July 28, 1959 G. N. JENNINGS 2,896,707

TIME MECHANISM FOR CONDUCTING A SELECTED ONE OF A PLURALITY OF SEQUENCES OF OPERATIONS

Filed Aug. 5, 1957 2 Sheets-Sheet 1

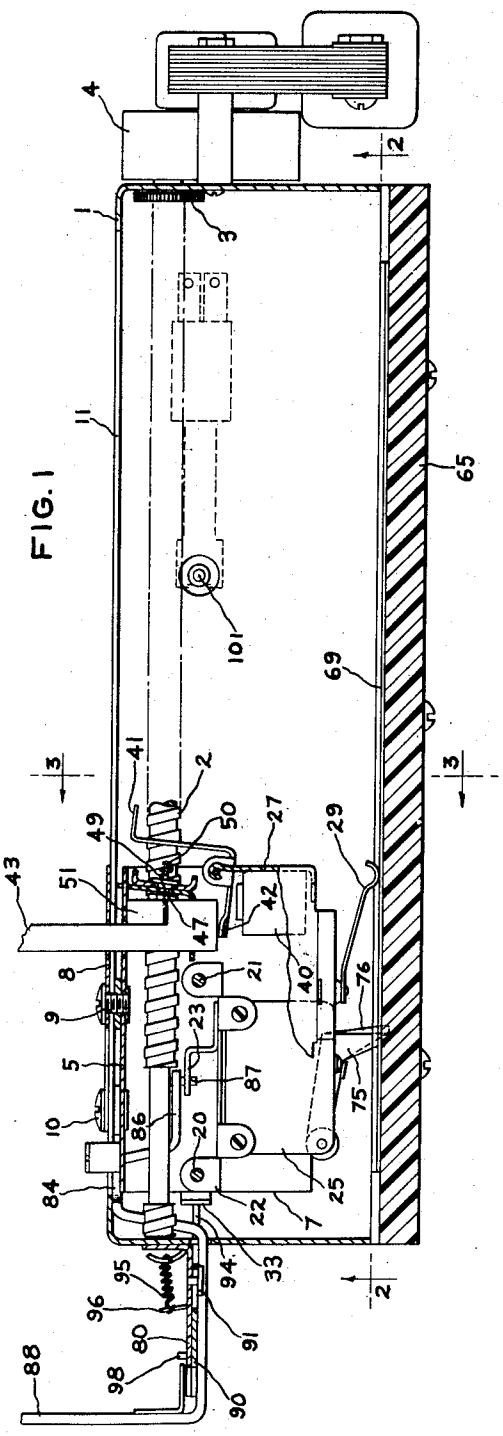


FIG. 1

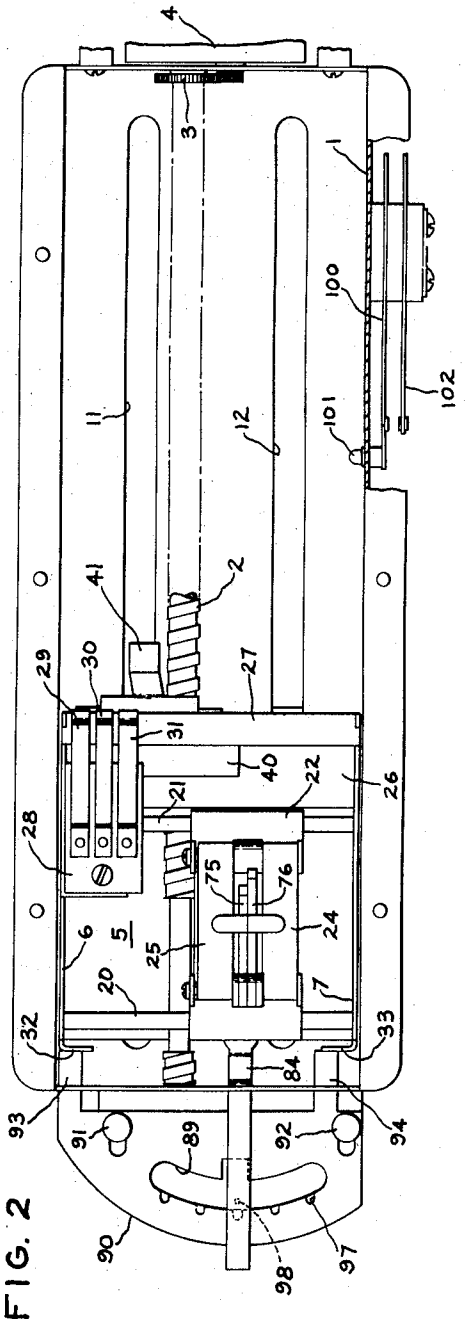


FIG. 2

