

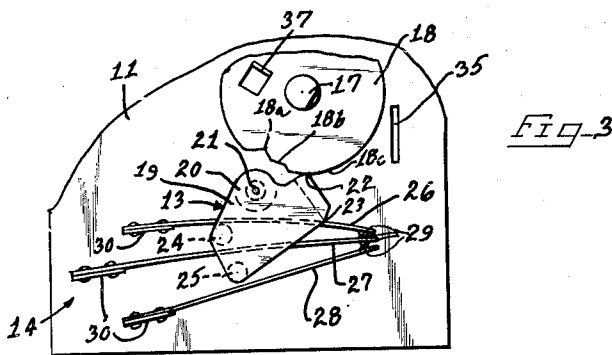
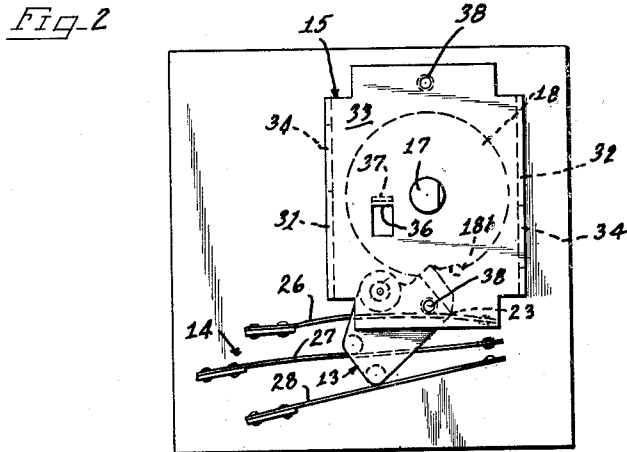
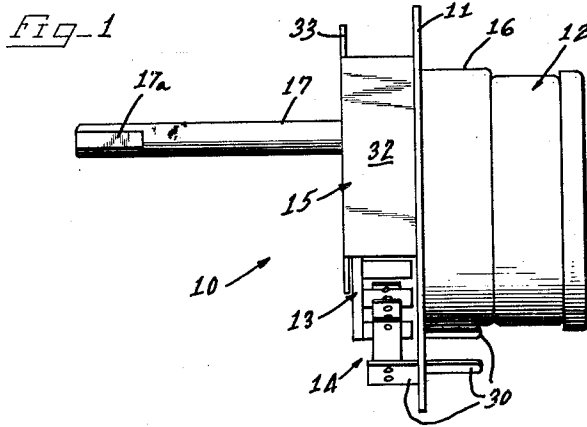
June 18, 1963

J. BOWMAN
INTERVAL TIMER

3,094,593

Filed June 8, 1960

2 Sheets-Sheet 1



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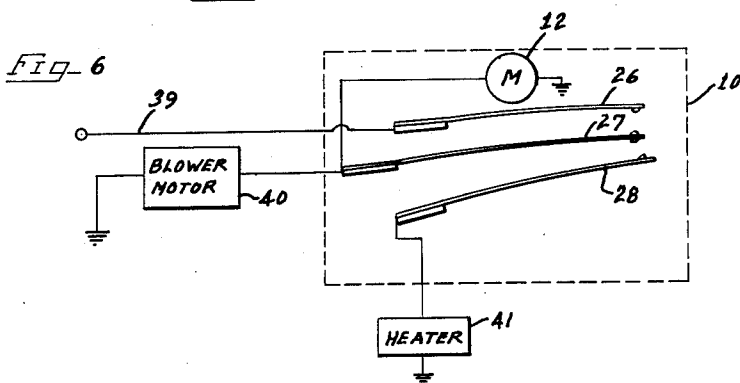
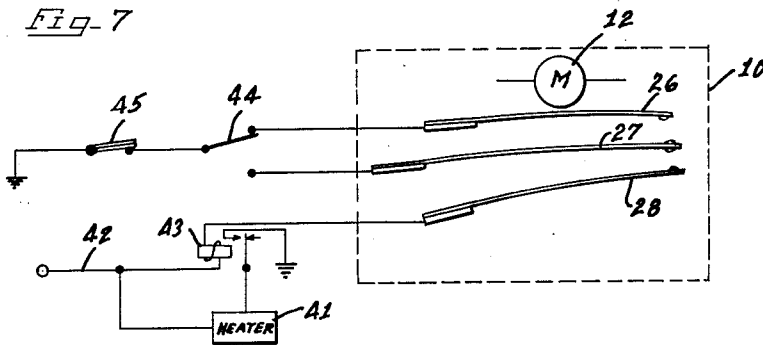
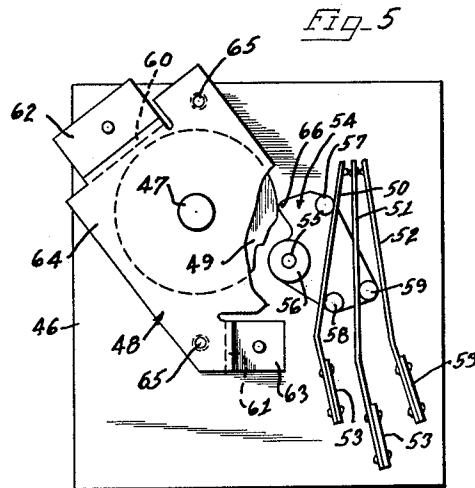
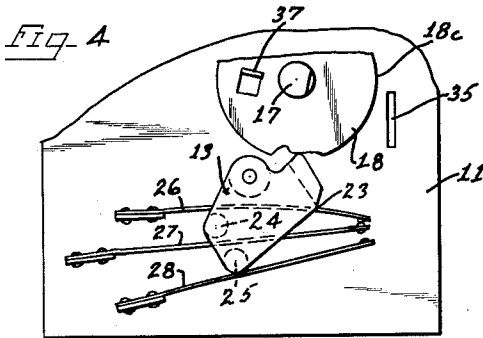
June 18, 1963

