United States Patent [19]

Obermann et al.

[11] **3,823,280**

[45] **July 9, 1974**

[54] **TIMER**

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[73] Assignee: **Controls Company of America,** Schiller Park, Ill.

[22] Filed: **Oct. 26, 1973**

[21] Appl. No.: **409,961**

[52] **U.S. Cl.** ..... **200/38 B,** 200/166 J, 335/73

[51] **Int. Cl.** **H01h 43/10**

[58] **Field of Search** ..... 200/38 D, 38 B, 166 J, 200/3; 335/173; 310/79

[56] **References Cited**

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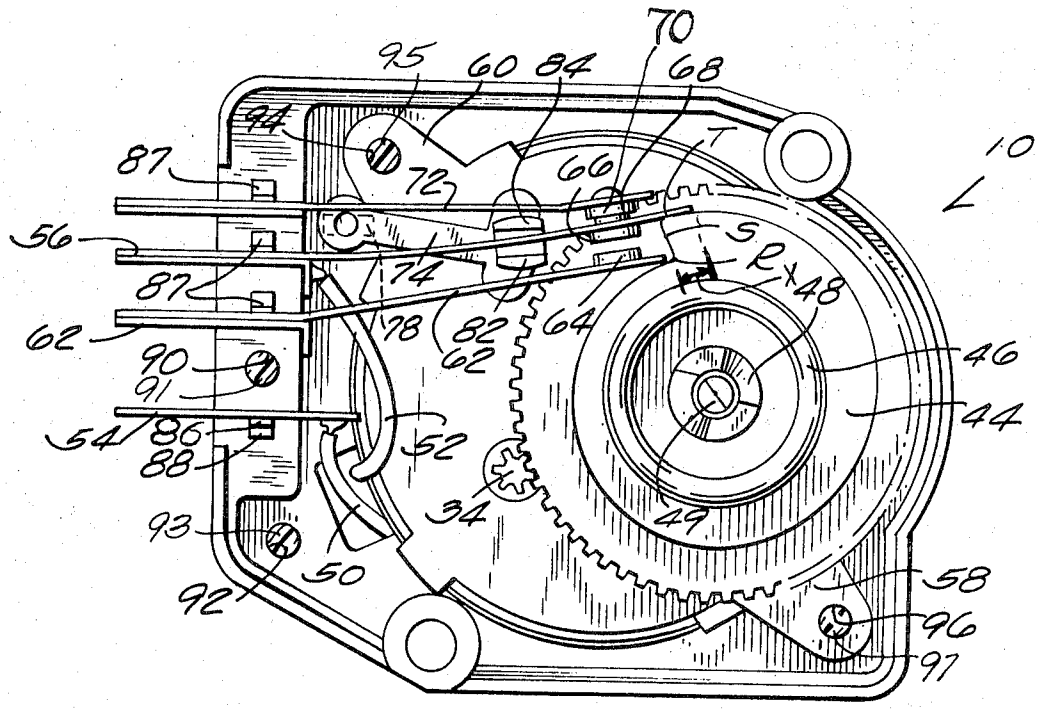
Attorney, Agent, or Firm—Michael, Best & Friedrich

[57] **ABSTRACT**

The motor subassembly is mounted in the housing with the motor leads dressed between the motor case and the housing and connected to the motor terminal and to a switch blade terminal and does not require grounding. The gear case somewhat divides the motor case to retain the coil while the motor case cover cooperates with the gear case to enclose and journal the gearing with the drive pinion projecting therebetween to drive the gear on the perimeter of the timing cam. The timing cam is journaled on the bushing extruded from the motor cover and in the aperture in the housing cover with the gear cluster extension projecting into and visible in the cam hub to afford visual verification of motor operation. The three switch blades are accurately located in the housing by tabs engaging locating cavities and the pivoted yoke has pads which space the two outside blades from each other. During the time between defrost cycles the No. 1 blade rides on the cam with the No. 2 blade engaging the No. 1 blade. When the No. 1 blade drops off the cam drop, the No. 3 blade engages the No. 2 blade and remains so engaged until the No. 2 blade drops off the cam. The tangential distance between the ends of blades No. 1 and No. 2 determines the duration of the cycle in combination with the rotational speed of the cam. All components are trapped by the assembly of the cover to the housing which is accomplished without fasteners. The great reduction in parts while completely enclosing the product results in a quiet, low cost, accurate timer which is easily serviced in the field by way of easy verification of operation.

