Feb. 13, 1962 C. J. GOODHOUSE 3,020,772

SWITCH ACTUATING TIMER

Filed Feb. 24, 1959 2 Sheets-Sheet 1

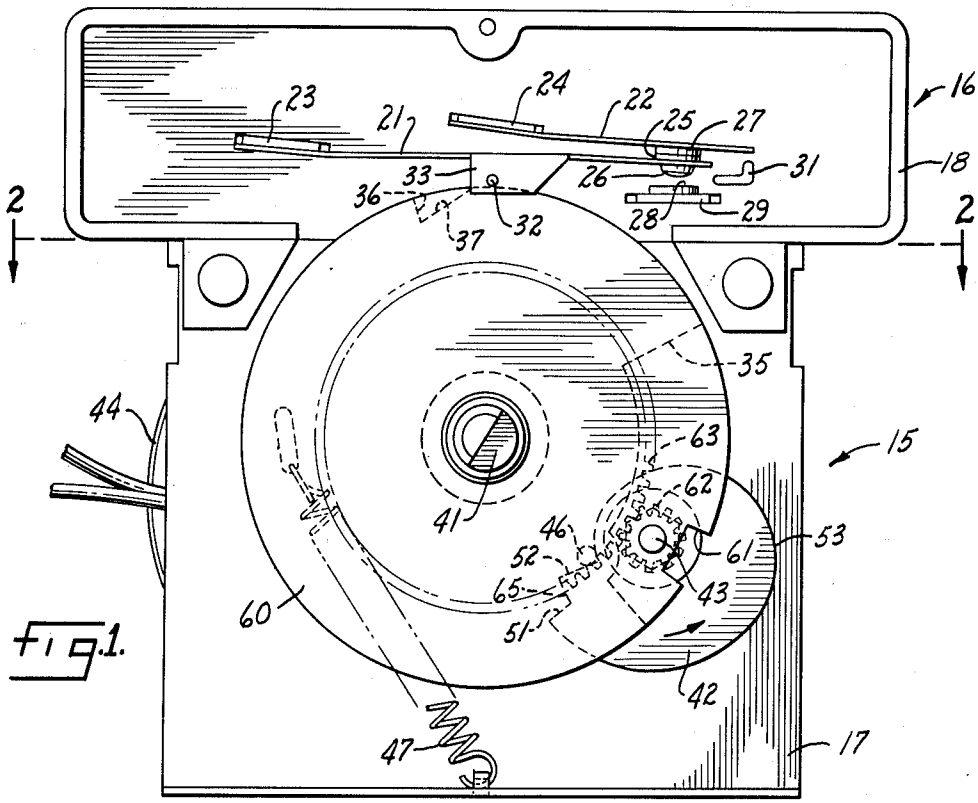


Fig. 1.