INVENTOR.
GRESHAM N. JENNINGS

BY H. F. Manbeck, Jr
HIS ATTORNEY

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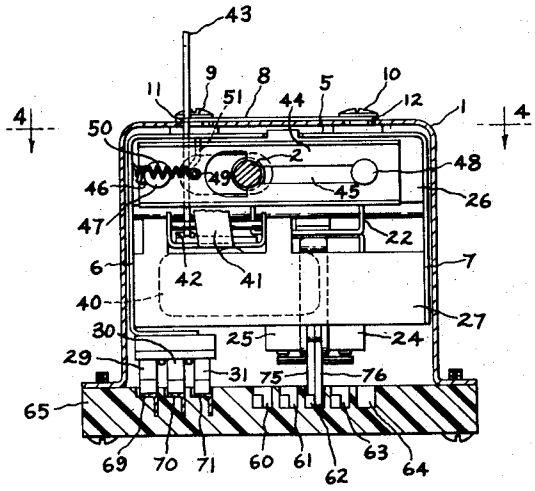


FIG. 3

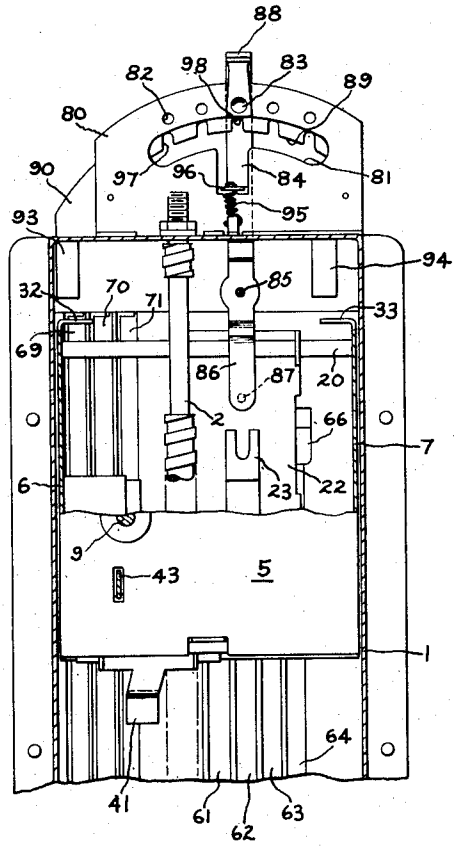


FIG. 4

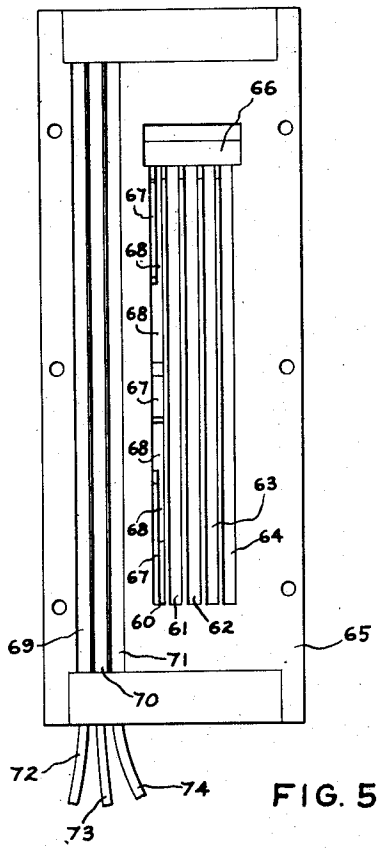


FIG. 5.

