March 2, 1965 J. BOWMAN 3,171,907

STOP STRUCTURE FOR SEQUENTIAL TIMER

Filed March 7, 1963

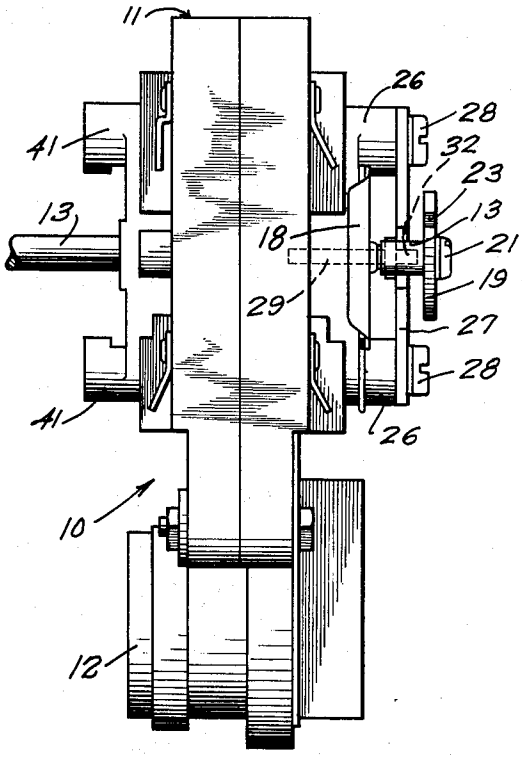


Fig 1

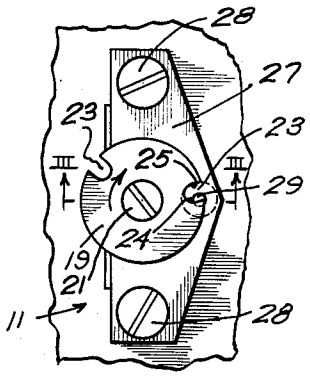


Fig 2

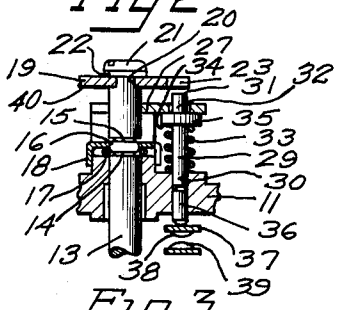


Fig 3

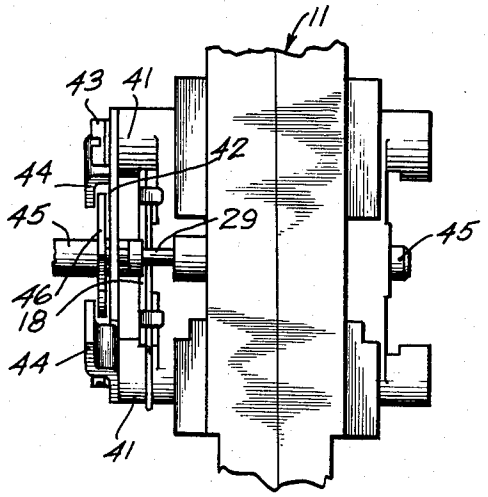


Fig 4

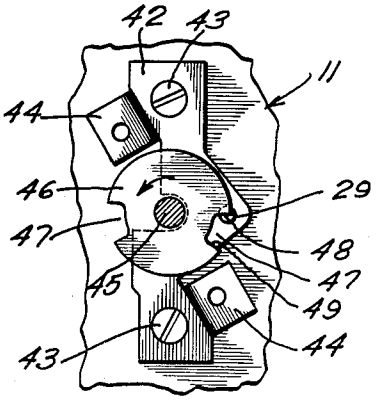


Fig 5

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United States Patent Office 3,171,907 Patented Mar. 2, 1965

3,171,907

STOP STRUCTURE FOR SEQUENTIAL TIMER

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Filed Mar. 7, 1963, Ser. No. 263,614
6 Claims. (Cl. 200—38)

This invention relates generally to sequential timers, and more specifically to a stop structure incorporated therein.

Although the principles of the present invention may be included in sequential timers employed for various purposes, a particularly useful application is made in sequential timers of the type that are used with automatic home laundry type of machines.

