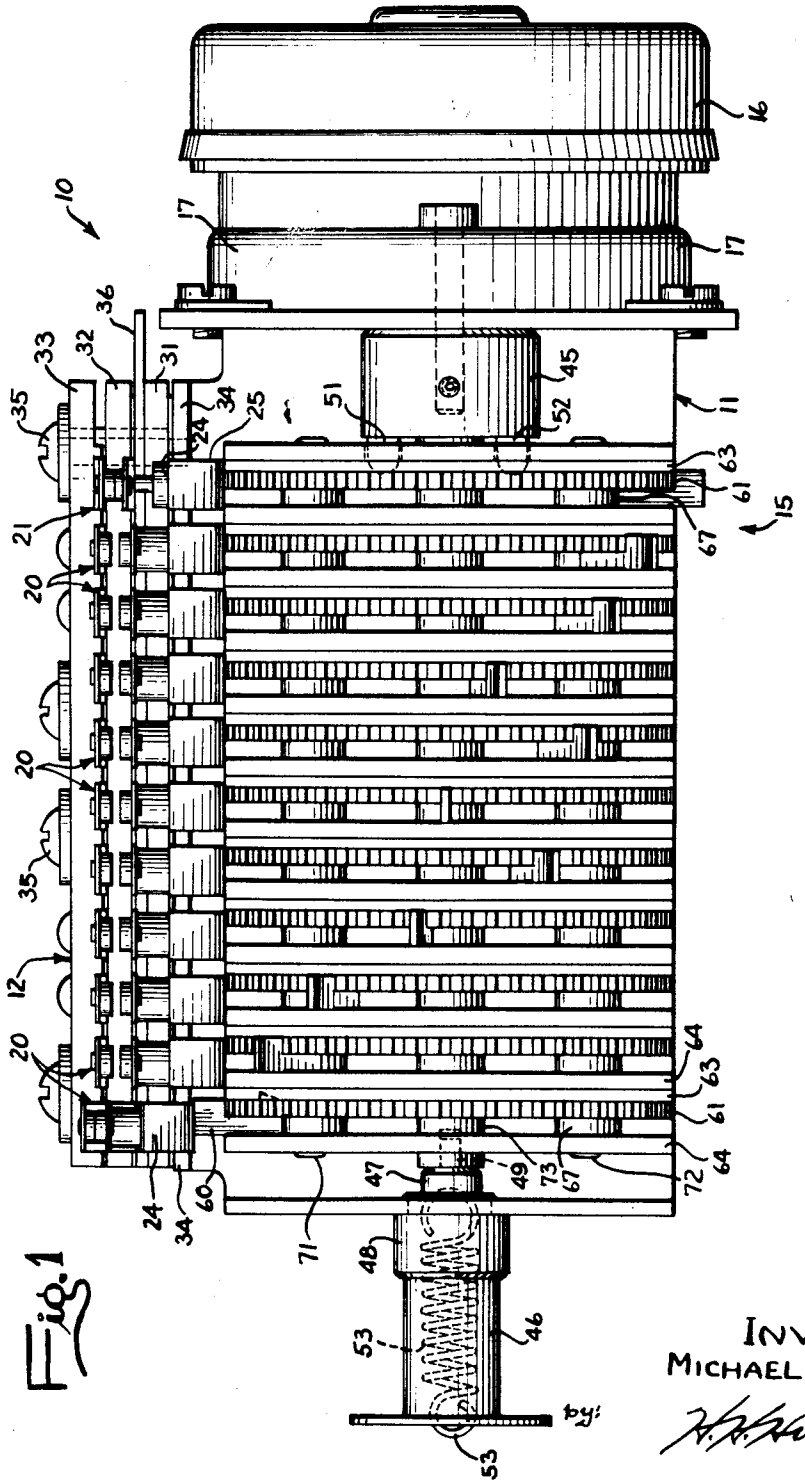


Fig. 1

INVENTOR
MICHAEL JUHAS

ATTY.

