June 28, 1960 C. J. GOODHOUSE ET AL 2,943,159

INTERVAL TIMER

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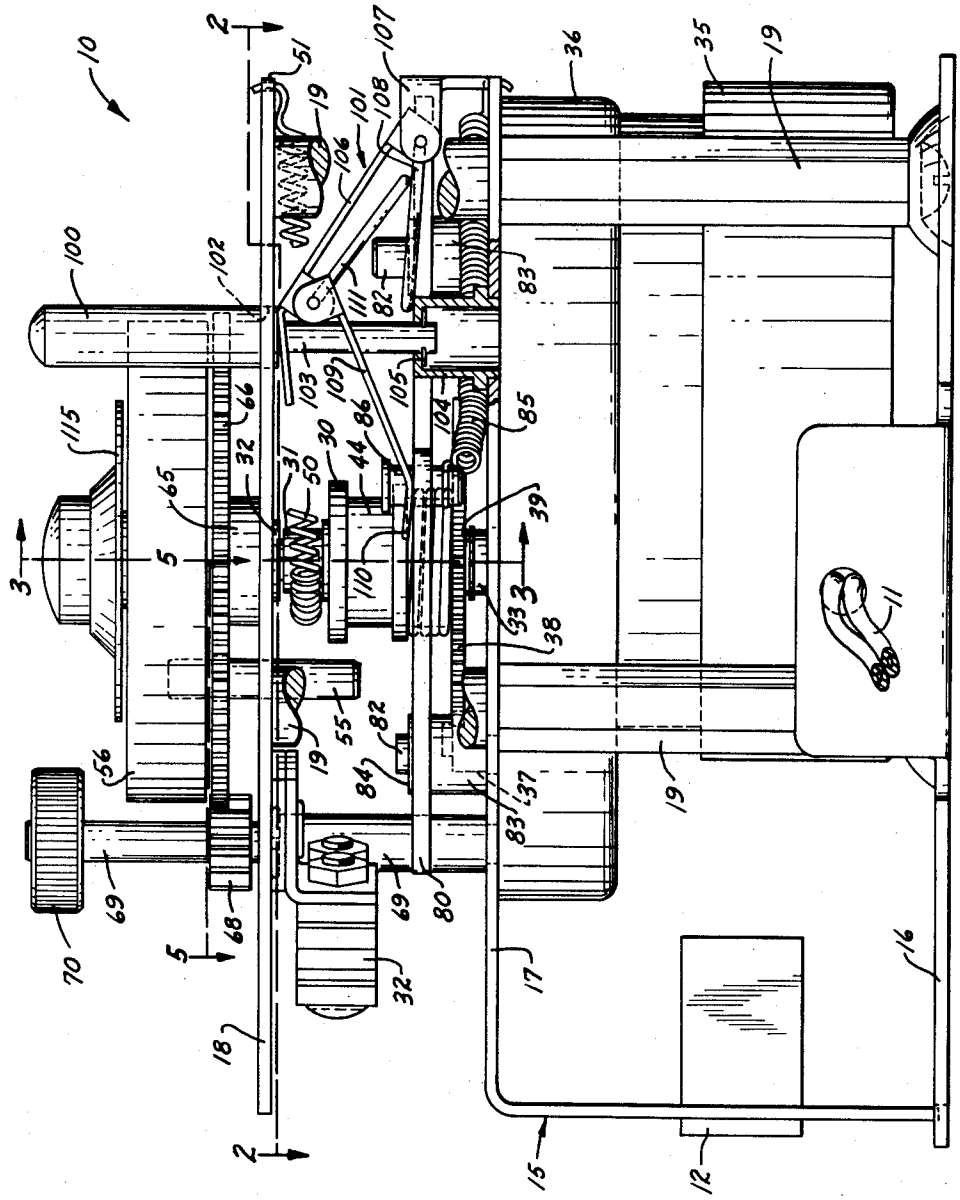


Fig. 1.

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Fig. 2.