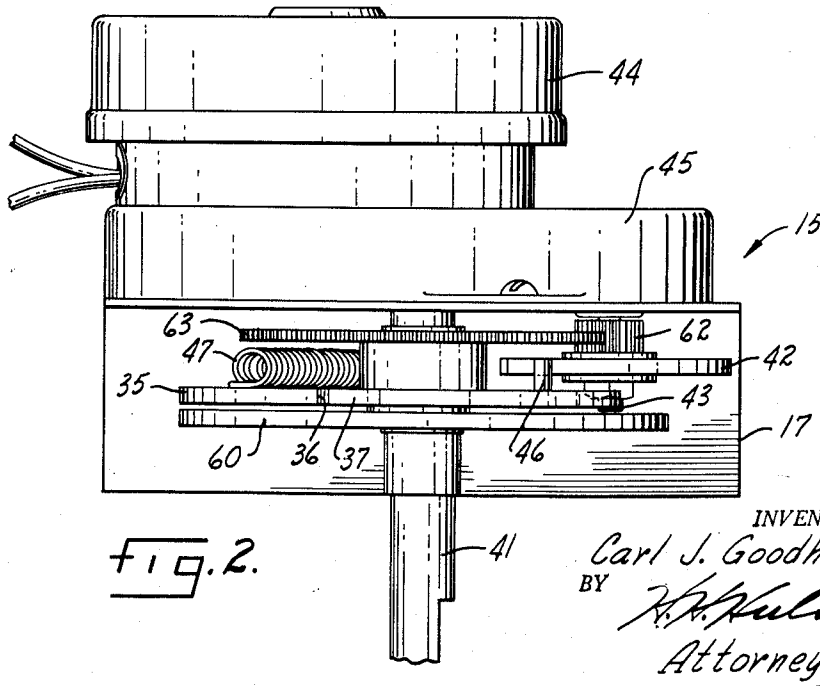


Fig. 2.

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SWITCH ACTUATING TIMER

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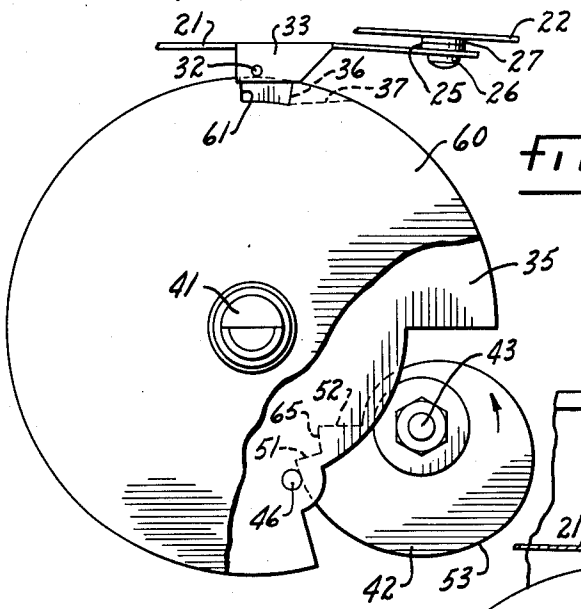


Fig. 3.

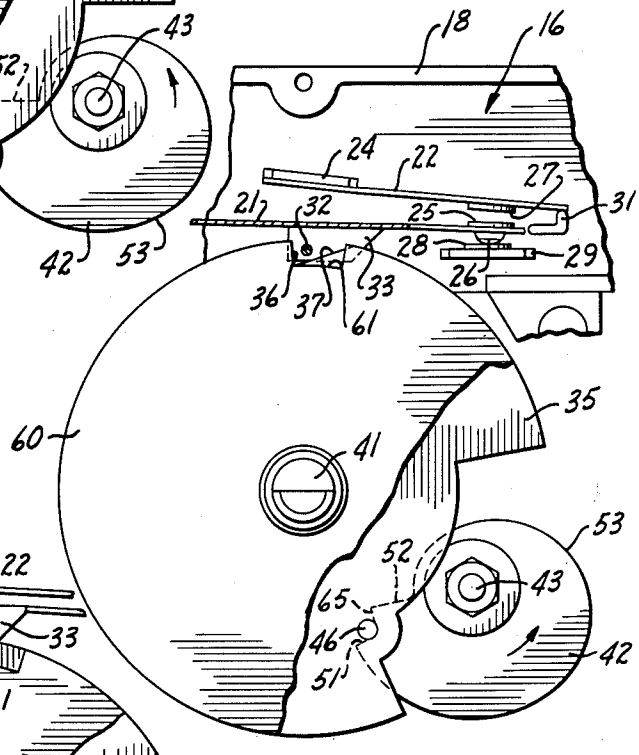


Fig. 4.