J. BOWMAN
INTERVAL TIMER

3,094,593

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2 Sheets-Sheet 2



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3,094,593

INTERVAL TIMER

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7 Claims. (Cl. 200—38)

This invention relates generally to interval timers, and more specifically to a simplified embodiment thereof.

Although the principles of the present invention may be included in various interval timers, a particularly useful application is made in timers employed to control home laundry dryers and other appliances employing similar circuits. In such devices, it frequently becomes necessary to open a first circuit after a predetermined lapse of time, and thereafter, to open a second circuit after a predetermined lapse of time from the opening of the first circuit. In industry today, large quantities of such devices are utilized as a part of highly competitive end products, and therefore the simplicity of structure becomes one of the important criteria in evaluating a new timer construction in determining whether it comprises an improvement over prior devices. As a practical matter, applications for devices of this type differ from each other, and the manufacturer thereof has a further criterion or prerequisite, namely that the device must be readily manufacturable to suit numerous installation requirements from a single set of tools.

The present invention contemplates the utilization of a synchronously driven timing cam which acts through a pivotal actuator to regulate the position of movable switch elements. Further, the invention contemplates the utilization of a single sheet of insulate material as a chassis upon which the various components are directly or indirectly supported.

Accordingly, it is an object of the present invention to provide an interval timer of simplified constructional configuration.

Another object of the present invention is to provide a basic interval timer which can be manufactured by use of a single set of tools, and yet readily adapted to suit various customer installation requirements.

Yet another object of the present invention is to provide an interval timer which employs novel means acting between a cam track and movable switch elements for positioning the switch elements.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example.

On the drawings:

FIGURE 1 is a side elevational view of a sequence timer provided in accordance with the principles of the present invention;

FIGURE 2 is an elevational view showing the left side of FIGURE 1 with the contacts in an open position;

FIGURE 3 is a fragmentary view of a portion of FIGURE 2, with parts removed and broken away, showing the contacts closed;

FIGURE 4 is similar to FIGURE 3 except that only one set of contacts is closed;

FIGURE 5 is an elevational view with certain parts broken away, generally corresponding to FIGURE 2, but of a modified form of the instant invention;

FIGURE 6 is a schematic view showing how the instant invention may be employed in an electrical circuit; and

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FIGURE 7 is a further schematic drawing showing another mode in which the instant invention may be utilized in an electric circuit.

As shown on the drawings:

The principles of this invention are particularly useful when embodied in an electrical sequential timer assembly such as illustrated in FIGURE 1 generally indicated by the numeral 10. The sequential timer 10 includes a sheet-like base 11 of insulative material, such as a laminated phenolic, to which is attached a synchronous electric motor assembly 12, a pivotal actuator member 13, a plurality of switch blades generally indicated at 14, and a combined cover-guard-bracket 15. The motor assembly 12 is of conventional construction and includes an internal speed reducing gear train contained within the motor case 16, the case 16 being attached by conventional means provided thereon to the base 11. The gear train terminates in a shaft or shaft extension 17 adapted at its outer end 17a to receive a knob. The shaft extension 17 is optional for certain applications, and where it is used, the motor 12 includes a spring-loaded clutch as a part of the gear train.