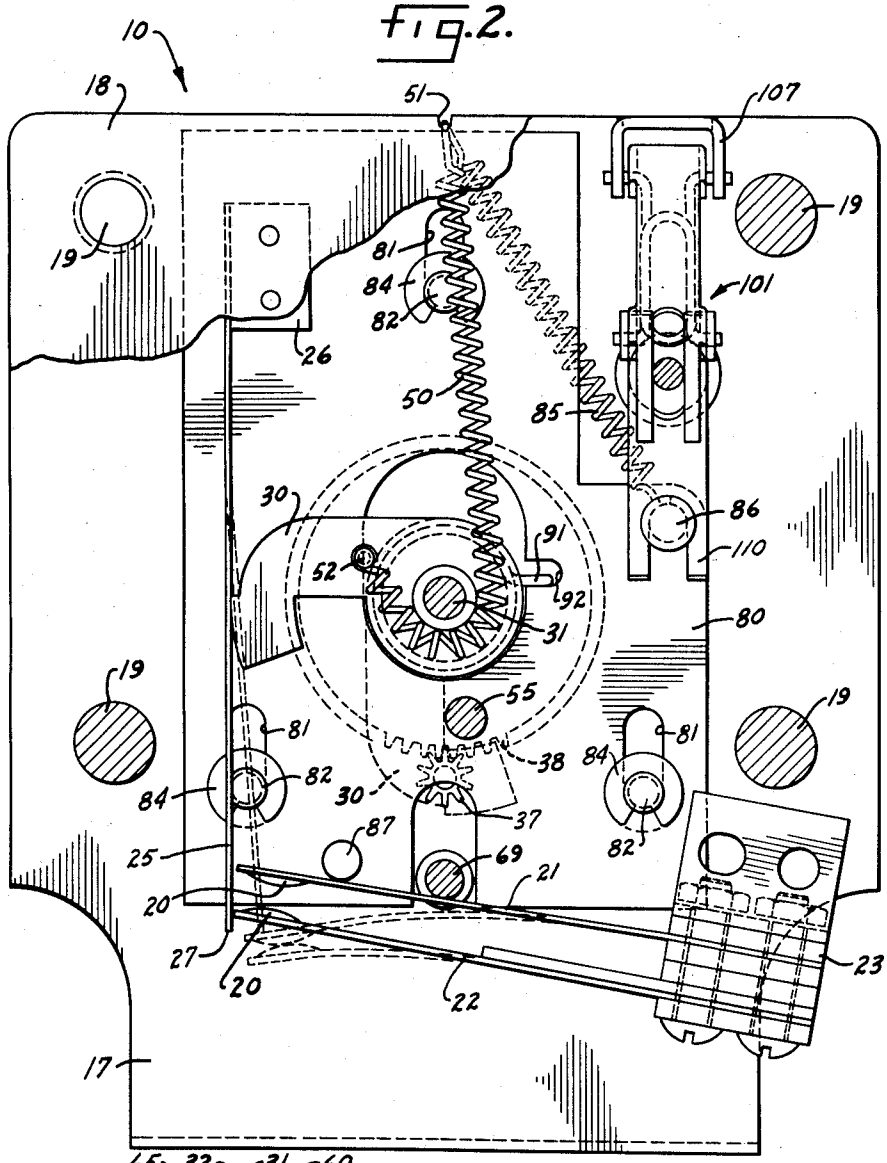
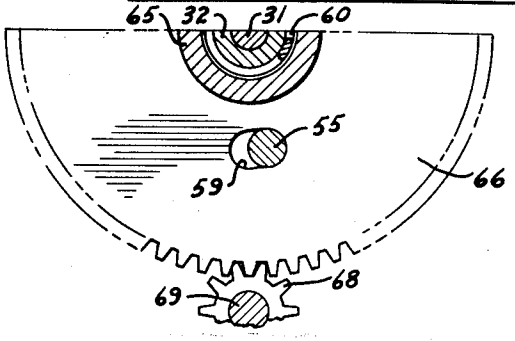


Fig. 5.