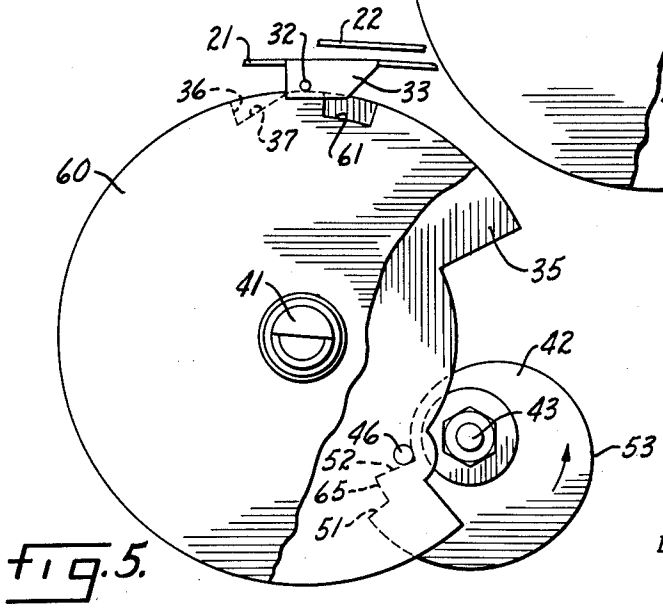


Fig. 5.

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SWITCH ACTUATING TIMER

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The present invention relates generally to electric switch actuating timing devices and concerns a timer particularly well suited for controlling a defrosting cycle in refrigerators.

The primary object of the invention is to provide a novel switch actuating timer capable of reliably operating a switch through a short timed interval during a relatively much longer timing cycle. In this way, the timer can effectively control a refrigerator defrosting cycle lasting but a few minutes but which occurs only once or twice a day.

It is also an object of the invention to provide a timer as described above which snap-actuates common, inexpensive switch components to avoid arcing or fluttering of switch contacts, even though the timer operates the switch through only a small fractional part of the total timing cycle.

It is a further object to provide a reliable timer having the above characteristics which is exceptionally compact and quite inexpensive to manufacture.

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 section of a switch actuating timer constructed in accordance with the present invention;

FIG. 2 is a section taken approximately along the line 2—2 of FIG. 1; and

FIGS. 3, 4 and 5 are fragmentary views similar to FIG. 1, showing in stop-motion form, the operation of the timer.

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 alternatives, 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 **15** embodying the invention which is effective to operate an electric switch **16**. The timer **15** includes a frame **17** on which is rigidly mounted a switch housing **18**, preferably formed of a dielectric material, that supports the components of the switch **16**.

The switch includes a pair of resilient contact arms **21**, **22** anchored by terminals **23**, **24** to the housing **18**. The arm **21** is the movable member of the switch and it carries a pair of opposed contacts **25**, **26**. When the arm **21** is swung upwardly, the contact **25** is urged into engagement with a contact **27** carried by the arm **22**. Lowering the arm **21** brings the contact **26** into engagement with a contact **28** which is carried by a fixed terminal **29** mounted in the housing **18**. Thus, lifting the arm **21** closes the contacts **25**, **27** and opens the contacts **26**, **28**, while lowering the arm **21** opens the contacts **25**, **26** and closes the contacts **26**, **28**.

To prevent the contacts **25**, **27** from remaining in engagement when the arm **21** is lowered, a lug **31**, preferably formed as an integral portion of the housing **18**, engages the end of the arm **22** when the arm **21** is lowered (see FIG. 4) and positively holds the contacts **25**, **27** apart.

For moving the arm **21**, the arm is provided with an operator **32** in the form of a pin or rod. The operator pin is secured to the arm **21** by being fixed between a pair of depending flange portions **33** formed integrally with the switch arm.

In accordance with the present invention, the operator **32** is biased against a cyclically driven control cam having a drop-off portion, and a timing member is provided which blocks the operator from the cam drop-off portion. The timing member is driven through a cycle whose duration is a multiple of the control cam cycle and is formed to periodically free the operator for operation by the control cam.

In the illustrated embodiment, the operator **32** is urged against a control cam **35** by mounting the contact arm **21** so that its inherent resilience tends to swing the operator **32** against the control cam. The control cam **35** is provided with a drop-off portion **36** having one side **37** formed as a sloping cam surface.

