United States Patent [19]

Harris

[11] **3,922,924**

[45] **Dec. 2, 1975**

[54] **MANUAL PRESET TIMER**

[75] Inventor: **John L. Harris,** Clearwater, Fla.

[73] Assignee: **Deltrol Corporation,** Bellwood, Ill.

[22] Filed: **Dec. 19, 1974**

[21] Appl. No.: **534,222**

[52] **U.S. Cl.** ..... **74/3.5;** 200/39 R

[51] **Int. Cl.²** **G05G 17/00**

[58] **Field of Search** ..... 74/3.5; 137/624.22; 200/38 B, 39 R, 39 A

[56] **References Cited**

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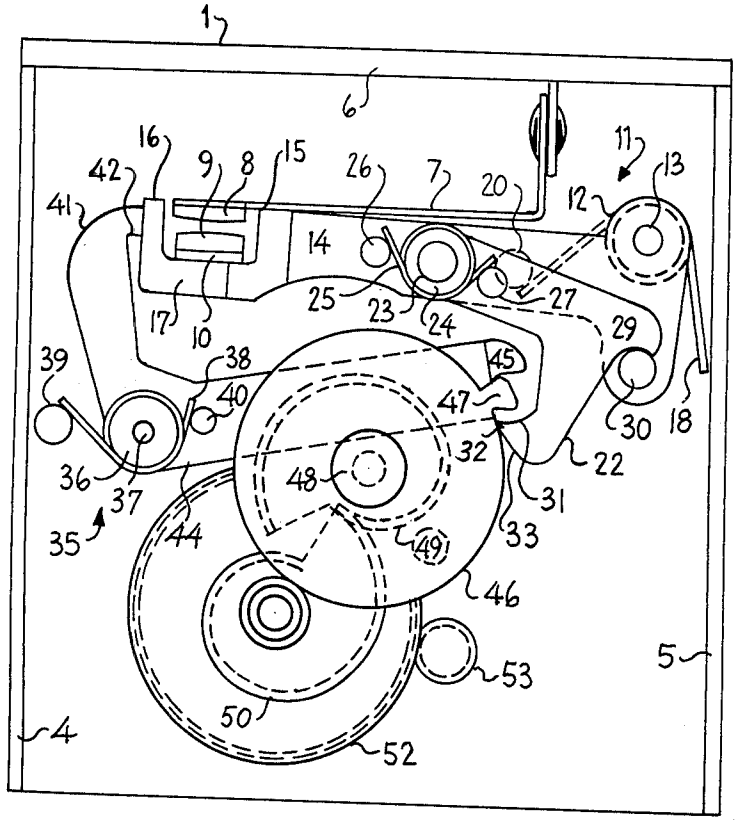
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Primary Examiner—Allan D. Herrmann

[57] **ABSTRACT**

A manual preset interval timer in which drag on the timer cam shaft is eliminated after the timer is set so that it can run back to the OFF position with almost zero torque applied. The timer cam during the initial setting stroke lifts a switch operator through a pawl to timing position where it is held by a latch. The pawl and cam are arranged to apply a component of force to the pawl to hold it in driving position during the setting stroke. This component of force instantly disappears at the end of the setting stroke to unload the cam.