Dec. 15, 1959 M. JUHAS 2,917,591

SWITCH ACTUATING TIMER

Filed May 10, 1957 3 Sheets-Sheet 2

Fig. 2

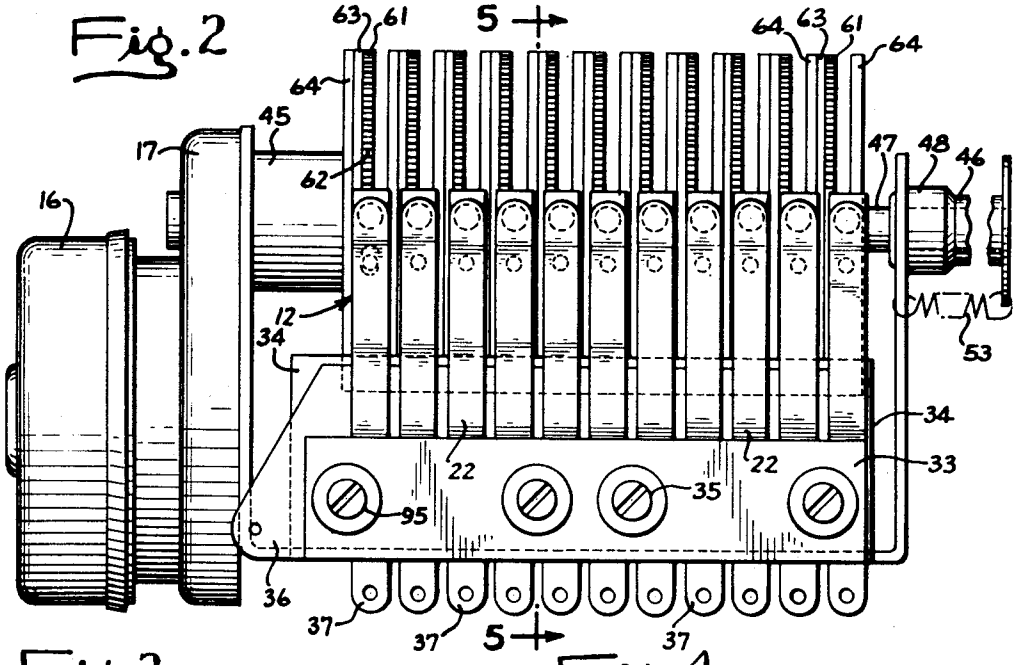


Fig. 3

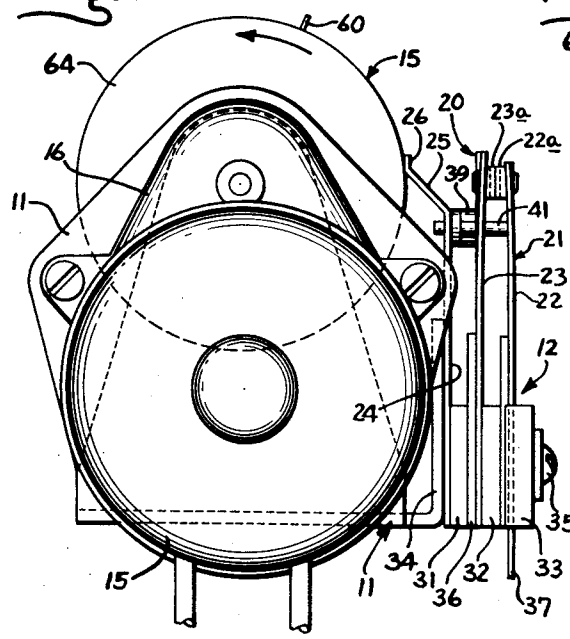
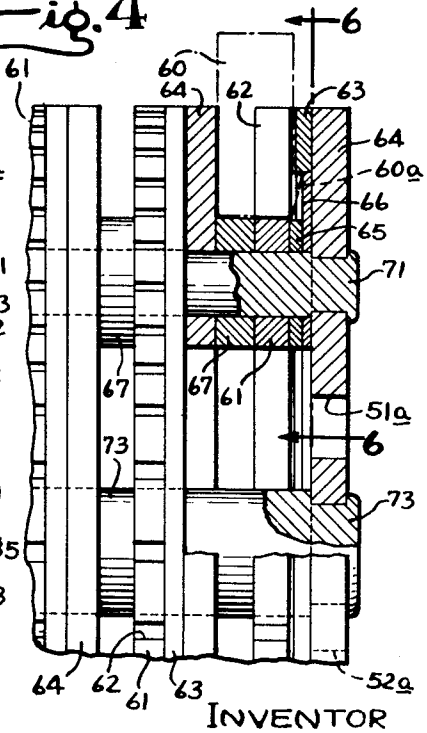


Fig. 4



INVENTOR
MICHAEL JUHAS

by: ATTY.