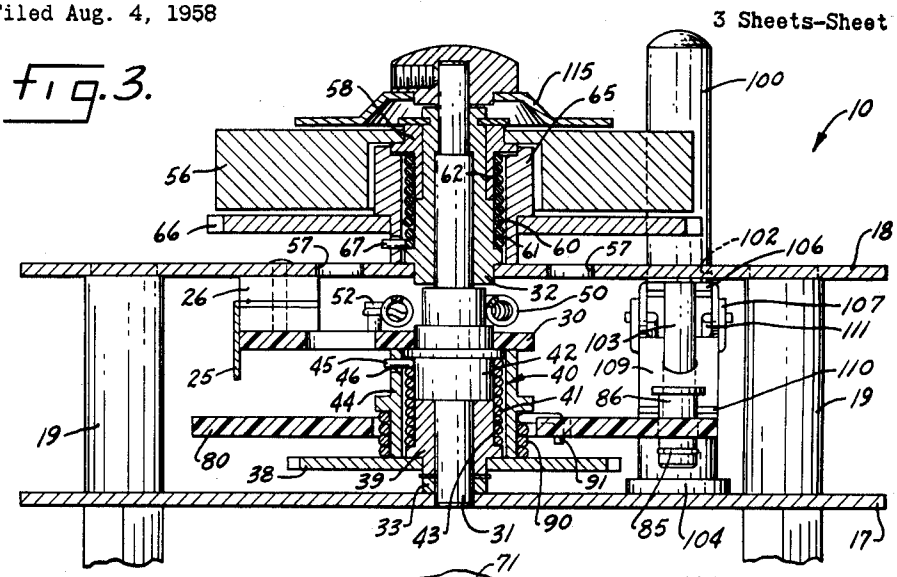
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Fig. 3.



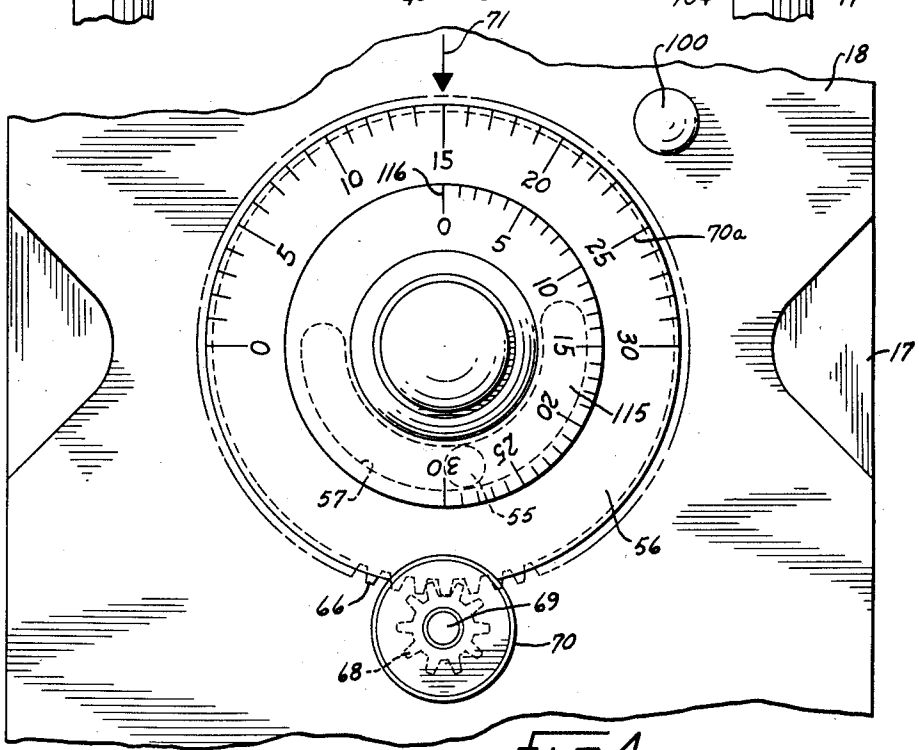


Fig. 4.

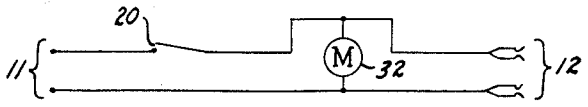


Fig. 6.

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United States Patent Office 2,943,159 Patented June 28, 1960

2,943,159

INTERVAL TIMER

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6 Claims. (Cl. 200—33)

The present invention relates generally to timing devices and more particularly to an interval timer for operating a switch through a preselected cycle.

It is the general aim of this invention to provide a timing device permitting "pushbutton" initiation of a preselected timing cycle, the duration of which an electrical switch is operated.

It is a further object of the invention to provide a device of the above type that permits the user to easily preselect a desired timing interval for the switch operating cycle, with this interval being of constant length for each subsequent "pushbutton" initiation of the cycle.

It is also an object to provide a timing device as characterized above that plainly indicates to the observer the time remaining during an operating cycle.

Moreover, it is an object to provide a device having the above features whose controls are simple, easily understandable, and readily operable.

It is another object to provide such a device that is quite flexible in use since the timing cycle, once begun, can be shortened or lengthened as desired by simple manipulation of the normal controls.