10 Claims, 6 Drawing Figures



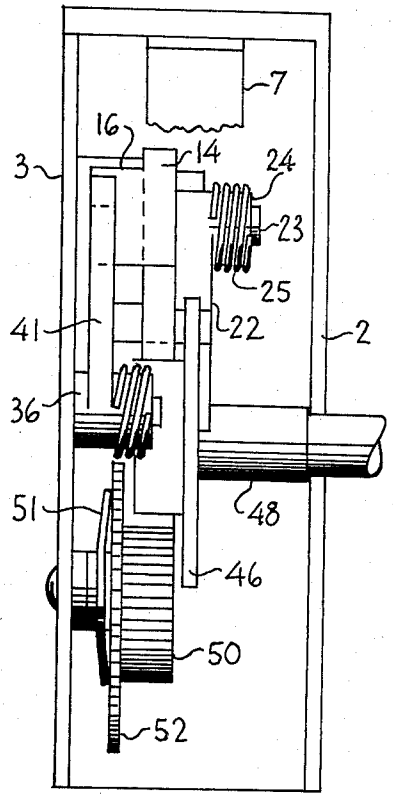


FIG. 2

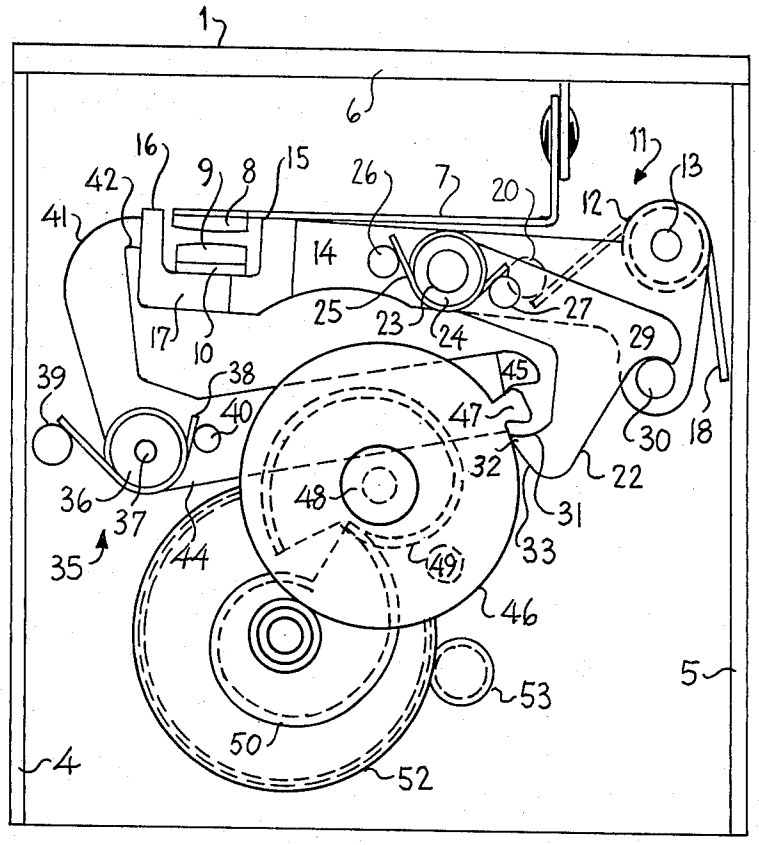


FIG. 1

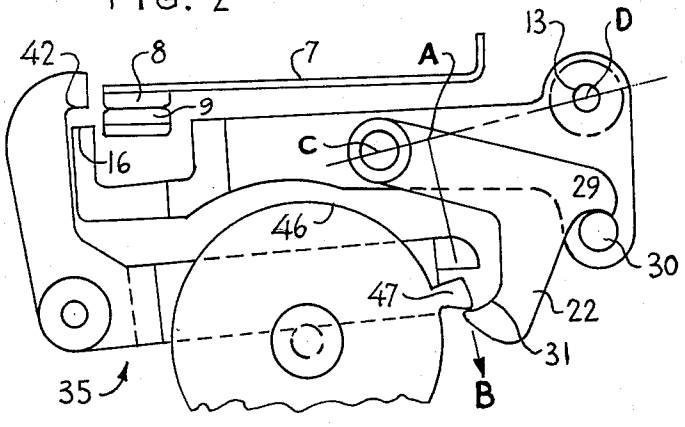


FIG. 3

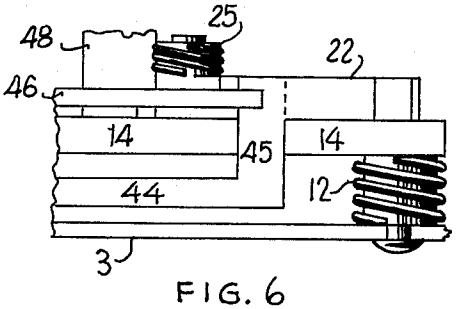


FIG. 6

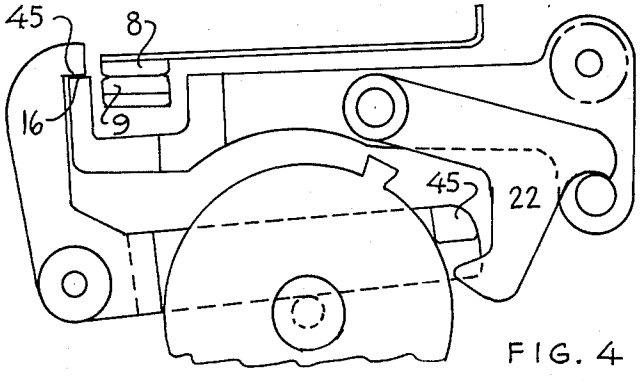


FIG. 4

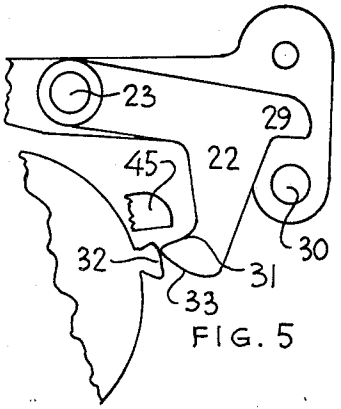


FIG. 5

MANUAL PRESET TIMER

BACKGROUND OF THE INVENTION

This invention relates in general to timing devices and more particularly to timers of the manual preset type.

Such timers are used for turning off appliances after a desired time. The user turns a knob which drives a cam lifting a cam follower to close the timer switch, starting the appliance and the timer motor, which drives the cam back to the off position. A friction clutch is necessary between the motor and cam shaft to allow setting of the cam shaft without damage to the motor and gearing. The motor must drive the cam shaft back to the off position through this friction clutch and its torque must be high enough to overcome the friction load of the follower on the cam or the timer will fail.

In some applications it is necessary to use both short timings and long timings. For example, in micro-wave ovens, some items will heat in a minute or two while others require up to **30** minutes. When a uniform scale thirty minute timer is set down to two minutes, the inaccuracy in setting becomes a large percentage of the desired time, giving unsatisfactory results. This makes it desirable to use a logarithmic or expanded scale timer. This type of timer utilizes a pair of eccentric gears meshing together to drive the cam shaft at a variable rate which increases in speed as the timer approaches the OFF position. This gives relatively large dial divisions for short timings where accuracy is needed and relatively small dial divisions for long timings where accuracy is not needed.

This type of timer involves a problem with the friction clutch. The torque must be set high enough to drive the timer to the OFF position with a reasonable factor of safety. Due to the variable ratio gears, turning the timer shaft to its maximum setting slips the friction clutch approximately six times as fast as occurred at the start of the setting stroke. This makes it about six times as hard to turn the knob, making the timer hard to set and giving a rough feeling as the eccentric gear teeth bump over each other with the heavy loading.

BRIEF SUMMARY OF THE INVENTION

The primary object of the invention is the provision of a timer mechanism in which the timer cam shaft runs unloaded and trips the timer switch to its off position with a minimum of force required, this reducing the torque required in the friction clutch and making the timer easier to set.

In accordance with the invention, the timer cam shaft drives the timer switch operator to timing position through a pawl when the timer shaft is turned from the OFF position. A latch holds the timer switch in timing position and the pawl is rendered incapable of applying pressure from the switch to the cam shaft at the instant the setting stroke of the switch operator is completed. This insures that the cam shaft is always unloaded when driven by the friction clutch back to the OFF position where it releases the latch to open the switch.

A further object of the invention is to provide a timing mechanism requiring but slight force to trip the switch at the OFF position.