Dec. 15, 1959 M. JUHAS 2,917,591

SWITCH ACTUATING TIMER

Filed May 10, 1957 3 Sheets-Sheet 3

Fig. 5

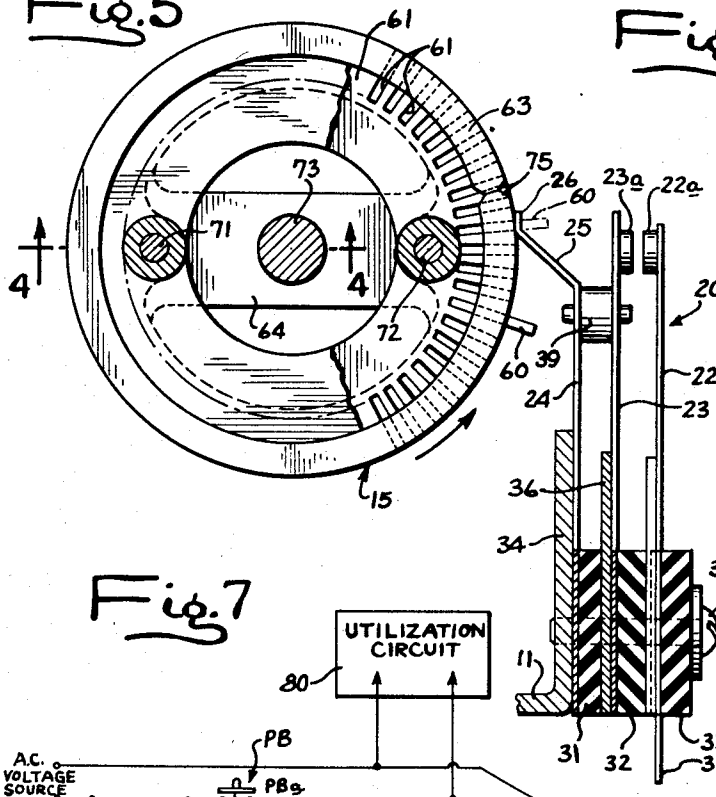


Fig. 6

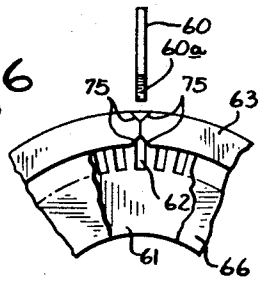


Fig. 6a

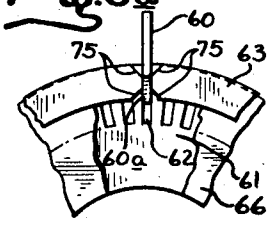


Fig. 6b

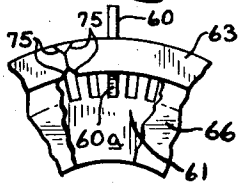


Fig. 7

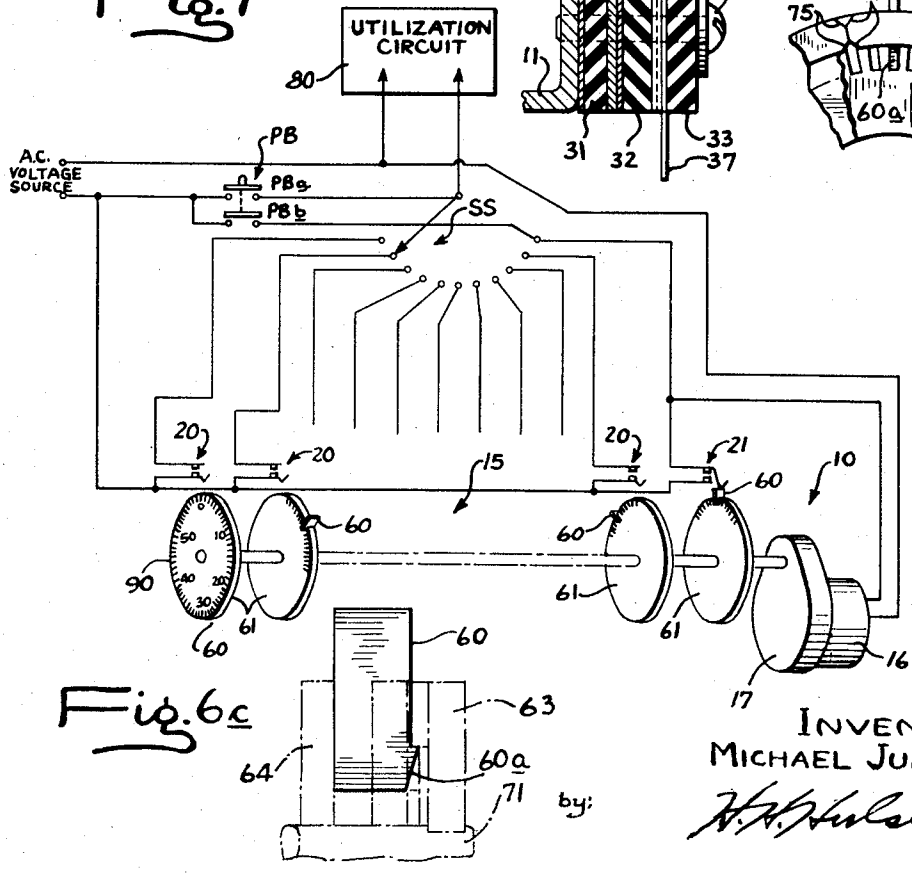


Fig. 6c

INVENTOR
MICHAEL JUHAS

by:

ATTY.