A timing cam 18 is disposed on the other side of the base 11 from the motor 12, as shown in FIGURE 2 and is supported by the output shaft from the gear train for co-rotation therewith. The cam 18 is provided with three effective radial heights, the lowest being indicated by the reference 18a, the intermediate height being indicated by the reference 18b, and the highest being indicated by the reference 18c. The three cam heights 18a, 18b, and 18c jointly comprise a peripheral track which is engageable by the actuator member 13.

As best seen in FIGURE 3, the actuator member 13 includes a generally flat portion 19 which is provided with a hub portion 20 which is pivotally received and supported by pin 21 secured to the base 11. The actuator member 13 further includes a follower portion 22, and three-blade-engaging portions 23-25. In this embodiment, the blade-engaging portion 23 comprises an integral part of the follower portion 22 but is oppositely directed.

The set of blades 14 includes a first blade 26 which is disposed closest to the cam 18, a second, intermediate, or middle blade 27, and a third or outer blade 28. The blades 26 and 28 are provided with contacts 29 which are directed toward each other, and the intermediate blade 27 is likewise provided with electrical contacts directed in both directions. Each of the blades 26-28 is supported at the opposite end by a terminal 30 which extends through the insulative base 11 and is staked thereto or pressed therein, the terminals extending to the motor side of the base 11 where they are adapted to receive appropriate socket connectors, as best seen in FIGURE 1. Each of the blades 26-28 is so formed that it has a resilient natural bias which urges it against the follower portions 23-25 respectively of the actuator 13, as shown in FIGURE 2. It will be noted that the actuator portion 24 extends between the blade 26 and the blade 27 toward the base 11, and that the actuator portion 25 extends between the blades 27 and 28 toward the base 11.

The cover-guard-bracket 15 lies immediately adjacent to the actuator member 13, as shown in FIGURE 1, and prevents dislodging of the actuator member 13. The cover member or bracket 15 is generally U-shaped in cross section having legs 31, 32 joined together by a bight portion 33 through which the shaft extension 17 extends. The bracket 15 is provided with ears 34 which extend into slots 35 in the base 11 into which they are securely staked or pressed. If desired, the bight portion 33 of the bracket 15 is provided with a downwardly extending pierced-out stop means 36 which cooperates with upwardly extending pierced-out stop means 37 as shown in FIGURES 2 and

3. The bight 33 of the bracket-cover 15 forms a flat mounting surface in which mounting holes 38 may be disposed as required by a particular installation.

Referring now to FIGURE 6, there is illustrated a representative circuit in which the instant invention may be utilized to advantage. Line voltage may be introduced through a lead wire 39 which connects with the blade 26. The blade 27 may be connected to the motor 12 and also to a blower motor 40, the motors 12 and 40 having a return circuit. The blade 28 may be connected to a heater or heater relay 41 which likewise is connected to a return circuit. It is apparent that the condition of the circuit illustrated in FIGURE 6 corresponds to the relative relationship of the parts shown in FIGURE 2. When it is desired to operate the dryer of which the circuit of FIGURE 6 forms a part, the shaft 17 is manually advanced by a selected amount which causes the follower 22 to ride up the cam track to the highest height 18c thereby closing the various contacts 29 together as shown in FIGURE 3. This delivers voltage to both the timer motor 12, the blower motor 40, and the heater 41 so that all operate jointly. When the motor 12 has advanced the timing cam 18 so that the follower 22 drops down to the intermediate height 18b as shown in FIGURE 4, the outer blade 28 is caused to be biased out of position with respect to the other blades thereby opening the circuit to the blade 28 and hence the heater 41. This situation continues so that the blower motor may continue to operate and to cool down the appliance heated by the heater 41 for a predetermined time corresponding to the peripheral extent of the intermediate cam height 18b, after which the follower 22 drops into the lowest height 18a to again open all circuits.

The stop means 37 are so arranged that the timing cam can be rotated slightly less than 360° in order that excessive rotation will not cause the follower 22 to drop directly from the height 18c to the height 18a.

Considering now the mechanical operation of the actuator member 13, when the parts are arranged as shown in FIGURE 2, each of the blades 26, 27, and 28 is respectively biased against the actuator portions 23, 24, and 25. As the cam 18 is rotated in a clockwise direction from the position shown in FIGURE 2, it is apparent that the rise 18b will also effect clockwise rotation of the actuator member 13. (The actuator portion 23 is on the opposite side of the center of the pin 21 from the actuator portions 24, 25.) While such cam movement will effect further bias of the blade 26, such cam movement will effect partial release of bias of the blades 27, 28 since the actuator portions 24, 25 will be moving in the direction of the blade bias. Thus simultaneously with clockwise rotation of the actuator member 13, the blade 26 moves in a downward direction as shown in FIGURE 2 and the blades 27, 28 move in an upward direction. Such movement continues until a relationship between the parts is obtained as shown in FIGURE 4 which shows that the contact of the blade 26 engages the contact of the blade 27 to lift the blade 27 against its bias away from the portion 24.