This is achieved by arranging the latch and switch operator so as to provide a substantial mechanical advantage at the point where the latch is contacted by the timer cam.

Other objects will appear from the following detailed description and appended claims.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a front view of a manual preset timer embodying the invention, with the front cover removed and showing the parts in the positions assumed at "timed-out";

FIG. **2** is a side internal view of FIG. **1**;

FIG. **3** is a fragmentary view showing the parts in the positions assumed during the manual setting stroke;

FIG. **4** is a similar fragmentary view showing the positions of the parts during a time cycle;

FIG. **5** is a fragmentary view showing the driving pawl in released position;

FIG. **6** is a partial bottom view of FIG. **1**.

Referring to FIGS. **1** and **2**, reference character **1** indicates generally a timer housing including a front plate **2**, a back plate **3**, side walls **4** and **5** and a switch panel **6**. The switch panel **6** supports a switch including a switch blade **7** carrying a movable contact **8** cooperating with a stationary contact **9** carried by a bracket **10**. The contact bracket **10** is carried by the switch panel **1** by suitable means not shown. Switch blade **7** is biased downwardly as seen in FIG. **1** for causing contact **8** to engage contact **9**. This switch blade is moved upwardly against its bias by means of a switch operator or controller operating means generally indicated as **11**. This switch operator includes a hub **12** fitting over a stud **13** and carrying a lever portion **14** which extends to the left as seen in FIG. **1** and includes an edge **15** engaging the switch blade **7**. The switch operator also includes a latch engaging surface **16** carried by an offset portion **17** extending under the contact bracket **10**. This offset portion **17** is preferrably arranged to engage the contact bracket **10** which limits its upward stroke as shown in FIG. **1**. This switch operator **11** is biased counterclockwise or upwardly by means of a torsion spring **18** carried by the hub **12**, one leg of this spring engaging sidewall **5** and the other leg engaging a stud **20** at the rear of the operator.

The switch operator **11** is rotated counterclockwise through its driven stroke from the timed-out position shown in FIG. **1** to its timing position shown in the other figures by means of a pawl **22** which is pivoted on a stud **23** formed on the switch operator **11**. This pawl **22** includes a hub **24** fitting over stud **23** and carrying a torsion spring **25**, one end bearing on a stud **26** on the switch operator and the other end bearing on a stud **27** formed on the pawl. The spring **25** serves to bias the pawl **22** in a clockwise direction into a predetermined relationship with the switch operator as determined by a stop ear **29** engaging a stop pin **30** formed on the switch operator. The pawl **22** extends downwardly and is formed with a curved camming surface **31** which terminates abruptly at a releasing surface **32** which merges with a lifting camming surface **33**.

As shown in FIG. **2**, the latching surface **16** of the switch operator extends rearwardly to a point adjacent the back plate **3** and is engaged by a latch means generally indicated as **35** (FIG. **1**). This latch means includes a hub **36** carried on a stud **37** attached to the back plate, the hub carrying a spring **38** one end of which bears against the stationary stud **39**, and the other end bearing on a stud **40** carried by the latch means. The latch **35** also includes an upwardly extending latching lever **41** which terminates in a latching surface **42** co-

operating with the latching surface **16** on the switch operator. The latch **35** also includes an operating arm **44** which extends to the right adjacent the back plate **3** as shown in FIG. **6.** The latch also includes an outwardly extending operating portion **45** which extends upwardly to a point adjacent the camming surface **31** of pawl **22.**

The lug **45** and camming surface **31** are actuated by a timing means including a cam **46** having a lobe **47,** one side of this lobe engaging lug **45** on the latch and the other side of the lobe engaging the lifting cam surface **31** on the pawl. The cam **46** is carried by a main shaft **48** which is journaled between the front and back plates and extends outwardly through the front plate to the usual manual setting knob not shown. The timing means preferrably includes an eccentric or "log" gear **49** which is driven by a second eccentric gear **50** which is driven through a friction clutch **51** by a gear **52** meshing with the pinion **53** of an electric timer motor (not shown).