INVENTOR.

GRESHAM N. JENNINGS

BY H. F. Manbeck, Jr.

HIS ATTORNEY

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TIME MECHANISM FOR CONDUCTING A SELECTED ONE OF A PLURALITY OF SEQUENCES OF OPERATIONS

Gresham N. Jennings, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Application August 5, 1957, Serial No. 676,236

5 Claims. (Cl. 161—1)

This invention relates to controls for a sequence of operations and, more particularly, to timing mechanisms such as are used in connection with automatic domestic washing machines.

It is an object of my invention to provide an improved timing mechanism or controller for a sequence of operations including provision for adjusting the duration of and eliminating or repeating operations.

Another object is to provide an improved timing mechanism for conducting a selected one of a plurality of sequences of operations, including provision for manually selecting the desired sequence.

A further object is to provide an improved timing mechanism embodying means for carrying out any of a plurality of sequences of operations by simple manual positioning of movable switches contained in a compact single housing.

While the invention is particularly useful as applied to automatic control of a domestic washing machine, it is to be understood that this is only one application for it and that the invention may be used wherever found applicable.

In carrying out my invention, I provide a compact housing having a timer motor driven shaft mounted therein and along which a carriage mounting switches is adapted to move. On a stationary part of the housing, a plurality of separate recesses having raised cam surfaces and depressed indentations therein are provided, each cam surface and indentation corresponding to a particular stage in a predetermined sequence of operations. Also, on a stationary part of the housing, a plurality of conductor bars leading to the apparatus to be controlled and forming a part of the control circuits for that apparatus are mounted, these bars being connected to the carriage mounted switches by means of brushes likewise mounted on the carriage. The switches in turn are provided with follower arms biased into contact with the surfaces in the recesses so as to make and break the switch contacts in a predetermined sequence as the carriage moves along a selected recess. Means also is provided for shifting the carriage for travel along any chosen one of the separate recesses and for mechanically connecting and disconnecting the carriage to and from the shaft.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention itself, however, both as to its organization and method of operation, may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side elevation view of the assembled timer with the side panel removed and with parts in section, and showing the switch carriage in fully retracted position and engaged with the shaft;

Fig. 2 is a view of the interior of the timer along line 2—2 of Fig. 1;

Fig. 3 is a sectional view along line 3—3 of Fig. 1;

Fig. 4 is a view of a portion of the timer along line 4—4 of Fig. 3 and with parts broken away and in section; and

Fig. 5 is a plan view of the interior of the cover for the housing.

Referring now to the drawings, I have shown therein a timing mechanism or controller embodying the invention in one form thereof for use with a domestic clothes washing machine. This mechanism is contained in an elongated housing 1 which may be attached to the washing machine at any convenient accessible location, as on the backsplash panel. Extending lengthwise of the housing and rotatably mounted in the end walls thereof is a threaded shaft 2 driven in one direction only by means of suitable reducing gears 3, the pinion gear of which is driven by a timing motor 4 mounted externally of the housing. This motor, for example, may be a low speed synchronous clock motor.

Mounted within the housing for travel longitudinally thereof is a travelling framework having a top wall 5 disposed between the shaft and the top of the housing and side walls 6 and 7 disposed closely adjacent the side walls of the housing. This framework is slidably supported upon the housing by means of a plate 8 resting upon the exterior of the housing and joined to the top wall of the framework by means of suitable bolts, or the like, 9 and 10. These bolts are adapted to pass along slots 11 and 12 formed in the top wall of the housing, thus to permit longitudinal movement of the framework and its attachments with respect to the housing.

Extending between the side walls of the framework are spaced rods 20 and 21 upon which is mounted for movement transversely of the shaft, a switch carriage body 22. On its upper surface this carriage body has an upstanding yoke 23 facing toward the end of the housing from which the framework travels at the beginning of a cycle of operations. On its lower surface the carriage body mounts a pair of small microswitches 24 and 25.