Further movement of the actuator 13 in a clockwise direction in response to further movement of the cam 18 in the same direction brings the follower portion 22 up onto the highest height 18c of the cam 18. As this highest height is being reached, the actuator portion 23 provides further bias to the blades 26, 27 bringing them closer to the contact of the blade 28 which continues to move toward the cam 18 in response to further receding of the actuator portion 25, until the contact of the blade 28 engages the contact of the blade 27, after which further cam movement lifts the blade 28 away from the actuator portion 25 to provide the relationship shown in FIGURE 3.

As the motor drives the cam 18 in a counterclockwise direction, the reverse of the foregoing takes place. Beginning with the position shown in FIGURE 3, the follower 22 drops down to the height 18b, thus pivoting the

actuator 13 in a counterclockwise direction. This first effects an engagement between the actuator portion 25 and the blade 28 to force the blade downwardly while the actuator portion 23 is moving upwardly to allow the blades 26, 27 to move upwardly until the contacts of the switch defined by the blades 27, 28 open. Further counterclockwise rotation of the actuator 13 in response to the follower 22 moving into the lowest height 18a permits the blade 26 to move of its own bias in an upward direction and the blade 27 to be forced by the portion 24 in an opposite direction and to open the second switch defined by the contacts of the blades 26, 27.

Referring now to FIGURE 7, there is shown a further circuit in which a sequence timer constructed according to the principles of this invention may be utilized to advantage. Potential to the motor 12 is provided by other means and the timing cam is driven at a relatively high speed, for example one revolution per minute. In this embodiment, the stop means 36, 37 is omitted, and the shaft extension 17 may also be omitted. Potential is supplied through a line 42 to a heater relay 43 to operate the heater 41 whenever the relay 43 is energized. The circuit to operate the relay 43 further includes the contact blades 28 and one of the blades 27, 26 as determined by a manual selector switch 44. Preferably the circuit also includes a high temperature responsive limit switch 45. It will be appreciated that the angular extent of the various cam heights will be altered to suit requirements. It is apparent that the circuit through one of the switches, namely through one of the blades 26, 27 will be closed a longer time than through the other of the blades so that depending upon which position the selector switch 44 is placed in, different levels of temperature will ultimately be attained.

Referring now to FIGURE 5, there is shown a slightly different form or embodiment of the instant invention. This embodiment includes a sheet-like base 46 of insulative material through which an output shaft 47 extends. The shaft 47 projects through a U-shaped bracket-cover 48 and receives further bearing support therefrom. However, in this embodiment the shaft 47 does not extend to any appreciable extent beyond the outer surface of the bracket 48. The shaft 47 supports a timing cam 49 which is identical to the timing cam 18 already described. The base 46 is similarly provided with contact blades 50-52 which are disposed in edgewise relation to the base 46 and in flatwise nearly parallel relation to each other. The blades 50-52 are nearly identical to the blades 26-28, and differ therefrom only in actual dimensions. A terminal 53, identical to the terminal 30, is provided for each of the blades 50-52.

In this embodiment, an actuator 54 is pivoted by a pin 55 on the base 46, the pin 55 being received in a hub portion 56, with the main part of the actuator 54 extending generally parallel to the base and being disposed between the base 46 and at least one of the blades. By this relationship, the blade 50 serves to hold the actuator 54 on the pin 55. The actuator 54 also includes actuator portions 57, 58, and 59 which extend in a direction normal to the base 46, and in this embodiment away from the base 46. The actuator portion 58 extends between the blades 50 and 51, while the actuator portion 59 extends between the blades 51 and 52. The actuator portions 58 and 59 engage the blades 51 and 52 respectively near the midpoint of such blades.

The U-shaped bracket 48 includes a pair of legs 60, 61 which are secured by an integral ear portion 62, 63 respectively directly to the base 46 as by riveting. The bracket 48 includes a bight portion extending between the legs 60 and 61, the bight portion being indicated at 64 and like the bight portion 33, being flat and apertured as at 65 to provide a mounting surface.

The actuator 54 has a follower portion 66 which engages the periphery of the cam 49 to pivot the actuator

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54 in response to rotation of the cam 49, thereby causing the actuator portions 57-59 to cooperate respectively with the blades 50-52 in the manner already described.

Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such embodiments as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A sequential timer comprising in combination:

- (a) a base;
- (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
- (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights;
- (d) a plurality of flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, said blades comprising part of two switches, and one of said blades being common to both said switches; and
- (e) an actuator member pivotally supported on said base, having a follower portion engageable with said track, and having a plurality of actuating portions which are respectively individually drivingly engageable with said blades, and which are so disposed that both of said switches, only one of said switches, and neither of said switches are respectively open as said follower portion engages said three effective heights of said cam.

2. A sequential timer comprising in combination:

- (a) a base;
- (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
- (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights;
- (d) a plurality of flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, said blades comprising part of two switches, and one of said blades being common to both said switches; and
- (e) an actuator member pivotally supported on said base, having a follower portion engageable with said track, and having a plurality of actuating portions extending normal to said base, at least one of said actuating portions extending between said blades, and being respectively individually drivingly engageable with said blades, and said actuating portions being so disposed that both of said switches, only one of said switches, and neither of said switches are respectively open as said follower portion engages said three effective heights of said cam.

3. A sequential timer comprising in combination:

- (a) a base;
- (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
- (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights;
- (d) a plurality of flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, said blades comprising part of two switches, and one of said blades being common to both said switches; and
- (e) an actuator member pivotally supported on said base, having a follower portion engageable with said track, and having a plurality of actuating portions extending normal to said base, at least one of said actuating portions extending between said blades, and

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being respectively individually drivingly engageable with said blades, another of said actuating portions comprising an oppositely directed surface on said follower portion engageable with that one of said blades which is closest to said cam, and said actuating portions being so disposed that both of said switches, only one of said switches, and neither of said switches are respectively open as said follower portion engages said three effective heights of said cam.

4. A sequential timer comprising in combination:

- (a) a base;
- (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
- (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights;
- (d) a plurality of flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, said blades comprising part of two switches, and one of said blades being common to both said switches; and
- (e) an actuator member pivotally supported on said base and extending between said base and one of said blades, said member having a follower portion engageable with said track, and having a plurality of actuating portions extending away from said base and each individually drivingly engageable with one of said blades, all of said actuating portions being so disposed that both of said switches, only one of said switches, and neither of said switches are respectively open as said follower portion engages said three effective heights of said cam.

5. A sequential timer comprising in combination:

- (a) a base;
- (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
- (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights;
- (d) three flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, and having contacts at their other ends, the center one of said blades comprising a part of two switches with the adjacent blades; and
- (e) an actuator member pivotally supported on said base, having a follower portion engageable with said track, and having three actuating portions against which said blades are normally drivably biased into engagement, said actuating portions being so located that when said follower portion is at the lowest of said heights, the contacts of said blades are spaced from each other, that when said follower portion is at the middle of said heights, only one adjacent pair of contacts are spaced from each other, and that when said follower portion is at the highest of said heights, the contacts are in mutual engagement.

6. A sequential timer comprising in combination:

- (a) a base;
- (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
- (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights;
- (d) three flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, and having contacts at their other ends, the center one of said blades comprising a part of two switches with the adjacent blades; and
- (e) an actuator member pivotally supported on said base, having a follower portion engageable with said track, and having three actuating portions against which said blades are normally drivably biased into

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engagement, a first of said three actuating portions being in engagement with that one of said blades which is closest to said cam, and being so located on said actuator as to increase the blade bias in response to rise of the follower portion, and a second and a third of said three actuating portions being respectively in engagement with those of said blades which are second and third closest to said cam, and being so located on said actuator as to decrease the blade bias in response to rise of the follower portion, all said actuating portions being so further located as to operate said switches successively as said three cam track heights are engaged by said follower portion.

7. A sequential timer comprising in combination: 15
 (a) a base;
 (b) a synchronous electric motor assembly secured to said base and including a rotatably driven output shaft;
 (c) a cam rotatably driven by said output shaft and having a peripheral track with three angularly spaced effective radial heights; 20
 (d) a plurality of flexible electrically conductive blades each supported at one end by said base in flatwise spaced relation to each other, said blades comprising part of two switches, and one of said blades being common to both said switches; 25

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- (e) an actuator member pivotally supported on said base having a follower portion engageable with said track, and having a plurality of actuating portions which are respectively individually drivingly engageable with said blades, and which are so disposed that both of said switches, only one of said switches, and neither of said switches are respectively open as said follower portion engages said three effective heights of said cam;
 (f) a generally U-shaped bracket having legs secured at their free end to said base, and a bight extending about said cam as a guard, said bight being adapted to support said timer; and
 (g) means on said cam on said bight of said guard and support bracket coacting as a stop to limit rotation of said cam.

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