Nov. 4, 1969 H. T. SIMMONS ET AL 3,476,892

SHAFT LOCKING DEVICE

Filed Dec. 14, 1967 2 Sheets-Sheet 1

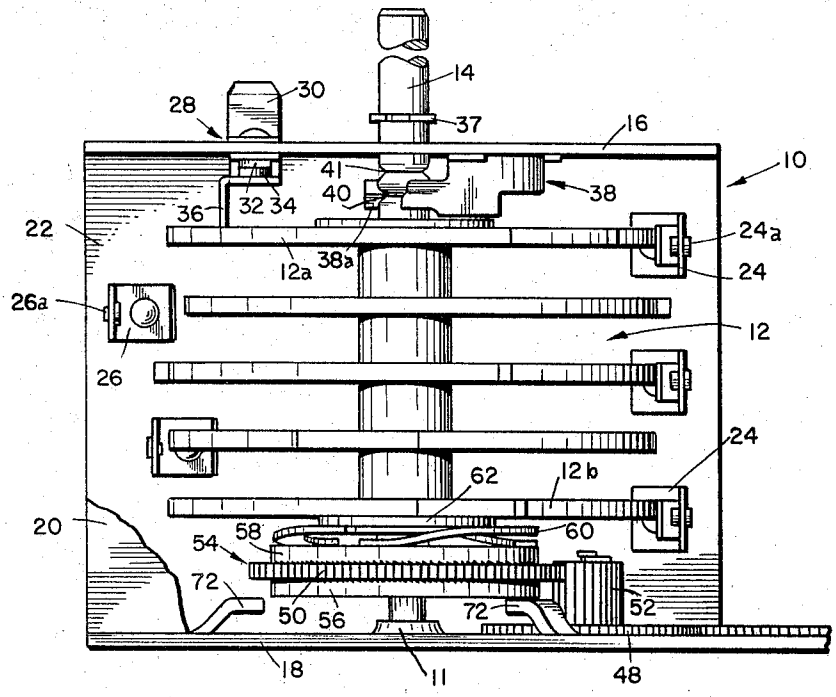


FIG. 1

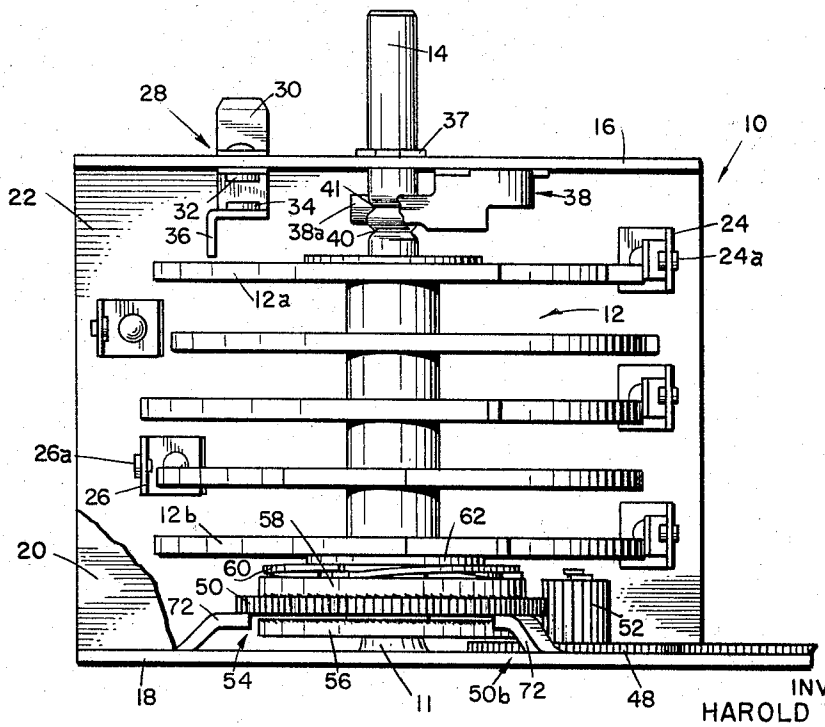


FIG. 2

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Filed Dec. 14, 1967 2 Sheets-Sheet 2