In addition to the above, it is an object to provide a timing device of the above character which is of simple, compact design so as to be reliable in operation, economical to manufacture and adapted for installation where space is at a preminum.

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

Figure 1 is a side elevation of a timing device constructed in accordance with the present invention with portions of the frame being broken away;

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

Fig. 3 is a sectional view taken along line 3—3 in Fig. 1;

Fig. 4 is a fragmentary view of the top face of the device shown in Fig. 1;

Fig. 5 is a fragmentary sectional view taken along lines 5—5 of Fig. 1; and

Fig. 6 is a schematic wiring diagram of the electrical circuit embodied in the illustrated device.

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

Turning now to the drawings, there is shown a timing device **10** embodying the present invention. In the illustrated form, the device is adapted to be connected to a source of electric current through electrical conductors **11** and is effective, when operated, to energize a conventional electrical socket **12**. The device includes a frame

15 made up of a back plate **16**, a center or main plate **17**, and a face plate **18**, which are rigidly joined in spaced relation by a plurality of pillars **19**.

In carrying out the present invention, a pair of electrical contacts are resiliently mounted on the frame **15** and are provide with a latch effective for holding the contacts in operated relation. In the present embodiment, a pair of contacts **20** are mounted respectively on resilient spring arms **21, 22**. The spring arms **21, 22** are carried by an insulated block assembly **23** secured to the undersurface of the face plate **18**. The contacts **20** are normally held by the spring arms **21, 22** in separated or open relation.

In order to hold the contacts in their operated or closed position, a spring latch **25** is provided, mounted in an insulating block **26** under the face plate **18**. The relaxed position of the latch **25** is shown in dashed lines in Fig. 2 so that the latch resiliently bears against the end of the contact arm **22**, when the contacts **20** are open.

In operation, the contacts **20** are closed by swinging their respective contact arms **21, 22** downwardly, as seen in Fig. 2, to their dashed line positions. When the arm **21** clears the latch **25**, the latch will swing to its relaxed position so that its lower end **27** engages the top surface of the contact arm **21**. The latch thus prevents the contacts from returning to their normal open positions. Movement of the latch **25** to the left in Fig. 2 until the latch clears the contact arm **21** permits the contact arms **21, 22** to swing upwardly to their normal, contact-open positions.

In keeping with the invention, the device **10** includes a driven latch operator adapted to release the latch **25**, and a cycle initiating member which is effective to (1) operate and thus latch the contacts **20**, (2) position the latch operator a preselected distance from the latch, and (3) start the driven operator towards the latch so that the contacts are restored to their normal open positions following a predetermined time interval. In the illustrated device, the latch operator takes the form of a cam arm **30** which is secured to a main post or shaft **31**. The shaft **31** is journalled in the frame **15** by a cylindrical bushing **32** fixed in the face plate **18** and a bushing **33** mounted on the main plate **17**.

When in operation, the cam arm **30** is driven in a clockwise direction, as seen in Fig. 2, so that it is effective to engage the latch **25** and swing it outwardly of the contact arms **21, 22**. For driving the cam arm, a synchronous motor assembly including a motor **35** and a speed reducing gear train in a gear case **36** is secured to the underside of the main frame plate **17**. The motor **35** drives a pinion **37** which is in meshing engagement with a gear wheel **38**. The gear wheel is fixed to a sleeve **39** which is rotatably carried on the shaft **31**.

So that the cam arm **30** may be positioned at preselected distances from the latch **25** and yet be driven by the motor **35**, a releasable clutch **40** is provided for coupling the sleeve **39** and the shaft **31**. In the preferred embodiment, the clutch **40** includes a helical spring **41** wound snugly around adjacent cylindrical portions **42** and **43** of the shaft **31** and sleeve **39**, respectively. The spring **41** is wound so that rotation of the gear whel **38** in a clockwise direction, in Fig. 2, by the motor **35**, will tend to tighten the spring around the cylindrical portions **42, 43** and thus impart a clockwise driving force to the shaft **31**.

In order to release the clutch **40**, a collar **44** is provided which loosely surrounds the helical spring **41**, and one end **45** of the spring is locked to the collar **44** by being fitted through a notch **46** in the collar. It can therefore be seen that movement of the collar **44** in a

clockwise direction will tend to unwind the helical spring **41** from about the portion **42** of the shaft **31**. This loosens the spring and permits the shaft **31** to rotate freely. The collar **44** thus serves as a clutch release element and a slight clockwise movement of the collar releases the clutch **40**.