Timers of this general type typically employ a reciprocable timer shaft which is axially moved to one position to turn on the laundry appliance, and to the other axial position to turn off the laundry appliance. Not infrequently, the operator desires to change the timer setting with the timer in an energized condition. If the timer knob is rapidly advanced when the system controlled thereby is energized, the various system components are rapidly energized and deenergized. Such full or partial spinning of the knob produces a sequence of operations that are so rapid that they are hard on machine components, and thus causes considerable arcing in the timer resulting in contact deterioration and in some cases, welding of contacts. It has been previously proposed to provide various types of knob disconnect structures to prevent this possibility.

In accordance with the principles of the present invention, there is provided a simplified structure which precludes spinning of the knob when the timer is energized, there being no mechanical disconnect structure employed between the knob and the main timing cam. In this invention, means are provided which coact between the timer housing and the shaft to limit angular shaft movement when the shaft is axially positioned in the "on" position.

Accordingly, it is an object of the present invention to provide an improved sequential timer structure.

A further object of the present invention is to provide a structure by which rotation of the timer shaft is limited when the timer shaft is in an "on" position.

Another object of the present invention is to provide means for preventing spinning the timer knob or shaft through 360° when in an axially "on" position.

A still further object of the present invention is to provide means by which the operator may readily find the beginning of a succeeding timer cycle.

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 sheet of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

FIGURE 1 is a side elevational view of a sequential timer equipped with a stop structure provided in accordance with the principles of the present invention;

FIGURE 2 is a fragmentary view of the right side of the structure shown in FIGURE 1;

FIGURE 3 is a fragmentary cross-sectional view taken along line III—III of FIGURE 2;

FIGURE 4 is a fragmentary side elevational view of a further sequential timer equipped with a stop structure provided in accordance with the principles of the present invention; and

FIGURE 5 is a fragmentary elevational view of the left side of the timer shown in FIGURE 4.

As shown on the drawings:

The principles of this invention are particularly useful when embodied in a sequential timer such as illustrated in FIGURE 1, generally indicated by the numeral 10. The timer assembly includes a two-piece housing 11 on which there is supported a motor 12 within which there is a conventional gear train (not shown) operating a conventional stepping mechanism (not shown) for advancing a switch-controlling timing cam (not shown), such cam being also movable manually by the rotation of a main timer or selector shaft 13. The selector shaft 13 is rotatably supported in the housing 11 as shown in FIGURE 3, and the timer shaft 13 is axially slidably movable for a limited distance between two positions. To define these two axial shaft positions, as best seen in FIGURE 3, the shaft is provided with a detent structure including a pair of axially spaced annular recesses 14, 15, the recesses 14, 15 being spaced by a cam-like intermediate structure 16. A spring 17 includes fingers which embrace opposite sides of the shaft 13, the fingers of the spring 17 being receivable in the annular recesses 14 and 15 to define and to limit the axial extent of movement of the shaft 13. The spring 17 is retained by a clip 18. When the motor 12 drives the main timing cam, such cam in turn drives the shaft 13 rotationally.

A disk 19 is rigidly secured to the shaft 13, and to this end, the end of the shaft 13 is provided with a noncircular configuration at 20 which is received within a central opening of the same configuration in the disk 19. The disk is held axially by a screw and washer 21, 22. The disk 19 is provided with one, two, or more slots 23, each slot 23 being defined by a leading or releasing edge 24 and a trailing edge or stop 25.

The housing 11 is provided with a pair of bosses 26, 26 which define a surface lying in a plane against which boss plane there is disposed a plate 27, the plate 27 being secured thereto by a pair of screws 28, 28. The shaft 13 extends freely through the plate 27, the disk 19 being on one side of the plate 27 and the housing 11 at the other side of the plate.

There is provided a plunger 29 which has a cylindrical portion that is slidably supported in an opening 30 in the housing 11 so that the plunger is slidably supported therein. At the opposite end of the plunger 29 there is an end 31 which extends through an opening in the plate 27, the end 31 comprising an abutment 32 which is engageable with the stop 25 for one axial position of the shaft 13, the end 31 of the plunger 29 clearing the disk 19 for the other axial position of the shaft 13.