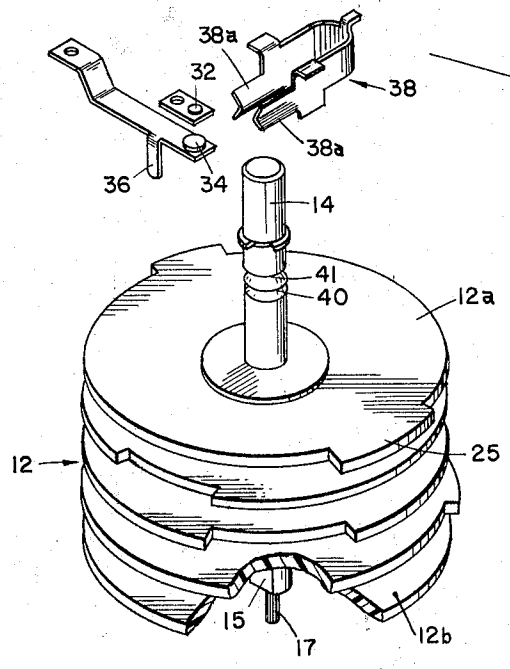


FIG 3

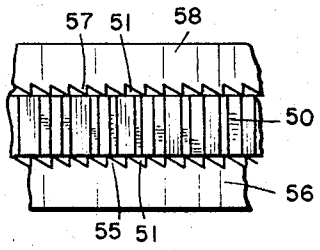


FIG 5

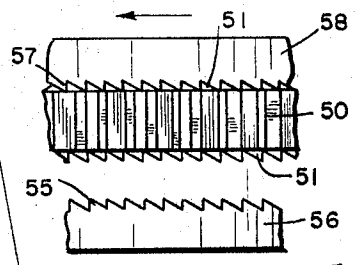
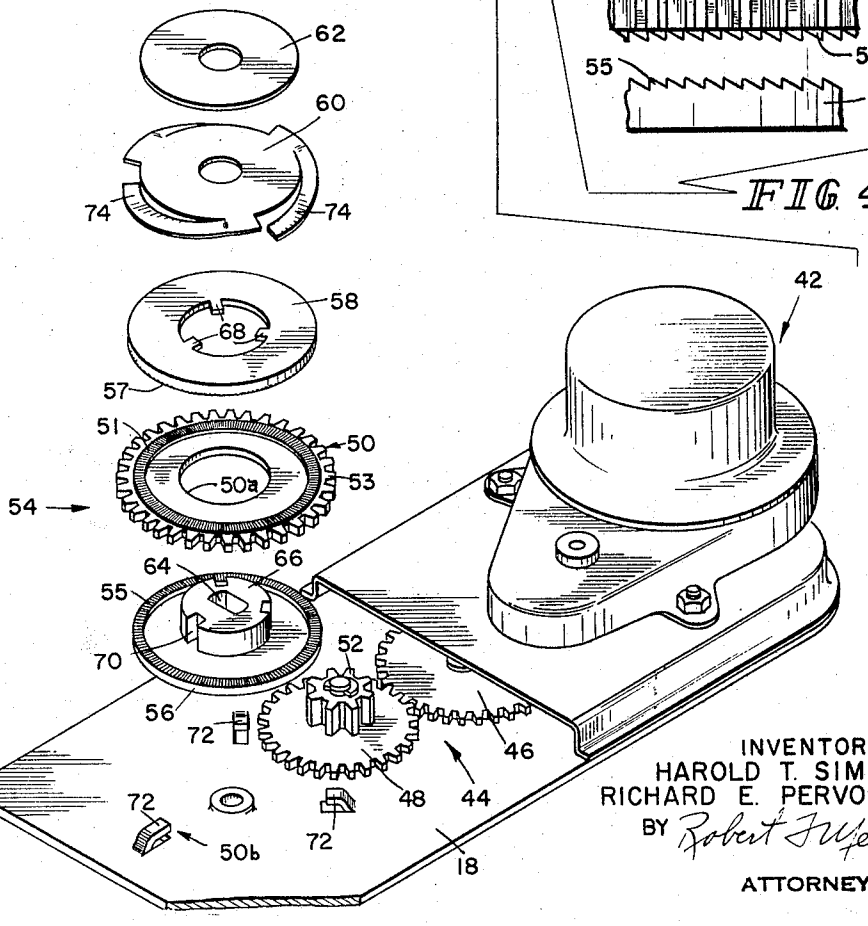