Also extending between the side walls of the framework is an upper bracket 26 and a lower bracket 27 providing support for elements later to be described. In addition, a bracket 28 is attached to side wall 6 of the framework at the lower edge thereof and upon this bracket a plurality of brushes 29, 30 and 31 are mounted and suitably connected to switches 24 and 25. At one end, the framework also is provided with abutment members 32 and 33 for use in the unlocking of a selector device, as will later appear.

Mounted upon lower bracket 27 is a third microswitch 40, serving as a safety switch, as well as a cut-off switch for the sequence of apparatus operations and having connections to brush 31 and to switch 24 and adapted to be operated upon actuation of a movable switch arm which is pivotally mounted upon the bracket 27 and biased to switch opening position. This switch arm comprises a forwardly extending portion 41 adapted to engage the wall of housing 1 at the conclusion of travel of the framework at the end of a sequence of operations, as well as a rearwardly extending portion 42 adapted to be forced into contact with the switch by a positive manual operation. For the purpose of operating the switch 40 manually, as when it is desired to interrupt a sequence of operations already in process, or when it is desired to shift the timing mechanism to a different sequence of operations, I provide a manually operably plunger 43 extending upwardly through slot 11 in the housing and adapted, when moved fully downwardly in a first direction to bear against portion 42 of the switch arm and to operate switch 40 and when moved fully upwardly in a second direction to permit

the switch arm to lift and to operate switch 40 in a reverse direction.

Since the manual operation of plunger 43 will occur only at times when the travelling framework is required to come to rest, or to be at rest, I provide a means actuated by movement of that plunger and serving to connect the framework to, and disconnect it from, the rotating shaft 2, depending upon the direction of movement of the plunger.

One convenient arrangement for accomplishing this purpose includes a slide 44 (Fig. 3) having slots 45 and 46 therein through which mounting bolts 47 and 48 extend into the face of upper bracket 26. Mounted rigidly on this slide is a pin 49 extending through a slot in bracket 26 and having a tension spring 50 attached thereto on the outer side of the bracket, the spring being mounted at its other end upon a projection integral with framework wall 6. In the slide, the slot 45 is formed at one end with an enlarged opening of greater diameter than shaft 2 so that when the slide is fully retracted against the action of spring 50, no contact occurs between the slide and the threaded shaft 2. Inwardly of this enlarged opening, the slot 45 is bounded by two spaced arcuate shoulders having a radius equal to the radius of shaft 2. Accordingly, when spring 50 pulls the slide 44 normally to the left in Fig. 3, these shoulders engage with the threaded shaft 2 and thus the framework is held to the shaft by reason of the bolts 47 and 48 which connect that framework to that slide. Thus, when the shaft is rotated, the entire framework travels longitudinally of the shaft, being driven thereby.

Pin 49 extends through bracket 26 and projects from the inner side of that bracket into the path of a camming arm 51 attached to plunger 43. When the plunger is fully depressed, this camming arm engages pin 49, moving the pin to the right in Fig. 3 against the action of the spring 50 and shifting slide 44 so that shaft 2 is disengaged therefrom. Simultaneously with this slide disengagement, the lower end of plunger 43 engages the movable switch arm at its portion 42 and operates switch 40.

Referring now to Figs. 3 and 5, an important feature of my invention will be noted wherein a plurality, here shown as five, of sequences of operations are made available to the operator in the form of a series of parallel recesses or tracks 60, 61, 62, 63 and 64 rigidly formed in a cover 65 for the housing 1 and which cover is constructed of a suitable electrical insulating material. Each recess is separated from its adjoining recess by a shallow wall except at one end where all of the recesses are joined by a header space 66. Within each recess a series of upstanding cam surfaces 67 and indentations 68 (as indicated in recess 60) are provided, a given cam surface and a given indentation occupying one-half of the width of the recess so that each recess in effect comprises two parallel cam tracks. Beginning at header space 66 the location of and length of each cam and indentation of a particular recess is related, as will be understood, to the sequence and duration of the processing operations conducted by the washing machine being controlled from the timing mechanism, as, for example, the washing, spinning, rinsing and drying steps of that machine. Each of the recesses 61, 62, 63 and 64 contain cam surfaces and indentations not shown, but which are arranged differently from those in recess 60 and from each other, so to provide different sequences of operation.