United States Patent Office 2,917,591 Patented Dec. 15, 1959

2,917,591

SWITCH ACTUATING TIMER

Michael Juhas, Torrington, Conn., assignor to General Time Corporation, New York, N.Y., a corporation of Delaware

Application May 10, 1957, Serial No. 658,451

10 Claims. (Cl. 200—38)

The present invention relates to switch actuating timers and more particularly to a motor driven timer which may be set to produce a desired cycle of switching operations.

It is an object of the invention to provide a switch actuating timer that is easily and simply set or adjusted so that desired switches are actuated at selected, predetermined, relative times when the device is energized. It is a related object to provide such a device which permits its settings to be readily modified, with minor changes being conveniently made without dismantling or disassembling the device or without the bending or breaking off of tabs.

It is also an object to provide a device of the above type which will positively retain a selected setting and whose switch actuating members, once positioned, cannot loosen or slip out of place. With more particularity, it is an object to provide a device which is simply, yet positively, set and prevented from twisting or moving in any direction but which requires no tools or special equipment to either initially set or subsequently adjust the relative timing of switch actuation.

It is a further object to provide a device of the type characterized above that can be easily installed in a control system and which is completely reliable in operation. It is a more detailed object to provide a switch actuating timer having a novel socketing arrangement permitting an entire drum to be substituted for another drum having a different arrangement of lugs thereon to affect a change in program. It is a related object to provide a switch actuating timer which is light and compact, economical to manufacture, and which is capable of operating without maintenance over 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 elevation view of a switch actuating timer constructed according to the present invention.

Fig. 2 is a plan view of the timer shown in Fig. 1.

Fig. 3 is an end view of the timer shown in Fig. 1.

Fig. 4 is a fragmentary view, partially in section, taken along the line 4—4 of Fig. 5.

Fig. 5 is a transverse sectional view taken along line 5—5 of Fig. 2.

Fig. 6 is a fragmentary sectional view taken along line 6—6 of Fig. 4 with a lug positioned for insertion.

Figs. 6*a* and 6*b* are similar to Fig. 6 and show a typical insertion and locking of a lug.

Fig. 6*c* shows a typical lug used in the present device.

Fig. 7 is a schematic wiring diagram of a typical circuit in which the timer shown in Fig. 1 may be utilized.

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 within

the spirit and scope of the invention as defined by the appended claims.

Turning first to Figs. 1 and 2, there is shown a switch actuating timer **10** having a frame assembly **11** supporting an array of switches **12** and mounting for rotation a cycling, switch operating, drum assembly **15**. To rotate the cycling drum **15**, a motor **16** operably connected to the drum through a gear box **17** is also carried by the frame assembly **11**. The motor **16** is preferably of the shaded pole, synchronous A.-C. type which is self-starting and capable of maintaining a constant predetermined speed of rotation.

The switch array **12** includes a plurality of switch contact sets, each of which have an actuator closely disposed to the periphery of the drum assembly **15**. In the illustrative embodiment, ten normally open switches **20** and one normally closed switch **21** make up the switch array **12**. Each switch **20** (see Fig. 5) includes an upper contact finger **22**, a lower contact finger **23**, and an actuator **24**. The actuator **24** has a tapered cam portion **25** sloping to a point adjacent the periphery of the drum assembly **15** and ending in a shoe portion **26** disposed roughly parallel to the cylindrical surface of the drum assembly.

The contact fingers **22**, **23** support contacts **22***a*, **23***a*, respectively, and are spaced so that these contacts are normally not in engagement. In order to transmit movement from the actuator to the contacts, a spacer **39** is fixed between the actuator **24** and the lower contact arm **23** so that when the actuator is cammed away from the periphery of the drum assembly **15**, the lower contact finger **23** will be moved in the same direction and will carry the contact **23***a* into engagement with the contact **22***a*, thus establishing a circuit through the switch **20**.