In the preferred form of the invention, the control cam **35** is loosely journaled on a shaft **41** and is driven in an oscillating cycle by a drive cam **42**. The drive cam **42** is secured to an output shaft **43** of a synchronous timing motor **44** which drives the shaft **43** through speed reduction gears in a gear case **45**. The drive cam **42** rotates counterclockwise, as seen in the drawings, at a constant predetermined rate when alternating current is supplied to the motor **44**.

To enable the drive cam **42** to oscillate the control cam **35** through its cycle, the cam **35** is provided with a cam follower in the form of a pin **46** and is biased by a tensioned spring **47** so as to urge the pin **46** against the periphery of the drive cam **42**. The drive cam is formed with a pair of drop-off steps **51**, **52** connected by a spiral cam surface **53**. It may thus be seen that as the drive cam **42** rotates in a counterclockwise direction, the pin **52** is urged to the left by the cam surface **53** so as to swing the control cam **35** in a clockwise direction against the urging of the spring **47**. Upon further movement of the drive cam **42**, the pin **46** drops from the successive drop-off steps **51**, **52** so that the control cam **35** "jumps" in a counterclockwise direction under the urging of the spring **47** to a first position as the pin **46** drops from the step **51**, and then to a second position as the pin drops from the step **52**. In other words, the control cam **35** oscillates by slowly moving in a clockwise direction and then jumping back in a counterclockwise direction through two steps to its original position.

The control cam **35** is phased so that its drop-off portion **36** is adjacent the switch operator **32** when the cam has jumped to its first position with the pin **46** dropping from the step **51** (see FIG. 4).

In the illustrated embodiment, the member which blocks the operator **32** from the drop-off portion **36** of the control cam takes the form of a timing cam **60** mounted coaxially with the control cam **35**. The timing cam is provided with a relieved peripheral or drop-off portion **61** and is secured to the shaft **41**. The cam **60** is rotated by the motor **44** through a pinion **62** carried by the output shaft **43** and a gear **63** mounted on the shaft **41** (see FIG. 2). Thus, the timing motor **44** cycles the timing cam **60** in a clockwise direction while driving the control cam **35** through its oscillating cycle.

The cycle of the timing cam **60** has a duration which is a multiple of the cycling interval of the control cam **35**. In the illustrated embodiment, the control cam **35** cycles, that is, makes a complete oscillation, six times while the timing cam **60** cycles once, that is, makes one complete revolution.

To more readily understand the operation of the timer **15**, a complete operating cycle of the timer will be reviewed. Considering first FIG. 1, it will be appreciated that so long as the switch operator **32** rests on the periphery of the timing cam **60**, the oscillating control cam **35** cannot operate the switch **16**. The contacts **25**, **27** thus remain closed and the contacts **26**, **28** open throughout the relatively long time interval required to rotate the

timing cam 60 so as to bring the relieved portion 61 adjacent the operator 32. In the preferred embodiment, the timing member 60 cycles once every twelve hours.

When the timing cam 60 approaches the end of a cycle and the relieved portion 61 is brought adjacent the operator 32, as shown in FIG. 3, it will be seen that the operator 32 rests solely on the control cam 35. As the control cam 35 cycles, the pin 46 drops from the step 51, see FIG. 4, and the drop-off portions 36 and 61 are brought into alinement adjacent the operator 32. Because of the resilience in the contact arm 21, the arm swings downwardly to open the contacts 25, 27 and close the contacts 26, 28.

As the control cam 35 continues its cycle and jumps into its second position, that is, when the pin 46 drops from the step 52, the cam surface 37 urges the operator 32 upwardly onto the periphery of the control cam, and the contact arm 21 is restored to its original position with the contacts 25, 27 closed and the contacts 26, 28 opened. Soon thereafter, the timing member 60, continuing its steady rotation, moves sufficiently far to carry the relieved portion 61 away from the operator 32 so that subsequent cycles of the control cam 35 are ineffective to operate the switch 16 until the timing cam 60 again completes its full cycle.