Also mounted upon the insulating cover are three separate conductor bars 69, 70 and 71 having leads 72, 73 and 74 extending respectively therefrom and adapted to be connected to the electrical circuit of the washing machine. As best seen in Fig. 3, the respective brushes 29, 30 and 31 remain in contact with the conductor bars at all times and the circuit through these bars is dependent upon whether the switches 24, 25 and 40 are opened or closed. As further noted from Figs. 1 to 3, switch 25 has depending therefrom a pivoted switch follower arm 75 biased downwardly into contact with the left hand portion of the surface of the recess with which the switch carriage 22 is engaged, while switch 24 has depending therefrom a similar pivoted switch follower arm 76 biased downwardly into contact with the right hand portion of the same recess. Preferably one of the followers, here shown as 76, leads the other follower so as to give a slight pause between the consecutive steps of washer operation, as, for example, between the wash-spin, spin-rinse and rinse-dry steps. Such a pause will occur when one follower is riding on a cam of the recess and the other follower is still in an indentation of the recess. It will be understood that when a follower is raised by passage over a stationary cam, it actuates its corresponding switch, such as closing the switch, and when it is lowered as by passage into a stationary indentation it actuates its corresponding switch in a reverse manner, such as opening the switch.

Each of the recesses in the cover are of equal width and are adapted to accommodate the two follower arms each on a separate cam track as thus described. However, in order to shift from any given recess into another recess and thereby change the machine operation from one sequence of operations to another sequence of operations, it is first necessary to move both switch follower arms into header space 66 and then to shift switch carriage 22 to a different setting. This may be accomplished as follows. With plunger 43 depressed, the framework is disengaged from shaft 2 and may be moved freely either forwardly or rearwardly of the housing. Thus, the operator may interrupt a given sequence at any time and re-establish that same sequence at any desired stage. Accordingly, by means of the invention, the operator may adjust the duration of any stage, may eliminate any stage, and may repeat any stage of the machine operations merely by adjusting the position of the framework and then lifting plunger 43 to re-establish the operations corresponding to a new position of the framework along the recess in which it is engaged.

When this readjustment takes the form of an entirely different sequence of operations the carriage 22 needs to be shifted transversely of the shaft. In such case, with the plunger 43 depressed, the framework is moved to the extreme left as viewed in Figs. 1 and 2 at which time the follower arms of switches 24 and 25 pass into header space 66 and the carriage may be shifted along rods 20 and 21 in order to engage in a different recess.

For the purpose of insuring a convenient guidance of the carriage into a desired recess and for positively indicating the recess in which the carriage is engaged at any given time, I provide a selector member at one end of the housing and means for latching that member in the selected position. As seen in Fig. 4, a rigid ledge or bracket 80 having an arcuate slot 81 therein, is affixed to the end of housing 1 near the recess 66 in housing cover 65. This ledge is provided with a series of dimples 82 into which a detent 83 mounted on a carriage shifting lever 84 is adapted to fit and to hold that lever in an established position. The shifting lever is pivoted at a post 85 affixed to the top of housing 1 and at its inner end has a portion 86 with a pin 87 depending therefrom. This pin is adapted to engage in a slot in yoke 23 on the top of the carriage 22 whenever the carriage is fully retracted. At its outer end the lever may include a handle portion 88. As best seen in Fig. 2, a selector slide 90 having an arcuate slot 89 therein, is arranged beneath ledge 80 for movement longitudinally of the housing, being mounted upon bolts or the like 91 and 92 extending through slots in the slide and supported by the stationary ledge. At its lateral edges the slide includes extensions 93 and 94 passing through apertures in the end of the housing and disposed in the path of travel of the respective abutments 32 and 33 of the travelling framework. By means of a tension spring 95

attached at one end to the housing and at the other end to a projection **96** of the slide, that slide normally is held with its extensions fully extended into the housing. The slide is formed with a series of spaced, narrow openings facing inwardly toward its arcuate slot **89**, one such opening being indicated at **97**. The number and location of these openings are such that as lever **84** is pivoted about the post **85**, a rigid pin **98** on that lever will be opposite a specified opening in the selector slide at the same time that pin **87** at the opposite end of the same lever has positioned the yoke **23** of the switch carriage so that the switch follower arms **75** and **76** simultaneously are in alignment with a specified recess in the housing cover **65**. The number of openings in the slide thus correspond with the number of sequences of operation for which the timing mechanism is capable of controlling.