The normally closed switch **21** is substantially identical to the switches **20** described above, with the exception that its contact fingers **22**, **23** are bent so that the contacts **22***a*, **23***a* are normally urged into engagement (see Fig. 3). For transmitting movement to the contacts the switch **21** is provided with a long plunger **41** that extends through an aperture provided in the lower contact finger **23** and connects the actuator **24** and the upper contact finger **22**. Thus, when the actuator **24** of the switch **21** moves away from the periphery of the drum assembly **15**, the upper contact finger **22** is moved in the same direction to open the contacts **22***a*, **23***a* and break the circuit through the switch **21**.

The contact fingers **22**, **23** of all of the switches **20**, **21** are sandwiched respectively, between insulator bars **31**, **32**, and **32**, **33** which are secured by screws **35** in the present instance, to a flange **34** forming a portion of the frame assembly **11**, while the actuators **24** for each of the switches **20**, **21** are sandwiched between insulator bar **31** and frame flange **34**. All of the contact fingers **23** of each of the switches **20**, **21** are electrically joined by being urged into contact with a ground plate **36** positioned between bars **31**, **32** and each of the upper contact fingers **22** are provided with a solder lug **37** for individual connection to an appropriate circuit.

For the purpose of removably mounting the drum assembly **15** within the frame assembly **11** so that it may be rotatably driven by motor **16**, a driving hub **45**, to support one end of the drum, is secured to the output shaft (not shown) of the gear box **17** and a bearing pin assembly **46**, to support the other end of the drum, is removably mounted in the frame in axial alinement with the driving hub **45**. The bearing pin assembly **46** includes a necked-down portion **47**, adapted to snugly seat within a sleeve **48** fixed to the frame assembly **11**, and a pin **49** providing a pivot about which the drum assembly may rotate. To drivingly connect the hub assembly **45** to the drum assembly **15**, the former is provided with

two pins 51, 52 which are adapted to be received within suitable apertures 51*a*, 52*a* (see Fig. 4) formed in the drum assembly so that the latter is locked for rotation with the hub assembly 45.

To remove the drum assembly 15 from the frame 11, it is sufficient to slide the bearing pin assembly 46 outwardly from the sleeve 48 until the pin 49 is carried free of the drum assembly 15, whereupon the latter may be simply lifted from the pins 51, 52 and removed from the frame assembly 11.

So that the pin assembly 46 is normally retained in its proper position, a spring 53 is tensioned between the frame assembly 11 and the pin assembly 46 so that the portion 47 is resiliently urged within the sleeve 48.

For the purpose of engaging the switch actuators 24 as the drum assembly 15 rotates and thus operate the switches 20, 21, a plurality of radially extending slugs 60 are adjustably positioned about the periphery of the drum assembly and are arranged so that each of the switch actuators 24 has its tapered portion 25 lying in the path of movement of one of the slugs 60. It will be understood that as the motor 16, through the gear box 17 and the hub assembly 45, slowly rotates the drum assembly 15, the radially extending slugs 60 will be carried into engagement with the cam portions 25 of the switch actuators 24 so that each actuator will be urged downwardly from the periphery of the drum assembly 15 to operate the associated switch contacts. It will be apparent that the order and relative time intervals in which the switches 20, 21 are operated depend upon the relative positioning of the slugs 60 about the drum assembly 15.

In accordance with the present invention, the drum assembly 15 comprises a stacked series of notched disks and spacer disks arranged in sets to define peripheral rows of axially oriented grooves with each row connected by a peripheral groove within which is carried a resiliently expansible split ring, and the slugs 60 are shaped to permit insertion within an axial groove and are formed with laterally projecting feet 60*a* which when seated, extends into the peripheral groove and under the split ring. In this manner, the slugs can be positioned in any one of the axial grooves and locked into place, to be released only by rotating the ring to position its split portion or gap over the slug foot so that the ring may be expanded and the slug withdrawn.

In the present embodiment each set includes a notched disk 61 having a series of notches 62 concentrically arranged about the periphery of the disk and which form, when the drum is assembled, a series of axially alined grooves or slots. Loosely mounted for rotation adjacent each notched disk 61, is a split ring 63 having the same outer diameter and which may be freely revolved so that its gap can be alined with any one of the notches 62 formed in the disk 61.