Means are provided which resiliently yieldably bias the plunger in a direction parallel to the axis of the shaft 13. One such mode of bias comprises a spring 33 acting between the housing 11 and a shoulder 34 defined by a flange 35 on the plunger 29. The opposite surface of the flange 35 may thereby engage the adjacent surface of the plate 27.

The plunger 29 preferably comprises metal such as

steel. Its inner end engages an insulator 36, the insulator 36 being held against the plunger 29 by a spring contact blade 37 having an electrical contact 38 thereon which is engageable with a further contact 39. The spring blade 37 is secured to the housing 11 and has a natural bias at its contact end tending to deflect the blade 37 toward the housing, thereby resiliently yieldably biasing the plunger 29 in an outward direction. Thus, the end 31 of the plunger 29 normally projects outwardly from the plate 27 as shown in FIGURE 3.

When the shaft 13 is angularly positioned so that no slot 23 registers with the end 31, and further when the shaft 13 is shifted axially from the position shown in FIGURE 3 to its other position, then the adjacent surface 40 of the disk 19 will engage the end 31, and depress the plunger 29 inwardly against its spring bias, thereby closing the contacts 38, 39. Subsequent rotation of the shaft 13, either by the motor 12 or by manual rotation, will bring one of the slots 23 into registration with the end 31, a condition being approached in the illustration of FIGURE 2. The plunger 29 will be released by the leading or release edge 24, allowing the end 31 to snap into the slots 23. This effects opening of the contacts 38 and 39 which are in circuit with the motor, thus stopping driving of the cam at a predetermined angular position. More importantly, if the shaft 13 is being manually rotated to the position shown in FIGURE 2 to effect reception of the plunger into the slot 23, the abutment portion 32 of the plunger 29 engages with the stop or stop edge 25 of the disk 19 to physically obstruct further rotational shaft movement. Owing to the straight-sided configuration of the abutment 32 and of the means that define the slot 23, once engagement occurs, the plunger 29 will not yield and thus will accurately and positively limit the angular extent of such rotation.

When the shaft is in the axial position illustrated in FIGURE 3, it is to be noted that it may be manually rotated for 360°. This is possible with the structure of FIGURE 1 only when the left end of the shaft 13 has been pushed in, thereby opening the contacts 38, 39. Since such contacts are in the nature of a master switch, manual rotation of the shaft 13 does not effect a sequential energizing of the various circuits under the control of the timer 10. However, when the shaft 13 is in its other axial position, and the shaft 13 is then rotated, the greatest extent of movement will be that angle of rotation required to bring the next slot 23 into registration with the plunger 29. Thus, the structure provided will prevent manual spinning of the timer shaft and will greatly reduce the number of circuits that can be energized.

Assuming that the timer is provided with two complete timing cycles, as is customary today, the disk 19 will be provided with two slots 23 as shown in FIGURE 2. Each slot respectively thus defines an end of one of the timing cycles. This structure makes it impossible for the operator to rotate the shaft 13 while in an "on" position in one cycle into an "on" position in the other timing cycle.

The stop 25 thus is rigidly secured to the shaft and extends in a generally radial direction from the axis of the shaft and is comovable with the shaft. The stop 25 is angularly oriented with respect to the succeeding cycle so that it will be mechanically engaged before the first switch is closed in such succeeding cycle. It is not necessary that the release edge 24 be generally radially directed as shown, but may extend tangentially to the bottom of the slot or notch 23 to produce a generally elongated slot which is the mechanical equivalent of that shown in FIGURE 5 and described below.

Referring to FIGURE 4, there is shown a modified arrangement of the present invention. The same housing 11 includes a further pair of bosses 41, 41 which define a surface lying in a first plane, against which surface a plate 42 is disposed and secured as by a pair of screws 43, 43. The plate 42 includes a pair of spaced mounting

flanges 44, 44 which extend in a direction parallel to the plane defined by the bosses 41 and offset therefrom in a direction away from the housing 11. A timer shaft 45 rigidly and comovably supports a disk 46 which disk, for either axial position of the shaft 45, lies between the plane defined by the bosses 41 and the plane defined by the mounting flanges 44. Thus, while the disk 19 is disposed on the side opposite from the housing 11 that the knob is secured to the shaft 13, in FIGURE 4 the disk 46 is disposed on the same side of the housing 11 as is the knob secured to the shaft 45.