As will thus be seen, when it is desired to conduct a new series of operations upon the machine, the framework is retracted toward a new starting position by manually moving plunger **43** which has been depressed to disengage the framework from shaft **2**. As the framework moves toward the starting position, the yoke **23** on the carriage engages with pin **87** on the carriage shift lever. When approaching the fully retracted position, the abutments **32** and **33** then engage extensions **93** and **94** of the selector slide which then is moved outwardly against spring **95** to disengage pin **98** from an opening in the slot of that slide.

Thus, when the framework is fully retracted, lever **84** may be turned by handle **88** to any new position desired, since, with the framework fully retracted, the switch follower arms **75** and **76** are disposed in header space **66**. Upon selecting a new sequence of operations, for example, as represented by the center recess **63**, the carriage is shifted along rods **20** and **21** until the pin **98** in lever **84** is opposite the desired opening from the slot **89** of the slide, in this case the central opening and the pull on plunger **43** is then released. The spring **95** at this time pulls slide **90** forward, which, in turn, moves the framework forward engaging the switch follower arms in the desired recess. Simultaneously, the pin **98** on the lever arm engages in the corresponding opening in the slide. In this way, the selector means for the mechanism is locked in position and also gives an indication of the particular sequence of machine operations which is to follow. When the plunger **43** is then operated to engage the framework with the rotating shaft **2** and to move that framework forward, the lever with its pin **87** on the forward end remains in set position and the carriage cannot thereafter be shifted to another sequence until it is retracted to the initial or far left hand position (as viewed in Fig. 1) where its yoke again engages with the pin **87**.

If desired, various side circuits involved in the control of the machine operations may be incorporated into the timing mechanism. For example, a circuit controlling the temperature of rinse water in a washing machine may be regulated by a switch mounted upon the side of housing **1** and having a resiliently mounted switch arm **100** biased to project a cam **101** into the path of the travelling carriage. Thus, when a sequence of operations has progressed to a point at which the forward edge of wall **7** of the framework engages cam **101**, switch arm **100** swings outwardly making contact with a second arm **102** and completing the side circuit. Likewise, when the trailing edge of wall **7** passes by the cam **101**, the arm **100** swings inwardly breaking that circuit. When the framework moves to the end of a sequence of operations, the portion **41** of the switch arm for cut-off switch **40** contacts the end wall of the housing **1** and actuates switch **40** which then stops all further operation.

In accordance with the patent statutes, I have described what at present is considered to be the preferred embodiment of my invention, but it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the true spirit and scope of the invention and I, therefore, aim to cover, in the appended claims, all such equivalent variations and modifications.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a housing having a travelling framework therein, a shaft in said housing, a timer motor for driving said shaft, a manually operable plunger extending outwardly of said housing and arranged for disengaging said framework from said shaft when moved in a first direction and for engaging said framework with said shaft when moved in a second direction, a cut-off switch mounted upon said framework, means attached to said plunger for contacting said switch when said plunger moves to shaft disengaging position and for moving out of contact with said switch when said plunger moves to shaft engaging position, a switch carriage carried by said framework, a cover for said housing having a plurality of parallel recesses therein, each recess including cam surfaces and each recess corresponding to a single complete sequence of operation, switches mounted upon said carriage and having follower arms biased into contact with the surfaces of a selected recess thereby to operate said carriage-mounted switches while being carried by said framework along a selected recess, and means for shifting said carriage transversely of said recesses to engage said follower arms in a selected recess for movement therealong and while said plunger occupies its shaft-disengaging position.