OPERATION

The parts in FIG. **1** are shown in the positions assumed at the end of a timing cycle. Lobe **47** of the cam has moved the latch to the released position shown which has allowed the switch operator to be rotated upwardly by its spring causing the switch operating surface **15** to engage blade **7** and open the contacts.

When the timer is set for a time cycle, the shaft **48** is turned clockwise by the usual setting knob, this causing the cam lobe **47** to engage the camming or lifting surface **31** of the pawl **22** as shown in FIG. **3.** As shown in this figure the camming surface **31** is plotted so as to present a surface substantially at a right angle to the path of movement of the engaging surface of the cam lobe **47.** This creates a force on the switch operator and pawl assembly represented by line A-B. This force has a component A-C tending to rotate the pawl **22** clockwise causing the stop portion **29** to engage lug **30** on the switch operator. This force A-B also operates on a lever arm A-D rotating the switch operator counterclockwise about its pivot **13** against the action of the biasing spring **18.**

From the foregoing it will be apparent that the manual setting operation of turning cam **46** clockwise results in counterclockwise rotation of the switch operator assembly. This allows contacts **8** and **9** to engage and also brings the latching surface **16** clear of the latching surface **42** which allows the latch **35** to move into latching position as shown in FIG. **3.** This manual setting rotation of the camshaft is permitted by slipping of the friction clutch **51** as well known in the art. On continued manual clockwise rotation of the camshaft the cam lobe **47** rides off the lifting surface **31** and under the surface **32** as shown in FIG. **5.** At this point the force acting along line A-B disappears and the switch operator assembly is free to rotate clockwise under its biasing spring until latching surface **16** engages with surface **42** on latch **35.** This position is shown in FIG. **4.** It will be noted that the switch contacts are still closed and that the cam may be rotated to its maximum timing position as shown. As the timer switch is now closed the timer motor (not shown) will drive the cam **46** counterclockwise back to the position shown in FIG. **1.** As the lobe **47** approaches the timed-out position it engages the camming or lifting surface **33** on the pawl, lifting it to the position shown in FIG. **5.** At this time the pawl is free to rotate about its pivot **23** and the light return spring **25** is the only force opposing this movement. This requires very little torque. As the cam approaches the timed-out position lobe **47** engages extension **45** of the latch lever rotating it counterclockwise about its pivot **37** toward the releasing position shown in FIG. **1.** When the latching surface **42** on the latch rides off latching surface **16** on the switch operator, the switch operator spring **18** rotates the operator with snap action to the position shown in FIG. **1** in which the movable contact **8** is separated from the stationary contact **9.**

The torque on cam **46** required to release the latch **35** is very low due to the mechanical advantage provided. It should be noted that the switch operator **11** is pivoted on the right side of the timing means or cam **46** and extends to the left side thereof where the latch engaging surface **16** is located. Also the latch **35** is pivoted on the left side of the timing means and includes the elongated leg **44** extending to the other side of the cam **46** in the path of cam lobe **47.** This arrangement in effect provides a compound leverage at the latch operating portion **45,** this giving substantial mechanical advantage to the cam lobe and permitting the latch to be released with very little operating force from the cam.

Summarizing, the cam lobe and pawl provide a one way drive means for driving the switch operator through its driven stroke from the timed-out position shown in FIG. **1** to the latch engaging position shown in FIG. **3.** During this driven stroke the engaging means consisting of lobe **47** and camming surface **31** provide a component of force for driving the switch operator and maintaining the pawl in fixed position relative to the switch operator. As soon as lobe **47** rides off camming surface **31** onto the neutral surface **32** this component of force disappears and the pawl is free to release from lug **30** allowing the switch operator to assume its timing or latched position as shown in FIG. **4.** As the timer runs back to its timed-out position there is no load on the cam as the pawl is not even touching it as shown in FIG. **4.** As the timer approaches its timed-out position it rides under pawl **22** as shown in FIG. **5,** this requiring very little force as the only resistance is the light spring **25.** On continued movement of the timing means it rotates the latch to released position, this requiring very little force as it is only an unlatching action with a substantial mechanical advantage.