6 Claims, 9 Drawing Figures



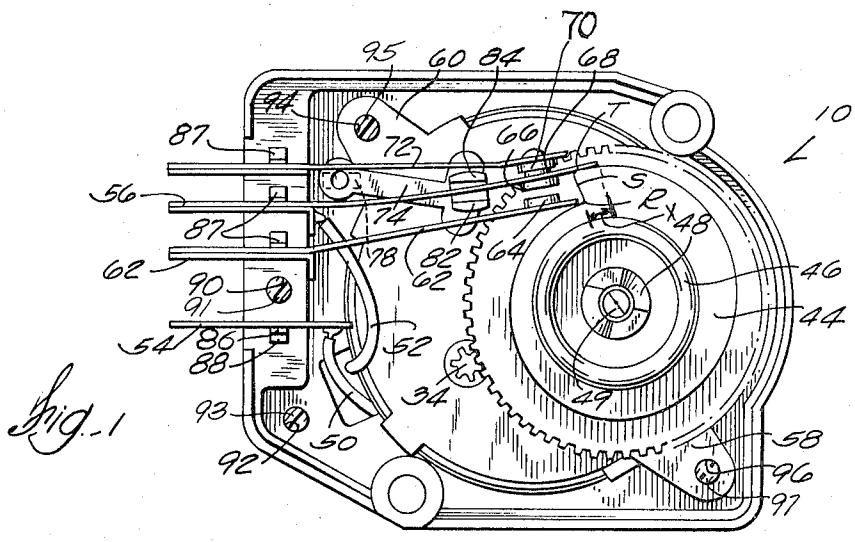


Fig. 1

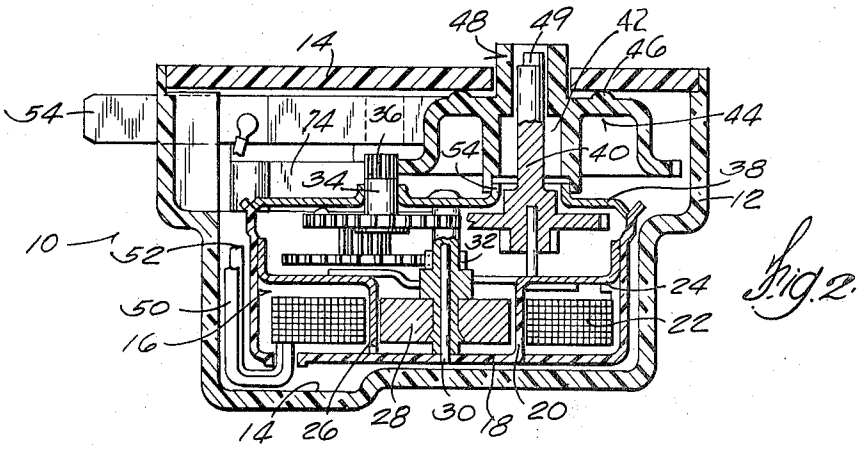


Fig. 2

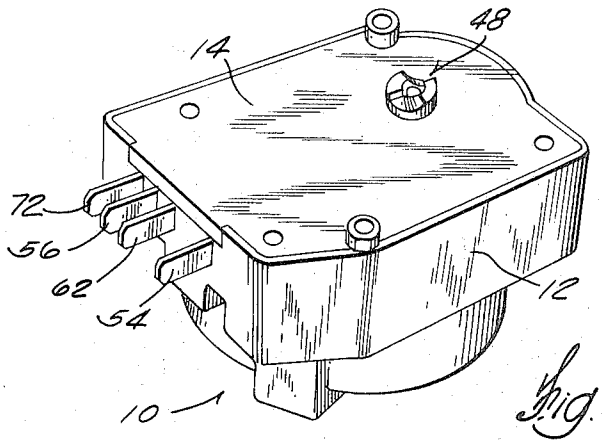


Fig. 3

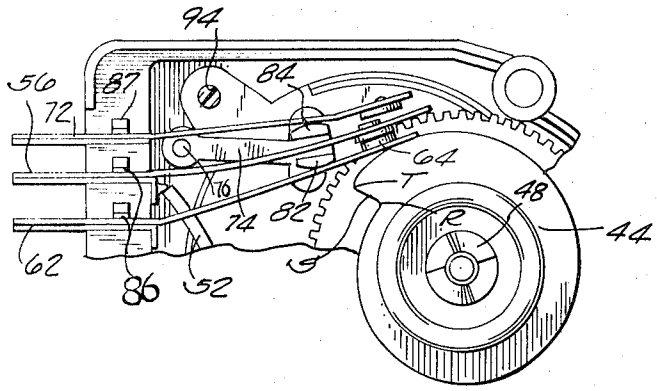


Fig. 4

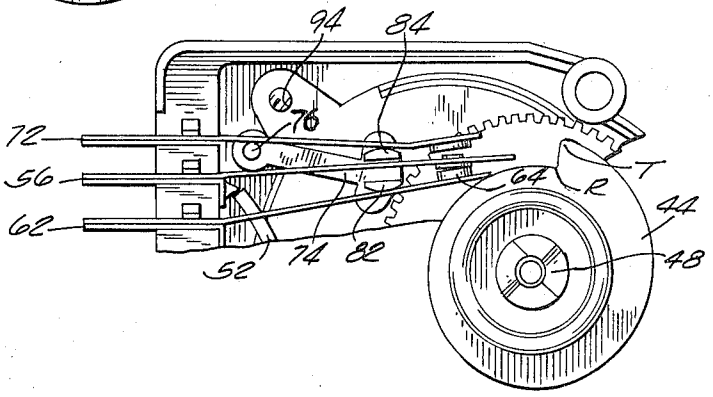


Fig. 5

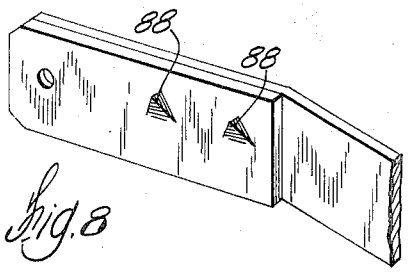


Fig. 8

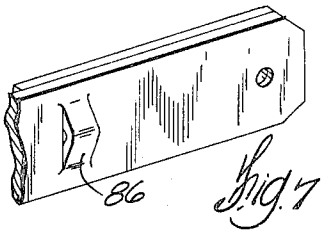


Fig. 7

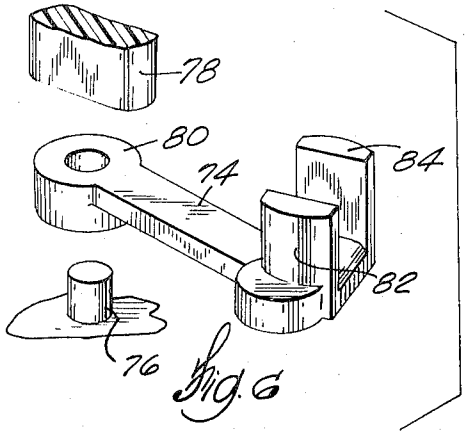


Fig. 6

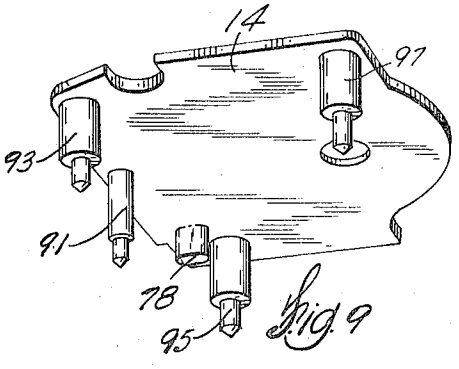


Fig. 9

TIMER

BACKGROUND OF THE INVENTION

This timer is designed for controlling refrigerator defrost cycles. Timers for such use have heretofore required more parts and space than the present design. The prior timers accomplished the desired end — controlling defrost cycles — but offered clear opportunity for improvement.

SUMMARY OF THE INVENTION

The construction described in the Abstract totally encloses the motor, gearing and switching in a plastic housing. This results in quiet operation and avoids the need for grounding. The timing cam hub can be actuated manually, in the correct direction only, to verify switch operation. The gear cluster shaft, which is visible through the hub, permits verification of motor operation. These two field checks are important with such timers since they operate at such slow speed as to preclude waiting for a normal operation check. All parts are accurately located in the molded housing and the cover functions to pin and/or retain all parts in assembled position while the cover pins are sonically welded to complete the assembly. The spacer/yoke member insures accurate switching at minimal cost with few parts.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view with the cover removed.

FIG. 2 is a vertical section taken through the center of the motor and the center of the timing cam.

FIG. 3 is a perspective view of the completed timer.

FIG. 4 is a fragmentary view corresponding to FIG. 1 but showing the switch blades in a different operational condition.

FIG. 5 is similar to FIG. 4 but shows still another condition.

FIG. 6 is a partial exploded perspective showing the spacer yoke, the pin on which it is mounted, and the finger which depends from the underside of the cover to retain the yoke on the post.