The plunger 29 is supported in a manner similar to that described above by the other half of the housing 11 and coacts with master switch contacts in the manner already described. However, it will be noted that this alternate location for the stop structure and plunger 29 renders the timer responsive to a pulling action on the shaft 13 to open the switch contacts.

The spring 33 may be omitted as shown in FIGURE 4 if the plunger 29 is used not only as a stop structure, but also as a means to actuate the spring blade 37.

Referring to FIGURE 5, it will be noted that the disk 46 is provided with two slots 47 each of which is somewhat angularly enlarged from that shown in FIGURE 2. The slot or notch 47 has a leading or release edge 48 which will release the plunger 29 when the disk 46 has been rotated a small amount from that shown in the drawing. Further manual rotation will effect engagement of a stop edge 49 with the abutment on the plunger 29 which is supported by the housing 11.

It is evident from FIGURE 5 that the timer is in a position of just being about to complete the longer cycle. Further rotation of the disk 46 in the direction of the arrow will release the depressed plunger 29 at the release edge 48, allowing the plunger to move up into the notch 47. If the contacts 38 and 39, as here, are under the control of the plunger 29, such movement opens the circuit to the motor 12. Whether the plunger 29 controls contacts or not, since it extends therein upwardly into the notch 47, further manual rotation into the next cycle with the shaft in the "on" position is precluded. Therefore and thereafter, the shaft 45 is first pulled to the "off" position, enabling the shaft 45 and disk 46 to be rotated. Assuming that the same cycle is to be repeated, when the second elongated notch 47 is aligned with the plunger 29, the shaft may be shifted to its "on" position with the plunger extending into the elongated notch. Then the shaft may be further manually shifted up to the point of engagement, such engagement indicating to the operator that the knob is almost at the start of the next cycle. Therefore the operator would then pull the shaft 45 to the "off" position and advance it by a very small increment, then pushing it to the "on" position at the very beginning of the selected cycle.

If desired, a serviceman may change the size of slot or notch 23 or 47, such as by filing or substitution of a new disk, to provide a measure of compensation for local water pressures employed with home laundry machines using a time-fill cycle. To this end, the stop 25 or 49 may be so disposed that its position defines the extent or duration of the latter portion of the time-fill to be actually used.

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. In a sequential timer having a motor, the improvement comprising:

(*a*) a housing;

(*b*) a shaft supported in said housing in a manner enabling said shaft to be manually shifted axially therein to either of two positions, said shaft being adapted to be rotated by the motor and to be rotated

manually in one of said positions, and to be rotated manually for 360° in the other of said positions;

(c) a mechanical stop rigidly secured to said shaft and extending in a generally radial direction therefrom and comovable therewith; and

(d) an abutment carried by said housing and extensible into the rotational path of said stop when said shaft is in said one of said positions for positive engagement therewith in which engagement the relative position of said abutment and said shaft stop is non-yielding, such engagement arresting the angular extent which said shaft can be manually rotated.

2. In a sequential timer having a motor, the improvement comprising:

(a) a housing;

(b) a shaft supported in said housing in a manner enabling said shaft to be manually shifted axially therein to either of two positions, said shaft being adapted to be rotated by the motor and to be rotated manually in one of said positions, and to be rotated manually for 360° in the other of said positions;

(c) a disk rigidly secured to said shaft and comovable therewith, said disk having a notch, an edge of which notch comprises a mechanical stop extending generally radially from said shaft; and

(d) a plunger supported by said housing for sliding movement in a direction parallel to the axis of said shaft, said plunger having an end comprising an abutment normally resiliently biased into engagement with the adjacent side of said disk when said shaft is in said one of said positions, and when said shaft is manually rotated, said end being movable in response to its bias into said notch to positively engage said stop in a manner wherein the relative position of said stop and said abutment is non-yieldable to arrest the angular extent of such manual rotation.