In order to hold the split rings 63 in position while maintaining space beneath the split rings for the slug feet 60*a*, a plate disk 64 is provided in each set and small and large spacer rings 65, 66 respectively, are sandwiched between the notched disks 61 and the plate disks 63 (see Fig. 4). The combined width of each set of the spacer rings 65, 66 is only slightly greater than that of a split ring 63 so that the rings are channeled in the peripheral grooves formed between the notches 62 and the adjacent plate disks 64. Also, the larger spacer rings 66 have an outer diameter only slightly less than the inner diameter of the split rings 63 so that the rings 63 may be freely rotated about the spacers 66. It can be seen that the smaller spacer rings 65 define an annular space beneath the split rings 63 which permit the projecting feet 60*a* of the slugs 60 to be received beneath the split ring, thus locking the slugs 60 in place.

In order to provide clearance for the slugs 60 between the successive disk plates 64, and to provide additional seating area, a spacer 67 is sandwiched between each notched disk 61 and the adjacent disk plate 64.

To firmly secure in proper alinement the sets of disks, plates and spacers making up the drum assembly 15, two rods 71, 72 (see Fig. 5) are extended through apertures formed in the disks, plates and spacers and are firmly secured to the outermost plate disks 64 which comprise the opposite ends of the drum assembly 15. A central rod 73 concentric with the axis of the drum assembly 15 is also extended between the outermost disks 64, and a bored hole is formed at one end of the rod 73 to receive the bearing pin 49. The disk plate 64 at the opposite end of the drum assembly 15 is provided with the spaced apertures 51*a*, 52*a* adapted for receiving the driving hub assembly pins 51, 52.

It can thus be seen that the entire drum assembly 15 comprises a novel arrangement of disks and plates, sandwiched together and rigidly secured by the rods 71, 72, 73. In the preferred embodiment, the central portions of the various disks and plates are relieved, and thus the entire assembly is exceptionally light in weight, and since each of the disk and plate elements can be economically formed from sheet stock, the entire drum assembly 15 is quite inexpensive to manufacture.

To remove a slug 60 from any one of the notches 62, it is merely necessary to rotate the adjoining split ring 63, using finger tip pressure, until the gap in the ring coincides with the particular notch 62 from which the slug 60 is to be withdrawn. The slug 60 can then be grasped by the fingertips and pulled upwardly, through the gap in the split ring, and out of the notch 62. It will be apparent that the insertion of a slug into any desired slot involves a similar procedure.

To aid in the insertion and removal of a slug through the split portion of a ring 63, each of the rings have tapered portions 75 adjoining their gaps (see Figs. 6–6*b*) so that the foot 60*a* of a typical slug 60 will engage the tapered portions 75 and wedge the split ring 63 into a slightly expanded condition whereupon such foot 60*a* may easily slide through the gap in the ring as shown in Fig. 6*a*.

It will be appreciated that a slug 60 will be securely locked within a notch 62 when the gap in the adjoining ring 63 is not alined with the slug (Fig. 6*b*). But even if the gap is alined, the slug cannot inadvertently loosen and fall from its notch 62 since a force must be exerted to urge the resiliently expansible ring 63 to an open position wherein the gap will widen to permit the passage of the slug projecting foot 60*a*. In this way there is no danger of a slug being accidentally removed from its preselected notch or displaced by reaction pressure from the switch actuator, and yet it can be seen that removal and repositioning can be quite easily accomplished with fingertip pressure when desired.

As an example of the usage to which the switch actuating timer 10 may be put, reference will now be made to the circuit shown in Fig. 7. In this example, the timer 10 is utilized to produce a coded signal for transmission to a utilization circuit 80. A coded signal of this type comprises an initial signal impulse followed, after a time delay of a predetermined and selectable number of seconds, by a second signal impulse. The utilization circuit 80 interprets the code by being responsive to a pair of signals having a time delay of a certain number of seconds between them. For a complete disclosure of a device capable of responding to and acting upon coded signals of this type, reference is made to the copending U.S. patent application Ser. No. 637,008, filed January 29, 1957.

In order to utilize the timer 10 for transmitting coded signals to the utilization circuit 80, a selector switch SS is connected so that any desired one of the switches 20 may be connected in circuit with the utilization circuit 80. In addition, a double throw pushbutton PB is provided with its first set of contacts PB*a* connected to close

a circuit to the utilization circuit **80**, and its second set of contacts PB*b* connected to energize the motor **16**.

In order to insure a single complete revolution of the cycling drum assembly **15** each time the motor **16** is energized, the normally closed switch **21** is connected in parallel with the pushbutton contacts PB*b* and is held open by a slug **60** when the drum assembly is at rest. It can thus be seen that when the pushbutton PB is depressed briefly, the closing of contacts PB*b* will energize the motor **16**, causing the drum assembly **15** to begin rotating. The rotation of drum assembly **15** permits the normally closed switch **21** to close and thus maintain energization of the motor **16** when the pushbutton PB is released. The switch **21** remains closed and the motor **16** energized until the timing drum assembly **15** makes one complete revolution, whereupon the switch **21** will again be opened to deenergize the motor **16** and immediately halt further rotation of the drum assembly.