FIG. 7 is a partial view showing the shear pad which is formed from the terminal portion of the blade for location purposes.

FIG. 8 shows the pointed tabs which are formed from the terminal portion of the blades for the purpose of retaining the blades in the housing.

FIG. 9 is a perspective of the underside of the cover.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Timer housing 10 includes body 12 and cover 14. The body has a cavity 14 which receives motor and gear case assembly 16. This assembly includes motor case 18, the bottom of which is lanced to provide upwardly projecting stator poles 20 which lie inside coil 22. The coil is enclosed by the gear case 24 pressed inside the motor case 18 and having lanced poles 26 concentric with and lying between poles 20. The permanent magnet rotor 28 is mounted on shaft 30 journaled in the motor case and in the cover 38 and carrying drive pinion 32 which drives the reduction gear clusters. One cluster includes an output shaft 34 carrying

output pinion gear 36 projecting through motor cover 38 and journaled therein. Another gear cluster that is axially in line with cam 44 also includes shaft 40 which projects through the motor cover 38 into the hollow hub 42 of the molded timing cam and gear 44. The gear on the perimeter of this molding is driven by pinion 36 and the molding has a cam shape best seen in FIG. 1. The cam is driven in the clockwise direction (FIG. 1) and has a slow rise portion extending from point R at the bottom of the fast drop portion S and running counterclockwise around the gear to the drop position T. It will be noted the top face of this molding 44 includes an annular boss 46 which functions as a bearing acting against the bottom of housing cover 14. The hub 42 projects through the housing cover for access from the exterior of the timer. The end of the hub has a one-way screwdriver slot arrangement generally denoted 48 permitting the serviceman to manually drive the cam in a clockwise direction (only) to check out the operation of the switching. It will be noted that the extension of shaft 40 is visible through the center of the hub 42. The end of the shaft has a flat 49 cut therein so as to give a different visual impression when viewed head-on. The purpose of this is to permit observation of the shaft end to determine whether or not the motor is operating. The timer cam is generally operated at a speed of one-twelfth or one twenty-fourth revolution per hour and this, of course, would be very difficult to observe. The end of shaft 40, however, rotates at approximately 13 RPM and this speed of rotation can, of course, be observed.

It will be noted that the motor and gear assembly constitutes a complete subassembly totally enclosed within the motor case 18 and motor cover 38 with the coil leads 50,52 being brought out the bottom of the subassembly and led up the side of the subassembly between the subassembly and the housing body 12 for connection to terminal 54 and the terminal portion of the middle switch blade 56. The middle blade will also be referred to as the second blade. The shaft 40 projects through the opening in motor cover 38 and the perimeter of the opening is extruded outwardly at 54 to provide a bushing or bearing surface for hub 42 of the timing cam. The timing cam hub 42 is also journaled in the aperture in housing cover 14. It will also be noted that motor cover 38 is provided with projecting mounting ears 58,60, each of which is provided with an aperture which aligns with an aperture in the housing body 12 for purposes which will appear more fully hereinafter.

Three switch blades are mounted in the housing. The first blade 62 has its proximal portion mounted in a slot in the housing body 12 with the end projecting to the exterior of the housing for connection to external wiring. The distal end of the blade carries a contact 64 and is adapted to ride on the cam surface of the timing cam 44. The middle or second blade 56 is similarly mounted in the slot and is longer than the first blade 62 by an amount designated X in FIG. 1, the significance of this dimension being more fully explained hereinafter. The second blade carries a contact on each side of the blade at the distal portion, contact 66 being engageable with contact 64 on the first blade and contact 68 being engageable with contact 70 carried by the distal portion of blade 72 which is also mounted in a slot in the housing body with its end projecting to the exterior of the

housing for external electrical connection. All of the blades are biased towards the cam.