FIG 4



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SHAFT LOCKING DEVICE

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U.S. Cl. 200—38 12 Claims

ABSTRACT OF THE DISCLOSURE

Shaft locking means carried by a cam carrying shaft prevents the manual rotation of a constant speed timing mechanism during the time interval the unit is in operation. Indexing the cam carrying shaft in one direction starts the timer and initiates cooperation between the shaft and the shaft locking means so as to lock the shaft thereby preventing rotation except by the timer motor. Indexing of the cam carrying shaft in another direction terminates cooperation between the shaft locking means and the shaft thereby releasing the shaft for manual rotation in a predetermined direction.

This invention applies to a novel shaft locking device for use as a constant speed timing mechanism such as used in appliances such as automatic dryers, washers and the like.

Several of the presently available timing mechanisms employ a cam assembly means including at least one programming cam which is rotated by a motor in one direction to actuate the proper combination of circuits at predetermined times. As applied to a washing machine, such circuits control the washing, extracting, rinsing, drying and the like of the machine. Frequently, the operator desires to alter the prescribed program, and therefore the timing mechanism includes a manual knob connected to the main timer cam through a cam carrying shaft for advancing the main timer cam to the desired portion of the program. If, however, alteration of the program is done while the appliance is in operation, the various components of the appliance are advanced quickly through their various cycles thus subjecting the cooperatively associated relays, solenoids, electrical contacts and the like to possible damage.

The present invention contemplates the utilization of improved structure which prevents the manual advance of a cam carrying shaft of a constant speed unit during the time that the appliance is in operation. To this end, in accordance with the principles of this invention, a shaft locking device is provided that is particularly useful for timing mechanisms of the type which employ an axially displaceable cam carrying shaft, the axial displacement of which determines the state of actuation of the master switch of the timing mechanism.

Accordingly, it is an object of the present invention to provide a shaft locking device which prevents the manual rotation of a cam carrying shaft during the time a timing mechanism is in operation.

Another object of the invention is to provide such a device for a timing mechanism of the type which employs an axially displaceable cam carrying shaft, the axial displacement of which opens and closes a master switch in the mechanism.

Still another object of the invention is to provide such a device that is directly connected to the cam carrying shaft of a timer mechanism.

Another object of the present invention is to provide such a device wherein indexing of the cam carrying shaft in one direction to initiate programming of an appliance locks the shaft from rotation except from rotation by the driving means of the timing mechanism.

Yet another object of the invention is to provide such a device whereby the indexing of the cam carrying shaft in one direction releases the shaft for manual rotation.

Another object of the invention is to provide such a device whereby the manual rotation of the shaft is limited to a predetermined direction.

Another object of the invention is the provision of such a device wherein engagement of the ratchet means with drive means of the timing mechanism prevents manual rotation of the cam carrying shaft through the resistance of the drive means.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in a novel shaft locking device for a constant speed timing mechanism substantially as described herein and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the invention here disclosed may be made as come within the scope of the claims.

In the drawings:

FIGURE 1 is a side elevation of a timing mechanism with a portion of the timing mechanism being removed to show the shaft locking device of the present invention.

FIGURE 2 is a view similar to that of FIGURE 1 showing the timing mechanism in a different operating mode from that of FIGURE 1.

FIGURE 3 is an exploded view of the novel shaft locking device of the timing mechanism showing its relationship to various other components of the mechanism.

FIGURE 4 is an enlarged view of the ratchet means of the shaft locking device showing the relationship of its component parts in one mode of operation.

FIGURE 5 is an enlarged view of the ratchet means of the shaft locking device showing the relationship of its component parts in another mode of operation.

Generally speaking, the objects of the invention are accomplished by providing a novel shaft locking device for a timing mechanism having a shaft carrying at least one cam, the axial movement of which engages and disengages the contacts of a master switch in the timing mechanism so that the program cam or cams may be advanced to the desired starting point with the cycle under a no load condition. The novel shaft locking device includes ratchet means carried by the cam carrying shaft, such ratchet means including a ratchet non-advance means, ratchet-drive gear means, ratchet drive gear stop means, a ratchet non-back-up means, and a clutch spring surrounding the cam carrying shaft and being disposed between the cams and the ratchet means. The ratchet drive gear stop means limits the axial displacement of the ratchet drive gear means when the cam carrying shaft is axially displaced in a predetermined direction. The ratchet drive gear means engages a driving means for the timing mechanism such that manual rotation of the cam carrying shaft in either direction is prevented because of the resistance of the driving means.