From the foregoing it will be seen that the invention provides an arrangement in which the force required of the timer cam in reaching timed-out position is extremely small. This permits the friction clutch to be set for a very low torque which makes it easy for the timer to be set to its maximum position even with the "log" gearing. This arrangement also provides for an additional reliability inasmuch as it avoids the largest single cause of manual preset timer failures which is slipping of the friction clutch.

While a preferred form of the invention has been shown and described it will be obvious that many changes may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a timing device, controller operating means movable through a predetermined stroke between a

timing position and a timed-out position, timing means having a timed-out position and being movable in one direction from its timed-out position to a timing position, said timing means being constructed and arranged to run in the opposite direction back to its timed-out position, means including latch means for holding the operating means in timing position when the latch means is engaged and for returning the operating means to timed-out position when the latch means is disengaged, one way drive means between the timing means and operating means and arranged to move the operating means through a driven stroke from timed-out position to timing position for engagement of the latch means as said timing means is moved in said one direction from its timed-out position, said one way drive means including a pawl bodily carried by one of said two first mentioned means and engaging the other, said pawl and its engaging means being constructed and arranged to provide a component of force holding the pawl in driving position while the operating means is being moved through its driven stroke and to reduce said component of force at the end of said driven stroke so that the pawl is ineffective to hold the operating means in timing position, and means actuated by the timing means on reaching its timed-out position for releasing the latch means.

2. The combination recited in claim **1** in which the pawl is pivoted to the operating means and the timing means includes a cam having a surface engaging and lifting the pawl.

3. The combination recited in claim **1** in which the pawl is pivoted to the operating means and the timing means includes a cam shaft having a cam segment, one part of said segment being arranged to engage and lift the pawl and another part of said segment being arranged to engage and release the latch means.

4. The combination recited in claim **1** in which the operating means is a lever having a pivot on one side of the timing means, said lever extending to the other side of the timing means and having a latch engaging surface, said latch means including a latch lever having a pivot on said other side of the timing means and a latch portion cooperating with said latch engaging surface, said latch lever also having an operating leg extending back to said one side of the timing means and being actuated by said timing means at said one side thereof.

5. The combination recited in claim **1** in which the operating means is a lever and the timing means is a cam shaft, said lever being pivoted at one side of the cam shaft and extending to the other side thereof and having a latch engaging surface, said latch means including a latch lever having a pivot on said other side of the cam shaft and a latch portion cooperating with said latch engaging surface, said latch lever having an operating leg extending back to said one side of the cam shaft and being actuated by the cam shaft at a location on said one side thereof, said pawl being pivoted to the operating means and extending to a point adjacent said location.

6. The combination recited in claim **1** in which the pawl is formed with two surfaces at substantial angles to each other, one surface providing the component of force holding the pawl in driving position during the stroke of the operating means and the other surface being contacted at the end of the stroke terminating said component of force.

7. The combination recited in claim **6** in which the pawl is pivoted to the operating means and is engaged by the timing means during the driven stroke of the operating means.

8. The combination recited in claim **5** in which the pawl is pivoted to the lever at a point substantially spaced from the location where the latch lever is actuated and extends adjacent to said location, the cam shaft including a camming portion having two sides, one side engaging the pawl and the other side engaging the latch means.

9. The combination recited in claim **8** in which the pawl is formed with two surfaces at substantial angles to each other, one surface providing the component of force holding the pawl in driving position during the driven stroke of the operating means and the other surface being contacted at the end of the stroke, terminating the component of force.

10. The combination recited in claim **9** in which the pawl is in tension during the driven stroke of the operating means and is provided with stop means between it and the operating means lever for determining the location of the pawl relative to the lever during the driven stroke of the lever, the one surface of the pawl being arranged to hold the pawl against the stop means.

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