3. In a sequential timer having a motor, the improvement comprising:

(a) a housing;

(b) a shaft supported in said housing in a manner enabling said shaft to be manually shifted axially therein to either of two positions, said shaft being adapted to be rotated by the motor and to be rotated manually in one of said positions, and to be rotated manually for 360° in the other of said positions;

(c) a disk rigidly secured to said shaft and comovable therewith, said disk having a notch, an edge of which notch comprises a mechanical stop extending generally radially from said shaft;

(d) a pair of normally open switch contacts in circuit with the motor; and

(e) a plunger supported by said housing for sliding movement in a direction parallel to the axis of said shaft, said plunger having one end comprising an abutment and an opposite end operative to control the relative position of said contacts, said plunger being normally engaged by the adjacent side of said disk to hold said switch contacts closed when said shaft is rotated either manually or by the motor while in said one of said positions, said abutment being thereafter urged to move into said notch to non-yieldably engage said stop to limit the angular extent of such manual rotation and to enable said switch contacts to open.

4. In a sequential timer having a motor, the improvement comprising:

(a) a housing having a pair of bosses;

(b) a plate secured to said bosses;

(c) a shaft freely extending through said plate and supported in said housing in a manner enabling said shaft to be manually shifted axially therein to either of two positions, said shaft being adapted to be rotated by the motor and to be rotated manually in one of said positions, and to be rotated manually for 360° in the other of said positions;

(d) a disk rigidly secured to said shaft and comovable therewith, said disk and said housing being disposed at opposite sides of said plate, said disk having a notch, an edge of which notch comprises a mechanical stop extending generally radially from said shaft;

(e) a plunger supported by said housing and said plate for sliding movement in a direction parallel to the axis of said shaft, said plunger having an end comprising an abutment normally projecting through said plate, and having means defining a shoulder engageable with the side of said plate which faces said housing; and

(f) means acting between said housing and said plunger and resiliently and yieldably urging said plunger against said disk when said shaft is rotated while in said one of said positions, and then urging said plunger end into said notch when aligned therewith to enable said abutment to non-yieldably engage said stop to limit the angular extent of such manual rotation.

5. In a sequential timer having a motor, the improvement comprising:

(a) a housing having a pair of bosses lying in a first plane;

(b) a plate secured to said bosses and having a pair of spaced mounting flanges lying in a second plane disposed in parallel relation to said first plane and offset therefrom away from said housing;

(c) a shaft freely extending through said plate and supported in said housing in a manner enabling said shaft to be manually shifted axially therein to either of two positions, said shaft being adapted to be rotated by the motor and to be rotated manually in one of said positions, and to be rotated manually for 360° in the other of said positions;

(d) a disk disposed between said planes and rigidly secured to said shaft and comovable therewith, said disk and said housing being disposed at opposite sides of said plate, said disk having a notch, an edge of which notch comprises a mechanical stop extending generally radially from said shaft;

(e) a plunger supported by said housing and said plate for sliding movement in a direction parallel to the axis of said shaft, said plunger having an end comprising an abutment normally projecting through said plate, and having means defining a shoulder engageable with the side of said plate which faces said housing; and

(f) means acting between said housing and said plunger and resiliently and yieldably urging said plunger against said disk when said shaft is rotated while in said one of said positions, and then urging said plunger end into said notch when aligned therewith to enable said abutment to non-yieldably engage said stop to limit the angular extent of such manual rotation.

6. In a sequential timer having a motor, the improvement comprising:

(a) a housing;

(b) a shaft supported in said housing in a manner enabling said shaft to be manually shifted axially therein to either of two positions, said shaft being adapted to be rotated by the motor and to be rotated manually in one of said positions, and to be rotated manually for 360° in the other of said positions;

(c) a disk rigidly secured to said shaft and comovable therewith, said disk having a notch defined by a pair of angularly spaced edges, one of said edges comprising a mechanical stop extending generally radially from said shaft, and the other comprising a plunger release means;

(d) a pair of normally open switch contacts in circuit with the motor; and

(e) a plunger supported by said housing for sliding movement in a direction parallel to the axis of said

shaft, said plunger having one end comprising an abutment and an opposite end operative to control the relative position of said contacts, said plunger being normally engaged by the adjacent side of said disk to hold said switch contacts closed when said shaft is rotated while in said one of said positions, said switch contacts being releasable to reopen in response to release of said abutment into said notch by said other notch edge to limit the angular extent of shaft rotation by the motor, said abutment being engageable by said stop in response to any manual further rotation of said shaft to limit the angular extent

of manual shaft rotation with the shaft in said one position.

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