For the purpose of adjustably positioning the cam arm **30** from the latch **25** when the clutch **40** is released, the arm is resiliently urged in a counterclockwise direction toward an abutment mounted on the frame **15**. Resiliently urging the arm **30**, in the illustrated embodiment, is a tensioned spring **50** having one end secured at **51** to the face plate **18** and its opposite end attached to a post **52** on the cam arm **30**.

Providing an abutment for positioning the cam arm **30** is a pin **55** that is secured to a timing disc **56** and is extended downwardly through an arcuate slot **57** in the face plate **18** into the path of the cam arm. It can be seen that when the clutch **40** is released, the tensioned spring **50** will rotate the shaft **31** so as to swing the cam arm **30** against the abutment pin **55**, the position shown in dashed lines in Fig. 2.

The timing disc **56** is fixed to a sleeve **58** rotatably carried on the bushing **32**. The disc **56** may therefore be rotated so as to move the pin **55** throughout the length of the slot **57** and thereby provide a range of positions for arresting the swinging movement of the cam arm **30**.

In order to lock the disc **56** in place while permitting it to be easily adjusted, a helical locking spring **60** is provided snugly surrounding adjacent cylindrical portions **61** and **62** of the bushing **32** and the sleeve **58**, respectively. The spring **60** is wound so that a force tending to turn the disc **56** in a counterclockwise direction simply tends to tighten the spring about the cylindrical portions **61**, **62**, thereby locking the disc **56** against the counterclockwise movement. It will be appreciated that the disc **56** will easily rotate in a clockwise direction since, when so rotated, the cylindrical sleeve portion **62** tends to unwind, and thus slip within, the spring **60**.

For the purpose of rotating the disc **56** in either direction and thus adjustably position the abutment pin **55**, a collar **65** carrying a gear wheel **66** is provided surrounding the spring **60**. The lower end **67** of the spring **60** is secured to the collar **65** by being fitted into an aperture in the collar. The gear wheel **66** is adapted to be rotated by a pinion **68** which is carried on a shaft **69** and has an adjusting knob **70**.

The gear wheel **66** is coupled to the disc **56** by the pin **55**, which passes through a slightly elongated aperture **59** in the gear wheel (see Fig. 5). When the knob **70** is rotated so as to turn the gear wheel **66** in a clockwise direction, the edge of the opening **59** will strike the pin **55** and carry the disc **56** in a clockwise direction. It will be recalled that the locking spring **60** will readily permit movement of the disc in this direction.

When the knob **70** is rotated so as to turn the gear wheel **66** in a counterclockwise direction, there will be a limited amount of lost-motion movement as the gear wheel **66** and the collar **65** move to bring the opposite edge of the aperture **59** into contact with the abutment pin **55**. This lost-motion movement of the collar **65** in a counterclockwise direction carries the end **67** of the spring **60** in a direction to unwind the spring from about the bushing **32**. This loosens the locking spring **60** and permits the disc **56** to be turned in a counterclockwise direction when the edge of the opening **59** in the gear wheel **66** engages the pin **55**. It will therefore be understood that the disc **56** and its attached abutment pin **55** can be easily rotated in either direction by simply turning the knob **70**, but, when once positioned, the locking spring **60** will prevent the pin **55** from moving counterclockwise so that is forms a firm abutment for positioning the cam arm **30**.

In order to visually indicate the position of the pin **55** to the operator of the device **10**, the upper surface of the disc **56** is provided with a scale **70***a* having indicia lines which cooperate with a reference mark **71** appearing on the face plate **18**. In the illustrated embodiment, the scale **70***a* indicates a range of from "0" to "30," which has reference to the number of minutes required for the motor **35** to drive the cam arm **30** from the abutment pin **55** to its latch releasing position. That is, with the numeral "15" opposite the mark **71** as in Fig. 4, the abutment **55** is positioned as shown in Fig. 2 and it will require fifteen minutes for the motor **35** to drive the cam arm clockwise from the dashed line position in Fig. 2 to its full-line position whereat the latch **25** is released.

To initiate operation of the device **10**, a pushbutton operated plate **80** is slidably mounted in the frame **15** and is coupled both to the clutch **40** and the contacts **20**. The plate is lidably mounted by having apertures **81** fitted on pins **82** which extend from the top of posts **83**. The plate **80** is retained on the pins **82** by means of E-rings **84** snapped in place about the pins. A tensioned spring **85** is attached to the lower portion of a pin **86** secured to the plate **80** and urges the plate upwardly in Fig. 2 to a normal rest position.