It is important to note that when the switch 16 is operated, its operation is solely under the control of the cam 35 which moves quite rapidly, in spaced jumps, when operating the switch. Thus, the switch contacts are moved quickly and positively into and out of contact and there is no opportunity for fluttering or arcing.

The length of time during which the switch is operated is determined by the spacing between the steps 51, 52 on the drive cam 42, that is, by the length of a ledge 65 which connects the steps. In the illustrated embodiment, the ledge 65 is sufficiently long to hold the switch 16 operated for the period of three minutes. By selecting an appropriately proportioned drive cam 42, this time interval can be adjusted quite accurately.

It can now be understood that the timer 15 is capable of reliably operating the switch 16 for an exactly determined relatively brief interval, three minutes in the illustrated embodiment, once during a relatively much longer timing cycle, twelve hours in the illustrated example. However, since the switch 16 is snap-actuated, it can be seen that there is no danger of arcing between the contacts despite the very long timing cycle involved.

Those skilled in the art will also appreciate that the timer 15 can be constructed quite compactly and economically, since it utilizes components of standard types which can be easily formed by tools and techniques common to the art.

I claim as my invention:

1. A mechanism actuating timer comprising, in combination, a timing motor, a control cam, means for intermittently stepping said control cam, said means being powered by said motor so that the control cam is stepped through repeating cycles, said cam having a drop-off portion, a mechanism operator biased against said cam and being operated when said drop-off portion is alined therewith at one of said intermediate steps, a timing member for blocking said operator from said drop-off portion, said timing member being driven by said motor through a cycle whose duration is a multiple of said control cam cycle, and said member having a relieved portion which periodically frees said operator for operation under the control of said control cam.

2. A mechanism actuating timer comprising, in combination, a timing motor, a timing cam coupled to said motor for rotation through a repeating cycle, a jump cam positioned adjacent said timing cam, a movable mechanism operator biased against the peripheries of said cams, each of said cams having drop-off portions permitting operation of said operator when said portions are each alined adjacent the operator, means powered by said motor for cycling said jump cam at a speed which is a multiple of said timing cam cycle, said means being effective to jump said jump cam during its cycle with a snap action into and out of the position at which the drop-off portion of the jump cam is adjacent said operator, said cams being phased so that once during each timing cam cycle said drop-off portions coincide adjacent the operator and the mechanism operator is operated.

3. A mechanism actuating timer comprising, in combination, a timing motor, a timing cam coupled to said motor for movement of said cam through repeating cycles, a control cam positioned adjacent said timing cam, a movable mechanism operator biased against said cams at a fixed location, each of said cams having drop-off portions permitting operation of said operator when the portions are alined at said location, means powered by said timing motor for oscillating said control cam through repeating cycles, said means causing the control cam to jump to first and second positions during its cycle, said cams being phased so that every time the timing cam drop-off portion reaches said location the control cam first jumps to its first position disposing its drop-off portion at said location, thus operating said mechanism operator, and then the control cam jumps to its second position to restore the mechanism operator.

4. A mechanism actuating timer comprising, in combination, a timing motor, a circular timing cam coupled to said motor for rotation of said cam through repeating cycles, a control cam positioned adjacent said timing cam and journaled coaxially therewith, a movable mechanism operator biased against the peripheries of said cams at a fixed location, each of said cams having drop-off portions permitting operation of said operator when the portions are alined at said location, means for resiliently urging said control cam in one direction, a drive cam coupled to said timing motor for oscillating said control cam through repeating cycles, the cycle of said timing cam being a multiple of the cycle of said control cam, said drive cam having spaced drop-off steps causing the resiliently urged control cam to jump to first and second positions during its cycle, said cams being phased so that every time the timing cam drop-off portion reaches said location the control cam first jumps to its first position disposing its drop-off portion at said location, thus operating said mechanism operator, and then the control cam jumps to its second position to restore the mechanism operator.

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