In the preferred embodiment, the output speed of the motor **16** is reduced through the gear box **17** so that the drum assembly **15** rotates at a speed of one revolution per minute, and each of the notched disks **61** is provided with 60 evenly spaced peripheral notches. Each notch then represents a time interval of one second. It can now be understood that by properly placing the slugs **60** into notches of varying angular displacement from the slug holding the switch **21** open, each of the switches **20** will be operated at selected time intervals following the initial energization of the motor **16**. Since each of the notches represents a time lapse of one second, the time delay interval for any particular switch **20** is quite easy to select. If desired, a numbered scale **90** can be provided on the end of the drum assembly **15** to aid in locating the notches corresponding to desired time delay periods. It will be appreciated that the notched disks are locked in axial alinement so that it is simple to project the readings on scale **90** along the drum assembly by sighting along the rows of notches from the end of the drum carrying the scale.

In operation, the selector switch SS is positioned to connect the switch **20** that will produce the desired coded signal to be transmitted by the timer **10**. The pushbutton PB is then briefly depressed, which simultaneously closes contact PB*a* and transmits an initial signal to the utilization circuit **80**, and closes contacts PB*b* which energizes the motor **16** to begin rotating the drum assembly **15**. As soon as the drum assembly begins rotation, the switch **21** is closed so that the motor **16** remains energized for one complete revolution of the drum assembly **15**.

One by one the switches **20** are closed as the associated slugs **60** are carried by the rotating drum assembly **15** into contact with the switch actuators. When the switch **20** that has been connected by the selector switch to the utilization circuit **80** is operated, a second signal impulse is transmitted to the utilization circuit and that circuit then responds to the two-impulse, coded signal which it has received. As soon as the drum assembly has made a complete revolution, the switch **21** is again opened, deenergizing the motor **16** and the unit is ready for the transmission of a subsequent coded signal.

The circuit described above is merely illustrative of one use to which the switch actuating timer **10** may be put, and those skilled in the art will appreciate that a timer such as the one disclosed herein may be advantageously used in a wide variety of applications and installations.

I claim as my invention:

1. In a cycling drum for use in an actuating device which permits the selective operation of an electric switch incident to rotation of the drum, the combination comprising, a notched disk and a spacer disk rigidly connected to define a cylindrical surface having peripheral, axially alined slots, a resiliently expansible split ring rotatably and concentrically mounted adjacent said notched disk on the side opposite said spacer disk, a slug slidably fitted into one of said slots and extending outwardly from the periphery of said drum for causing the operation of said switch when the drum is revolved, said slug having a laterally extending foot positioned beneath said split ring when the slug is seated in said slot so that said slug is positively retained when the split in said split ring is out of register with said slug, said split in the split ring being less than the width of said foot so that insertion or withdrawal of said slug requires the overcoming of spring force when the split is in register with the foot.

2. In a cycling drum for use in an actuating device which permits the selective operation of an electric switch incident to rotation of the drum, the combination comprising, a notched disk and a spacer disk rigidly connected to define a cylindrical surface having peripheral, axially alined slots, a resiliently expansible split ring rotatably and concentrically mounted adjacent said notched disk on the side opposite said spacer disk, the split in said ring defining a gap, a slug slidably fitted into one of said slots and extending outwardly from the periphery of said drum for causing the operation of said switch when the drum is revolved, said slug having a laterally extending foot positioned beneath said split ring when the slug is seated in said slot so that said slug is positively retained when the gap in said split ring is out of register with said slug, said gap in the split ring being less than the width of said foot so that insertion or withdrawal of said slug requires the overcoming of spring force when the gap is in register with the foot, and the portions of said split ring adjacent said gap being tapered so that insertion or removal of said slug will exert a wedging force tending to widen the gap and permit the slug foot to pass through.

3. A cycling drum for use in an actuating device which permits the selective operation of a plurality of electric switches incident to rotation of the drum comprising, in combination, a plurality of notched disks and a plurality of spacer disks rigidly stacked in alternate pairs to define a drum having peripheral, axially alined slots, a plurality of resiliently expansible split rings rotatably and concentrically mounted adjacent each of said notched disks, the splits in said rings defining gaps, a plurality of slugs, each one slidably fitted into one of said slots and extending outwardly from the periphery of said drum for causing the operation of one of said switches when the drum is revolved, said slugs each having a laterally extending foot positioned beneath an adjacent split ring when the slug is seated in a slot so that said slugs are positively retained when the gaps in said split rings are out of register with the slugs, said gaps in the split rings being less than the width of a slug foot so that insertion or withdrawal of said slugs requires the overcoming of spring force when a gap is in register with the foot.