For operating, and thus latching, the contacts **20** when the plate **80** is slid from its rest position, the plate is provided with an upstanding pin **87** adapted to engage the contact arm **21** and move the contacts into their operating position when the plate is slid from its rest position. So that the plate **80** may release the clutch **40** when it is slid from its rest position, a helical release spring **90** is wound loosely around the collar **44** and has one end **91** fitted into a notch **92** formed in the plate **80** (see Figs. 2 and 3). The spring **90** is wound so that clockwise movement of the end **91**, as seen in Fig. 2, will tighten the spring about the collar **44** so as to rotate the collar in a clockwise direction. When the spring **90** is in its normal relaxed position, the collar **44** can rotate freely within it.

It can be seen therefore, that movement of the slide plate **80** downwardly, as seen in Fig. 2, will tighten the release spring **90** about the collar **44** and rotate the collar in a clockwise direction. As pointed out above, this will tend to unwind the clutch spring **41** and thus release the clutch **40**. Simultaneously, movement of the plate **80** will cause the pin **87** to operate the contacts **20**.

For operating the slide **80**, a pushbutton **100** is slidably mounted in the frame **15** and associated with a toggle linkage **101** that is effective to slide the plate **80** from its rest position when the pushbutton is depressed. The pushbutton is slidably fitted in an aperture **102** formed in the face plate **18**, and is provided with a necked-down extension **103** which slides within a bracket **104**. A locking ring **105** is secured to the end of the extension **103** and abuts the underside of the bracket **104** to establish a normal upper position for the pushbutton.

The toggle linkage **101** includes a first link **106** which is pivoted to a bracket **107** by a generally U-shaped hinge clip **108**. A second link **109** is pivoted to the free end of the first link **106** by a second hinge clip **111** and is provided with a forked end **110** which hooks the pin **86** secured to the plate **80**. The spring **85**, acting through the plate **80** and the pin **86**, holds the linkage **101** in its jack-knifed, raised position. It can be readily seen that when the pushbutton **100** is depressed, the jack-knifed links **106**, **109** of the toggle mechanism will straighten out so as to urge the plate **80** to the left in Fig. 1.

In order to begin return movement of the cam arm **30** toward the latch **25** as soon as the contacts **20** are operated, the motor **35** is electrically connected in parallel with the output socket **12** so that movement of the contacts **20** to their operative closed positions energizes the motor **35** as well as activates the socket **12** (see Fig. 6).

To indicate the time remaining before the latch **25** is operated and the contacts **20** restored, a dial plate **115** is mounted on the upper end of the shaft **31** so as to overlie the central portion of the disc **56**. The plate

115 is provided with a scale 116 having indicia lines cooperable with the reference mark 71, and since both the dial plate 115 of the cam arm 30 are secured to the shaft 31, the steady movement of the arm 30 in a clockwise direction toward the latch 25 will be indicated on the scale 116 in terms of minutes remaining before the latch 25 is released.

Briefly summarizing the operation of the device 10, it will be recalled that the knob 70 is first rotated in either direction so as to position the timing disc 56 about the fixed bushing 32 and establish a time interval for the timing cycle. The interval setting is read directly on the scale 70*a*. The disc 56 may be turned clockwise since its mounting sleeve 58 simply slips within the locking spring 60 when rotated in this direction. Counterclockwise rotation of the disc is permitted by the slight lost-motion movement of the gear wheel 66 and its collar 65 which loosens the locking spring 60 and allows the disc to rotate in a counterclockwise direction.

Once the dial 56 is properly set to establish the desired timing interval it remains locked in position by the action of the locking spring 60.

To initiate operation of the device, the pushbutton 100 is depressed. This straightens out the linkage 101 and slides the plate 80 from its rest position. Movement of the plate 80 deflects the contact bearing spring arms 21, 22, through the pin 87, so that the contacts are operated and latched by the spring latch 25. Simultaneously, movement of the plate releases the clutch 40 by tightening and slightly rotating the release spring 90 and thus the cam arm 30 is freed to swing under the urging of the spring 50 against the abutment pin 55.

Also simultaneously with the operation of the contacts 20, the motor 35 is energized so that as soon as the cam arm 30 is swung against the abutment pin 55, the motor begins to return the arm in a clockwise direction by driving the shaft 31 through the engaged clutch 40. As the cam arm is driven back toward the latch 25, the minutes remaining in the cycle are indicated by the scale 116.