Referring now to FIGURES 1–3 there is shown a timing mechanism **10** having a plurality of rotatable cams **12** carried on a shaft **14**, the shaft being rotatably journalled in the spaced apart end plates **16** and **18**. The cam carrying shaft projects through an aperture in the end plate **16** and is retained by journal means **11** attached or otherwise formed on the end plate **18**. Included as part of the timing mechanism are spaced apart terminal plates **20** and **22** respectively, each of which carries a plurality of stationary electrical terminals **26** and movable electrical terminals **24**, the movable terminals being hinged to their respective plate. The terminals are so arranged on each plate such that when the unit is assembled, a movable terminal interfits between a corresponding stationary terminal. The electrical contacts **24***a* of the movable terminals engage the eectrical contacts **26***a* of the stationary

terminals when the movable terminals are displaced by the rise and fall peripheral contours **25** of the cams **12**. Also included as part of the timing mechanism is a master switch means **28** including an electrical terminal **30** which is electrically connected to a fixed electrical contact **32** and movable contact blade **36**. Contact **34**, carried by the movable contact blade, is adapted to engage with fixed contact **32**. Blade **36** is hinged to a plate **16** such that upon engagement of the free end of the blade **36** with the cam **12***a* upon axial displacement of the shaft **14**, contact **34** is displaced so as to engage with contact **32** thereby connecting a power source (not shown) to the motor of the timing mechanism. Cam carrying shaft **14** moves axially within the timing mechanism and is indexed to either one of two positions. As shown in FIGURE 1, the shaft has been indexed outwardly from the timing mechanism such that cam **12***a* engages blade **36** so as to engage the fixed and movable contacts of the master switch. In FIGURE 2, the cam carrying shaft is shown indexed so as to disengage cam **12***a* from blade **36** to thereby disengage contacts **32** and **34**. The shaft is secured in each of these positions by a substantially U-shaped retaining means **38** having fingers **38***a* and **38***b* adapted to engage the detents **40** and **41** formed in the cam carrying shaft.

As is illustrated in FIGURE 3, the timing mechanism is operated by a driving means, here illustrated as a synchronous motor **42** and gear train **44**, the cam carrying shaft **14** of the timer mechanism being activated by the motor through the gear train. Gear train **44** includes reduction gears **46** and **48**. The cam carrying shaft **14** is connected to the gear train through ratchet drive gear **50** and pinion **52**. As will be described hereinafter, ratchet drive gear **50** is part of the novel shaft locking device.

In general, the shaft locking device comprises a ratchet means **54** including a ratchet non-advance means **56**, which prevents manual rotation of the shaft, ratchet drive gear **50**, ratchet non-back-up means **58** which limits the direction of manual rotation of the shaft, and clutch spring means **60**. Clutch spring means **60** is separated from cam **12***b* by washer **62**. Ratchet drive gear **50** includes gear teeth **53** adapted to engage the teeth of pinion **52**. Also included in ratchet drive gear **50** are two sets of ratchet teeth **51** formed on opposite faces of the gear. Such ratchet teeth are adapted to engage the ratchet teeth **55** of ratchet non-advance means **56** and ratchet teeth **57** of ratchet non-back-up means **58**.

Ratchet non-advance means **56** has a hub **66** extending from the face thereof. Hub **66** contains a double-D shaped aperture **64**. The aperture **64** mates a corresponding double-D portion **15** of the shaft **14** such that the ratchet non-advance means **56** can be fixedly held to the cam carrying shaft through knurl **17**. Ratchet drive gear **50** and ratchet non-back-up means **58** float on the shaft **14**. Axial alignment between the mating ratchet teeth of the ratchet non-advance means **56**, ratchet drive gear **50**, and ratchet non-back-up means **58** is insured through ears **68** which are adapted to engage slots **70** formed in hub **66**. Hub **66** extends through ratchet drive gear **50** through aperture **50***a*. Ratchet drive gear and ratchet non-back-up means **58** are spring biased against the ratchet non-advance means **56** through spring clutch **60** having lanced ears **74**. The spring insures that the teeth of the ratchet means are properly engaged.