A yoke or spacer member **74** is pivotally mounted on post **76** molded in the housing underneath the blades. Cover **14** is provided with a depending finger **78** which rests on top of the hub portion **80** of the yoke **74** to retain the yoke in its assembled position. The yoke includes two upstanding arms **82,84** which straddle blade **56** while lying between the first and second blades in the case of arm **82** and between the second and third blades in the case of arm **84.** The outer surface of arm **82** is engageable with the blade **62** while the outer surface of arm **84** is engageable with the third blade. Thus when the parts are in the position shown in either FIG. 4 or FIG. 5 (i.e., when only the first blade is in contact with the cam), the yoke functions to space the third blade a predetermined distance from the first blade and this, in turn, prevents the third blade from making contact with the second or middle blade. It will be noted the coil leads **50,52** are connected to the motor terminal **54** and to the middle blade terminal **56.** Thus these two terminals are designed to be electrically hot. When this timer is used for timing defrost cycles, at the conclusion of a defrost cycle the end of the middle or second blade **56** will have just dropped off the drop position T so that the second blade is now in contact with the first blade and the first blade is riding on the low portion of the rise of the cam. At this time the yoke or spacer **74** functions to prevent engagement of the third blade with the second blade. Thus the electrically hot blade **56** is connected to blade **62** as well as being connected to the coil. The compressor may be connected in series through this switching so that the compressor is free to operate under these conditions. After either 12 or 24 hours has elapsed, the far distal end of the first blade **62** will drop off the cam to the position shown in FIG. **1.** Under these conditions the distal end of the second blade will rest on the maximum rise portion. Thus the connection between the first and second blades is broken but the movement of the first blade to the bottom of the drop S will permit the third blade to now move under self-bias into engagement with the second blade, thus making a circuit from the second blade to the third. This can control a heater, for example, while breaking the compressor circuit. The duration of the defrost cycle starts at this instant and lasts until the distal end of the second blade drops off point T. This, then, means that the dimension X (mentioned before) becomes determinative of the duration of the cycle in combination with the rotary speed of the timing cam.

Therefore, the distance X is one which must be controlled with precision and it is a simple matter to stamp a blade to a precise length. The next step in controlling this precision is to precisely mount the blade so that it lies exactly where it was designed to lie. Towards this end the proximal portion of each blade is provided with a shear-formed tab **86** (see FIG. 7) which is a simple thing to control with great precision. This tab is designed to be received in the cavity **87** adjacent each of the blades where they lie in the slots. This, then, precisely locates each blade and terminal relative to the body and relative to the cam. The cavity can be controlled with accuracy and its location, of course, is fixed. During assembly it is desirable to lock the blades into position so they cannot drop out and towards this end each blade is provided with sheared, pointed tabs **88** which project upwardly as the blade is inserted into the slot but which dig into the plastic body and prevent removal of the blades once they have been seated. Furthermore, the cover overlies all of these blades and retains them in position.

The cover itself is provided with integral depending plastic pins **91,93** which are received in the holes **90,92** and pins **95,97** are received in the holes **94,96** in the mounting ears **58,60** of the motor subassembly. These holes **94,96,** of course, line up with holes in the housing. The enlarged portion of each of these pins overlies the ears **58** and **60** to firmly hold the ears in the desired position and the extending reduced diameter portion of the pins pass into the holes and are then sonically welded into the body to firmly lock the cover in place while at the same time functioning to hold all of the parts in position. No conventional fasteners are used in the assembly of the entire timer.

We claim:

1. A timer comprising

a housing,

a timing cam rotatably mounted in the housing having a slow rise-fast drop surface,

motor and gear means rotating the cam,

three switch blades mounted in the housing with their distal ends adjacent and biased towards the cam,

the first of the blades being closest to the cam and always in engagement with the cam,

the second blade being longer than the first so it engages the rise after the first blade drops at the fast drop portion of the cam until the second blade drops at the fast drop,

a yoke member pivoted in the housing and having an arm projecting between the first and second blades and another arm projecting between the second and third blades with the second blade free to move freely between the arms and the arms serving to determine the minimum spacing between the first and third blades whereby the third blade is held out of contact with the second blade while the second blade is in contact with the first blade as the first blade engages the slow rise of the cam and the third blade is free to contact the second blade while the second blade is in contact with the cam.

2. A timer according to claim **1** in which the cam has a hollow hub and the motor and gear means includes a shaft projecting into the hub and having an end configuration which readily indicates whether or not it is rotating,

said hub projecting through the housing whereby the hub and the shaft are clearly visible from the exterior of the housing.

3. A timer according to claim **2** in which the exposed end of the hub has a one-way driving configuration whereby the cam may be manually advanced.

4. A timer according to claim **2** in which the motor and cam means are enclosed in a casing mounted as a unit in the housing,

said housing including a body and a cover,

said cam being journaled on the casing and the cover,

said cover including means for engaging and retaining the casing in position in the housing.

5. A timer according to claim **1** in which the proximal ends of the blades are mounted in slots in the housing wall,

each proximal blade end having a tab sheared therefrom,

each slot including a cavity receiving the tab whereby the distal end of the blade is accurately located.

6. A timer according to claim 5 in which the housing includes a cover which functions to retain the blades in said slots.

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