When the cam arm 30 engages and operates the latch 25, the contact arms 21, 22 are freed to return to their normal position and the contacts 20 are opened, deenergizing the motor 35 and deactivating the socket 12.

It will be appreciated that the timing disc 56 remains in its set position during the timing cycle and that each time the pushbutton 100 is depressed, the device 10 will activate the socket 12 for the preselected timing interval.

The controls for the timing device 10 are extremely simple, comprising only the knob 70 and the pushbutton 100, and it can be seen that their function will be obvious to users of the device. It may also be noted that the device is extremely compact, with a majority of the operating parts being mounted about the single shaft 31.

It will be understood that the timing cycle can be lengthened or shortened during operation of the device. To shorten the timing cycle, it is sufficient to rotate the knob 70 so as to carry the pin 55 in a clockwise direction against the cam arm 30 and then to move the cam arm in a clockwise direction until the scale 116 indicates the desired number of minutes to remain in the timing interval. The cam arm 30 can be moved in a clockwise direction without interfering with the motor 35 since the clutch 40 functions as an over-running clutch with the clutch spring 41 readily permitting the shaft portion 42 to rotate in a clockwise direction more rapidly than the driven sleeve 43 is rotating.

In order to delay the timing cycle for a predetermined interval, it suffices to set the disc 56 so that the scale 70*a* reads an amount equalizing the number of minutes remaining, as shown by the scale 116, plus the desired extension interval. That is, if the dial 115 showed ten minutes remaining in the timing cycle and it was desired to extend the interval to fifteen minutes, the disc 56 is set so that its scale 70*a* reads fifteen minutes and then

the pushbutton 100 is depressed. This operation will release the clutch 40 and allow the cam arm 30 to swing back through an arc representing the additional five-minute time interval desired without disturbing the contacts 20.

We claim as our invention:

1. A timing device for operating a switch through a preselected cycle comprising, in combination, a frame, a pair of contacts on said frame resiliently held in a normal position, a latch on said frame for locking said contacts in place when they are moved into operated relation, a shaft journaled in said frame adjacent said latch, a latch operator carried by said shaft so as to be swingable through an arc for engaging and releasing said latch and thus allowing said contacts to be restored to their normal position, a synchronous motor secured to said frame in driving engagement with a sleeve on said shaft, means for energizing said motor when said contacts are operated, a clutch coupling said sleeve and said shaft, said clutch having an extended release element, a timing disc journaled on said shaft, means for locking said disc in selected rotational positions on said shaft, an abutment pin on said disc extending into the arc of said operator, said operator being resiliently urged toward said pin and away from said latch, a plate slidably mounted on said frame and being resiliently urged to a rest position, means coupling said plate both to said contacts and to said clutch release element, and a pushbutton operated linkage for sliding said plate from its rest position so as to operate said contacts and release said clutch whereupon the contacts are latched, the operator is swung against said pin, and the motor is energized to drive the operator through its arc and restore the contacts at the end of a cycle determined by the setting of said disc.

2. A timing device for operating a switch through a preselected cycle comprising, in combination, a frame, a pair of contacts on said frame resiliently held in a normal position, a latch on said frame for locking said contacts in place when they are moved into operative relation, a shaft journaled in said frame adjacent said latch, a latch operator carried by said shaft so as to be swingable through an arc for engaging and releasing said latch and thus allowing said contacts to be restored to their normal position, a synchronous motor secured to said frame in driving engagement with a sleeve on said shaft, a helical clutch spring snugly surrounding adjoining portions of said sleeve and said shaft, said clutch spring being wound so that said motor may drive said operator toward said latch, one end of said clutch spring being secured to a collar loosely surrounding said spring, a helical release spring wound loosely around said collar, a timing disc journaled on said shaft, means for locking said disc in selected rotational positions about said shaft, an abutment pin on said disc extending into the arc of said operator, said operator being resiliently urged toward said pin and away from said latch, and a cycle initiating member coupled to said clutch and said contacts so that said movement of the member operates the contacts and tightens and rotates said release spring so as to release said clutch spring, whereupon the contacts are latched, the operator is urged against the abutment pin, and the motor is energized to drive the operator through its arc and thus restore the contacts at the end of a cycle determined by the setting of said disc.