The operation of the timing mechanism and the novel shaft locking device can now be described with particular reference to FIGURES 1, 2, 4 and 5. As shown in FIGURE 1, shaft **14** has been indexed so that the master switch **28** has been closed for timer operation, that is, timer motor **42** is energized. The shaft is locked in the "outward" position by engagement of retaining means **38** with detent **40** of the shaft. With the shaft so indexed, ratchet non-advance means **56** and ratchet non-back-up means **58** will both be engaged with ratchet drive gear **50** as is shown in FIGURE 5. With the ratchet means so engaged, manual rotation of cam carrying shaft **14** is prevented because of the resistance of the driving means; that is, the friction developed through the motor and the gear train. Cam carrying shaft **14** will be rotated in the direction of the motor rotation; that is, in a clockwise direction. The shaft is rotated through pinion **52** which is engaged with gear **53** of ratchet drive gear **50**, the ratchet drive gear being engaged with ratchet non-back-up means **58** and ratchet non-back-up means **58** being engaged with the ratchet non-advance means **56** through the engagement of the ears **68** with slots **70** of hub **66**. Since ratchet non-advance means **56** is fixedly held to the shaft **14**, shaft **14** will rotate in accordance with the output of the motor of the timing mechanism.

When shaft **14** is indexed as shown in FIGURE 2, and with retaining means **38** being engaged in detent **41**, master switch **28** will be open. As the shaft **14** is axially indexed inwardly, ratchet drive gear **50** biases against ratchet drive gear stop means **50***b*. Ratchet drive gear stop means consists of a plurality of tang means **72**, the tang means being lanced from support plate **18**. Such biasing of the ratchet drive gear **50** allows ratchet non-advance means **56** to be disengaged from the ratchet drive gear **50**. This is more clearly shown in FIGURE 4. With the ratchet drive gear being thus disengaged, shaft **14** can be manually rotated. Since ratchet non-back-up means **58** is connected to the ratchet non-advance means **56** through ears **68** being engaged with slots **70**, ratchet non-back-up means **58** will rotate in accordance with the rotation of cam carrying shaft **14** and the ratchet non-advance **56**. As shown in FIGURE 4, the ratchet teeth of the ratchet non-back-up means **58** and the teeth of ratchet drive gear **50** are both pointed in the same direction. Therefore, the ratchet non-back-up means **58** will be free to rotate independent of the ratchet drive gear **50** so long as the shaft **14** is turned, as is indicated by the arrow, in a clockwise direction. Conversely, manual rotation of the shaft **14** in a counterclockwise direction will be prevented since the teeth of the ratchet non-back-up means **58** and the ratchet drive gear **50** will not be able to become disengaged. Such limitation of a clockwise rotation is highly desirable since it prevents the rise and fall peripheral contours **25** of the cams **12** from being engaged with the movable terminals **24** in the wrong direction. While the device has been described as being limited to a clockwise manual rotation, it should be understood that the invention need not be so limited. Reversing the teeth direction from that shown would limit the manual rotation to a counterclockwise direction.

Thus there is described a novel shaft locking device for constant speed timing mechanisms having an axially displaceable cam carrying shaft and wherein displacement of the cam carrying shaft opens and closes the timer master switch. The shaft locking device prevents manual rotation of the cam carrying shaft in either direction when the timing mechanism is in operation. A simple indexing of the shaft, in addition to opening the master switch, permits the shaft to be manually rotated in a clockwise or otherwise predetermined direction when the timing mechanism is not in operation. And, as noted above, the manual rotation is limited to such predetermined direction such that rotation of the shaft will not cause the rise and fall contours of the cams carried by the shaft to become improperly engaged with the movable terminals of the timer. Thus, from the foregoing description, taken in conjunction with the accompanying figures of the drawing, it will be readily apparent to those skilled in the art that this invention provides a new and improved shaft locking device for a constant speed timer, the features of which may be applied to various arts and devices.