4. In a timer for operating an actuator, the combination comprising a cycling drum journaled for rotation with its periphery adjacent said actuator, said drum having on its periphery a spaced series of axially oriented grooves connected by a continuous peripheral groove, a resiliently expansible split ring disposed in said peripheral groove and being freely rotatable therein, and a slug snugly bottomed in one of said axial grooves and having a portion extending from the periphery of the drum for engagement with said actuator upon rotation of the drum, said slug having a laterally projecting foot extending into said peripheral groove and beneath said ring so that the slug is locked into position, the split in said ring being effective to permit withdrawal of the slug when the ring is rotated to aline the split with the slug.

5. In a timer for selectively operating a series of actuators, the combination comprising a cycling drum journaled for rotation with its periphery adjacent said actuators, said drum being formed of a stacked series of units, each unit having on its periphery a spaced series of axially oriented grooves connected by a continuous peripheral groove, one of said units being alined with an

actautor, a resiliently expansible split ring disposed in said peripheral groove on each of said units and being freely rotatable therein, and a slug snugly bottomed in one of said axial grooves on each unit and having a portion extending from the periphery of the drum for engagement with the actuator with which that unit is alined upon rotation of the drum, said slugs having laterally projecting feet extending into said peripheral grooves and beneath said rings so that the slugs are locked into position, the splits in said rings being effective to permit withdrawal of the slugs when the rings are rotated to aline the splits with the slugs.

6. In a timer for operating an actuator the combination comprising a cycling drum journaled for rotation with its periphery adjacent said actuator, a timing motor for rotating said drum at a predetermined peripheral speed, said motor and drum having an interfitting socket connection, a resiliently positioned member to hold said socket connection interfitted so that said member can be manually moved to release and permit removal of said drum, said drum having on its periphery a spaced series of axially oriented grooves connected by a continuous peripheral groove, a resiliently expansible split ring disposed in said peripheral groove and being freely rotatable therein, and a slug snugly bottomed in one of said axial grooves and having a portion extending from the periphery of the drum for engagement with said actuator upon rotation of the drum, said slug having a laterally projecting foot extending into said peripheral groove, and beneath said ring so that the slug is locked into position, the split in said ring being effective to permit withdrawal of the slug when the ring is rotated to aline the split with the slug.

7. In a cycling drum for use in an actuating device which permits the selective operation of an electric switch incident to rotation of the drum, the combination comprising, a notched disk and a spacer disk rigidly connected to define a cylindrical surface having peripheral, axially aligned slots, a split ring rotatably and concentrically mounted adjacent said notched disk on the side opposite said spacer disk, a slug slidably fitted into one of said slots and extending outwardly from the periphery of said drum for causing the operation of said switch when the drum is revolved, said slug having a laterally extending foot positioned beneath said split ring when the slug is seated in said slot so that said slug is positively retained when the split in said split ring is out of register with said slug.

8. The combination defined in claim 7 further defined in that said split in the split ring is substantially as small as the width of said foot.

9. The combination of claim 8 further defined in that said split in the split ring is substantially smaller than the width of said foot and said ring is resiliently expansible so that insertion or withdrawal of said slug requires the overcoming of spring force when the split is in register with the foot.

10. In a timer for operating an actuator, the combination comprising a cycling drum journaled for rotation with its periphery adjacent said actuator, said drum having on its periphery a spaced series of axially-oriented grooves connected by a continuous peripheral groove, a split ring disposed in said peripheral groove and rotatable therein, and a slug snugly bottomed in one of said axial grooves and having a portion extending from the periphery of the drum for engagement with said actuator upon rotation of the drum, said slug having a laterally-projecting foot extending into said peripheral groove and beneath said ring so that the slug is locked into position, the split in said ring being effective to permit withdrawal of the slug when the ring is rotated to align the split with the slug.

References Cited in the file of this patent

UNITED STATES PATENTS

1,882,495	Hipp	Oct. 11, 1932
1,940,598	Larkin	Dec. 19, 1933
2,387,097	Somes	Oct. 16, 1945
2,418,757	Collins	Apr. 8, 1947
2,597,928	Fehr	May 27, 1952
2,670,563	Anderson	Mar. 2, 1954
2,695,342	Junghans et al.	Nov. 23, 1954

FOREIGN PATENTS

108,606	Sweden	Sept. 28, 1943