2. In combination, a housing having a travelling framework therein, a shaft in said housing, a timer motor for driving said shaft, a manually operable plunger extending outwardly of said housing and arranged for disengaging said framework from said shaft when moved in a first direction, and for engaging said framework with said shaft when moved in a second direction, a cut-off switch mounted upon said framework, an actuating lever for said switch having a first portion extending forwardly of said framework for engagement by said housing at the conclusion of a sequence of operations and a second portion extending rearwardly of said framework for engagement by said plunger when said plunger moves to shaft disengaging position and for disengagement with said plunger when said plunger moves to shaft-engaging position, a switch carriage carried by said framework, a cover for said housing having a plurality of parallel recesses therein, each recess including cam surfaces and each recess corresponding to a single complete sequence of operations, switches mounted upon said carriage and having follower arms biased into contact with the surfaces of a selected recess thereby to operate said carriage-mounted switches while being carried by said framework along a selected recess for movement therealong, and means for shifting said carriage to engage said follower arms in a selected recess and while said plunger occupies its shaft-disengaging position.

3. In combination, a housing having a travelling framework therein, a shaft in said housing, a timer motor for driving said shaft, an abutment carried by said framework at one end thereof, means for engaging and disengaging said framework with and from said shaft, a switch carriage carried by said framework and having a yoke mounted thereon, a selector means mounted exteriorly of said housing at one end thereof and including a resiliently mounted slide having projections extending into said housing into the path of travel of said framework abutment, an adjustable lever pivotally mounted on said housing and having a pin at one end thereof for engaging with said yoke and a handle at the other end thereof for moving said carriage, means including said slide for locking said lever and slide in a selected position indicative of the location of said carriage, a cover for said housing hav-

ing a plurality of recesses therein, each recess including cam surfaces and each recess corresponding to a single complete sequence of operations, switches mounted upon said carriage and having follower arms biased into contact with the surfaces of a selected recess thereby to operate said switches as said switches are moved along a selected recess, and means for retracting said framework into starting position for travel of said switches along a selected recess thereby to engage said abutment with said selector slide and to permit movement of said lever to enable said carriage to be positioned for movement of its switches along said selected recess.

4. In combination, a housing having a travelling framework therein, a shaft in said housing, a timer motor for driving said shaft, means for engaging and disengaging said framework with and from said shaft, a switch carriage carried by said framework, a selector means for engaging with said carriage at one extremity of movement of said framework and for shifting said carriage into a selected path of movement parallel to the axis of travel of said framework, a cover for said housing having a plurality of recesses therein parallel to said axis of travel, said recesses being joined by a header space adjacent said extremity of movement of said framework, each recess including cam surfaces and each recess corresponding to a single complete sequence of operations, and switches mounted on said carriage and having follower arms biased into contact with the surfaces of a selected recess thereby to operate said switches as said switches are carried by said framework along the selected recess, said carriage being shiftable by said selector means into a selected recess only while said follower arms are disposed in said header space.

5. In combination, a housing having a travelling framework therein, a shaft in said housing, a timer motor for driving said shaft, a manually operable plunger extending outwardly of said housing and arranged for disengaging said framework from said shaft when moved in a first direction and for engaging said framework with said shaft

when moved in a second direction, a cut-off switch mounted upon said framework, an actuating lever for said switch mounted on said framework and positioned to be movably operable both by movement of said plunger in said first direction and by movement of said framework to a position thereof at the end of a sequence of operations where said lever is engaged by said housing, a switch carriage carried by said framework, a cover for said housing having a plurality of parallel recesses therein, each recess including cam surfaces and each recess corresponding to a single complete sequence of operations, switches mounted upon said carriage and having follower arms biased into contact with the surfaces of a selected recess, thereby to operate said carriage-mounted switches while being carried by said framework along a selected recess, means for shifting said carriage transversely of said recesses to engage said follower arms in a selected recess and while said plunger occupies its shaft-disengaging position, and a switch mounted in the side wall of said housing and having a projection extending into the path of movement of said framework thereby to actuate said last mentioned switch as the side of said framework passes into and out of contact with said projection and while said plunger occupies its shaft-engaging position.

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