3. A timing device, comprising, in combination, a frame, a switch controlling element on said frame, a shaft journaled in said frame adjacent said element, an element operator carried by said shaft so as to be swingable through an arc for engaging and operating said element, a motor secured to said frame in driving engagement with a sleeve on said shaft, a helical clutch spring snugly surrounding adjoining portions of said sleeve and said shaft, said clutch spring being wound so that said motor may drive said operator toward said element, one end of said clutch spring being secured to a collar loosely

surrounding said spring, a helical release spring wound loosely around said collar, a timing disc journaled on said shaft, means for locking said disc in selected rotational positions about said shaft, an abutment pin on said disc extending into the arc of said operator, said operator being resiliently urged toward said pin and away from said element, and a cycle initiating member coupled to said clutch and said motor so that said movement of the member energizes the motor and tightens and rotates said release spring so as to release said clutch spring, whereupon the operator is urged against the abutment pin and the energized motor drives the operator through its arc to operate the element at the end of a cycle determined by the setting of said disc.

4. A timing device for operating a switch through a preselected cycle comprising, in combination, a frame, a pair of switch contacts on said frame resiliently held in normal position, a latch on said frame for locking said contacts in place when they are moved into operative relation, a shaft journaled in said frame adjacent said latch, a latch operator carried by said shaft so as to be swingable through an arc for engaging and releasing said latch and thus allowing said contacts to be restored to their normal position, a synchronous motor secured to said frame in driving engagement with a sleeve on said shaft, means for energizing said motor when said contacts are operated, a clutch coupling said sleeve and said shaft, said clutch having an extended release element, a timing disc journaled on said shaft, an abutment pin on said disc extending into the arc of said operator, said operator being resiliently urged toward said pin and away from said latch, a helical locking spring snugly surrounding adjoining cylindrical portions formed on said disc and said frame, said locking spring being wound so that said abutment pin cannot move under the urging of said operator, a collar surrounding said locking spring carrying a disc positioning gear lying parallel to said disc, said pin being disposed with clearance through an aperture in said gear so that there may be rotational lost motion between said disc and gear, said spring having one free end secured to said collar so that rotation of said gear in either direction will also rotate said disc, and a cycle initiating member coupled to said contacts and said clutch release element so that movement of the member releases the clutch and operates the contacts, whereupon the contacts are latched, the operator is urged against the pin and the motor is energized to drive the operator through its arc and thus restore the contacts at the end of a cycle determined by the setting of said disc.

5. A timing device comprising, in combination, a frame, a switch controlling element on said frame, a shaft journaled in said frame adjacent said element, an element operator carried by said shaft so as to be swingable through an arc for engaging and operating said element, a motor secured to said frame in driving engagement

with a sleeve on said shaft, a clutch coupling said sleeve and said shaft, said clutch having an extended release member, a timing disc journaled on said shaft, an abutment pin on said disc extending into the arc of said operator, said operator being resiliently urged toward said pin and away from said element, a helical locking spring snugly surrounding adjoining cylindrical portions formed on said disc and said frame, said locking spring being wound so that said abutment pin cannot move under the urging of said operator, a collar surrounding said locking spring carrying a disc positioning gear lying parallel to said disc, said pin being disposed with clearance through an aperture in said gear so that there may be rotational lost motion between said disc and gear, said spring having one free end secured to said collar so that rotation of said gear in either direction will also rotate said disc, and a cycle initiating actuator coupled to said motor and said clutch release member so that movement of the actuator releases the clutch and energizes the motor, whereupon the operator is urged against the pin and the energized motor drives the operator through its arc to operate the element at the end of a cycle determined by the setting of said disc.

6. A timing device comprising, in combination, a frame, a switch controlling element on said frame, a shaft journaled in said frame adjacent said element, an element operator carried by said shaft so as to be swingable through an arc for engaging and operating said element, a motor secured to said frame in driving engagement with a sleeve on said shaft, a helical clutch spring snugly surrounding adjoining portions of said sleeve and said shaft, said clutch spring being wound so that said motor may drive said operator toward said switch controlling element, one end of said clutch spring being secured to a collar loosely surrounding said spring, an abutment pin extending into the arc of said operator, said operator being resiliently urged toward said pin and away from said element, and a cycle initiating member coupled to said collar and said motor so that movement of the member energizes the motor and rotates the collar so as to release said clutch spring, whereupon the operator is urged against the abutment pin and the energized motor drives the operator from the pin to the element.

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