What is claimed is:

1. A shaft locking device for an axially displaceable, rotatable, motor driven shaft comprising a ratchet non-advanced means fixedly carried by said shaft, a ratchet drive gear and a ratchet non-back-up means floatably

carried by said shaft, both the ratchet drive gear and the ratchet non-back-up means being spring biased against said ratchet non-advance means, said ratchet drive gear having means to engage a gear train of a motor driving said shaft and stop means to limit the axial displacement of said ratchet drive gear when said shaft is axially displacement of said ratchet drive gear when said shaft is axially displaced in a predetermined direction.

2. A shaft locking device for an axially displaceable, rotatable, motor driven shaft comprising a ratchet non-advance means fixedly carried by said shaft, a ratchet drive gear and a ratchet non-back-up means floatably carried by said shaft, both the ratchet drive gear and the ratchet non-back-up means being spring biased against said ratchet non-advance means, said ratchet non-advance means having ratchet teeth adapted to engage a first set of ratchet teeth of said ratchet drive gear and having a hub with a plurality of slots formed therein, said hub extending through said ratchet drive gear such that a plurality of ears formed in said ratchet non-back-up means engages said slots, said ratchet non-back-up means having teeth adapted to engage a second set of ratchet teeth of said ratchet drive gear, said ratchet drive gear having means to engage a gear train of a motor driving said shaft and stop means to limit the axial displacement of said ratchet drive gear when said shaft is axially displaced in a predetermined direction.

3. A constant speed motor driven timing mechanism comprising an axially displaceable cam carrying shaft rotatably journalled in a pair of end plates, a plurality of cams fixedly mounted on said shaft and having means to close a plurality of electrical contacts according to a programmed sequence as said shaft is rotated, a master switch adapted to be opened and closed in accordance with the axial displacement of said shaft, a shaft lock means comprising a ratchet non-advance means fixedly carried by said shaft, a ratchet drive gear and a ratchet non-back-up means floatably carried by said shaft, both the ratchet drive gear and the ratchet non-back-up means being spring biased against said ratchet non-advance means, said ratchet non-advance means having ratchet teeth adapted to engage a first set of ratchet teeth of said ratchet drive gear and having a hub with a plurality of slots formed therein, said hub extending through said ratchet drive gear such that a plurality of ears formed in said ratchet non-back-up means engages said slots, said ratchet non-back-up means having teeth engaging a second set of ratchet teeth of said ratchet drive gear, said ratchet gear having means to engage a gear train of a motor driving said shaft and stop means to limit the axial displacement of said ratchet drive gear when said shaft is axially displaced in a predetermined direction.

4. In a timing mechanism having an indexable cam carrying shaft; a shaft locking means comprising: a ratchet means carried by said cam carrying shaft, said ratchet means including means coupling said ratchet means to a drive means of said timing mechanism, means engaging said coupling means preventing manual rotation of said cam carrying shaft, means limiting the direction of manual rotation of said cam carrying shaft when said cam carrying shaft is axially displaced to disengage said means preventing manual rotation of said cam carrying shaft from said coupling means; and means limiting the axial displacement of said coupling means when said cam carrying shaft is axially displaced.

5. In a timing mechanism according to claim 4, wherein said means coupling said ratchet means to a drive means of said timing mechanism is a gear means.

6. In a timing mechanism according to claim 5, wherein said means preventing manual rotation of said cam carrying shaft includes ratchet teeth engaging teeth disposed on a face of said gear means.

7. In a timing mechanism according to claim 5, wherein said means limiting the direction of manual rotation of said cam carrying shaft includes ratchet teeth engaging teeth disposed on a face of said gear means.

8. In a timing mechanism according to claim 5, wherein said gear means and said means limiting the direction of manual rotation of said cam carrying shaft float on said cam carrying shaft and are spring biased against said means preventing manual rotation of said cam carrying shaft.

9. In a timing mechanism according to claim 5, wherein said drive means includes a motor and a gear train coupled to said gear means.

10. In a timing mechanism according to claim 4, wherein said means limiting the axial displacement of said coupling means includes tabs lanced from the housing of said timing mechanism.

11. In a timing mechanism according to claim 4, wherein there is further included a means to position said cam carrying shaft when it is axially displaced.

12. In a timing mechanism according to claim 11, wherein said positioning means includes a retaining means carried by the housing of said timing mechanism and detent means carried by said cam carrying shaft, said retaining means engaging said detent means.

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MILTON KAUFMAN, Primary Examiner

U.S. Cl. X.R.

74—3.5; 192—12