May 2, 1961 G. DOROTHEA 2,982,826

ADJUSTABLE SEQUENCE TIMER

Filed March 19, 1959 2 Sheets-Sheet 1

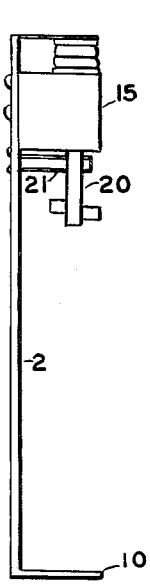


FIG 3

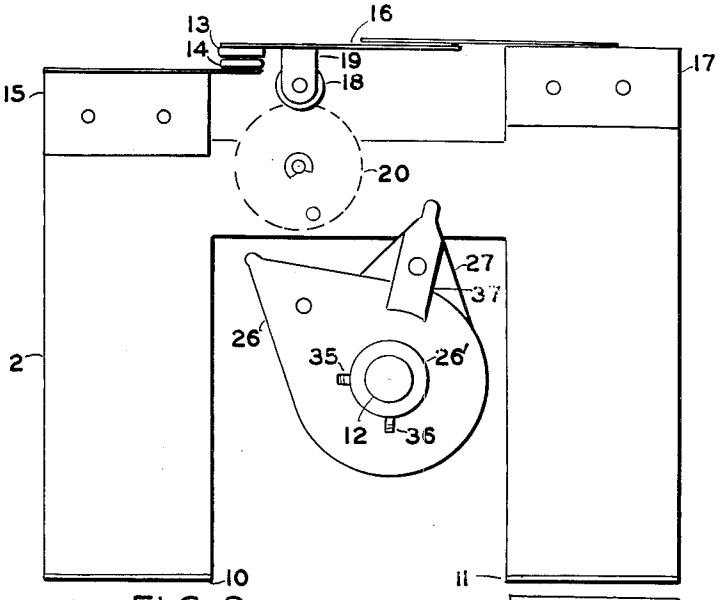


FIG 2

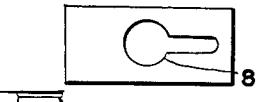


FIG 2A

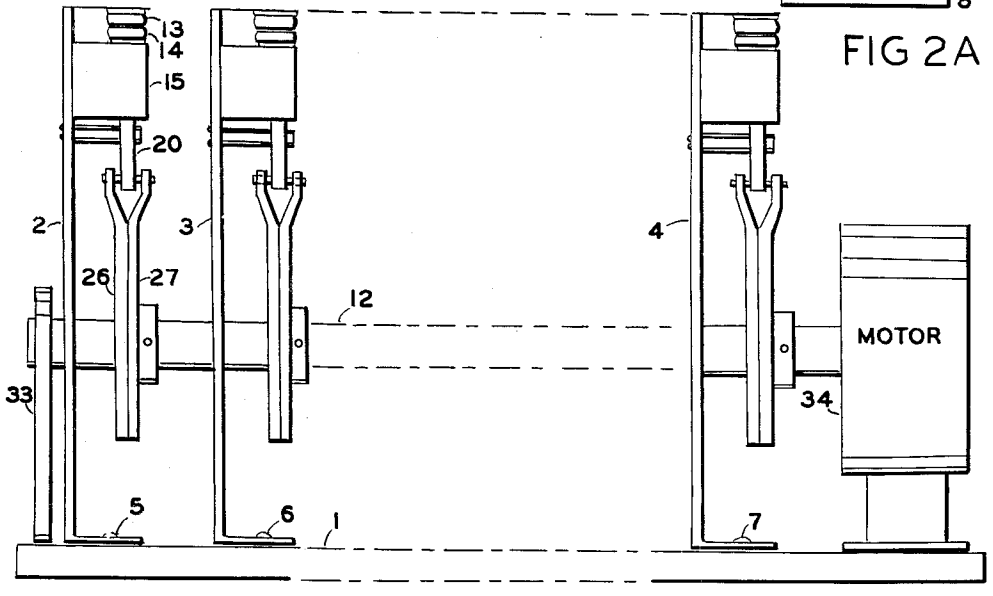


FIG 1

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FIG 5

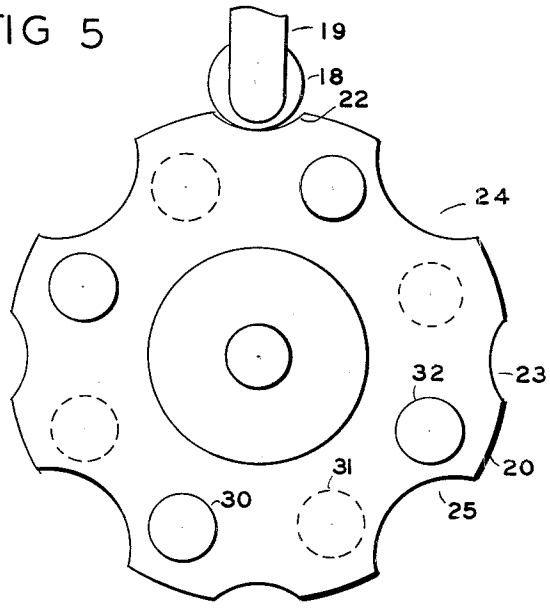


FIG 5A

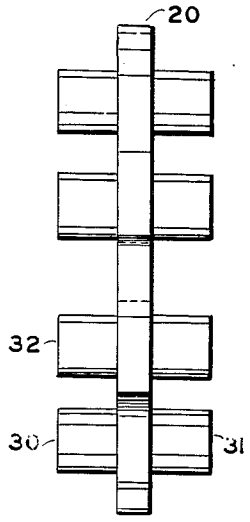


FIG 4

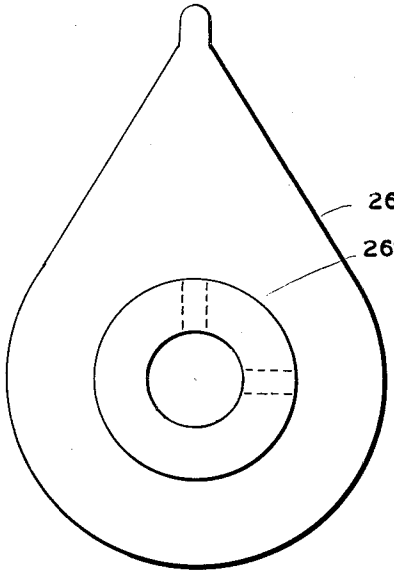


FIG 4A

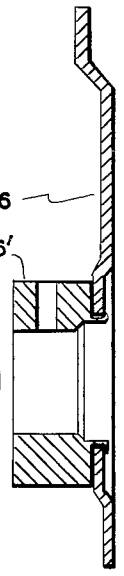


FIG 6

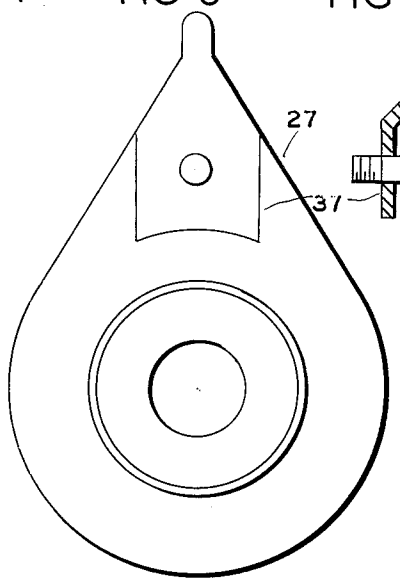
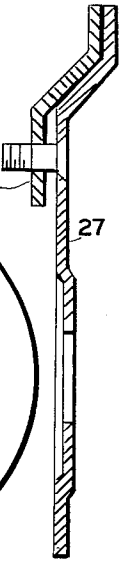


FIG 6A



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ADJUSTABLE SEQUENCE TIMER

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5 Claims. (Cl. 200—38)

This invention relates to means for timing a sequence of operations and more particularly to such means which are adjustable and flexible.

Conventional sequence timers generally use pre-cut cams to operate a series of switches which generally limit their use to one application. Also used are split cams comprising a pair of pre-cut cams, operating on a single switch, which cams may be adjusted relative one another to turn the switch on or off for a pre-determined portion of the cycle. However, split cams are limited to 180° of rotation control.

The present invention provides operation up to 360° of cam rotation and even multiples of 360 thereby eliminating gearing in sequences using more than one cycle of cam shaft rotation.

The present invention comprises a plurality of switches each mounted on a separately demountable frame. A detented wheel is mounted on each frame in position to actuate a switch into on and off positions depending upon the size of the detent. The wheels are actuated by arms mounted on a common motor driven timing shaft. A pair of actuator arms may be clamped together to operate on a single wheel with any desired angular spacing. For instance, one of the arms may turn the switch on and the other turn it off after a predetermined interval which is smoothly variable from 0° to 360°.

The present invention is extremely flexible in that it has a modular construction. Each frame may be removed for adjustment or replacement or new frames may be added without interfering with the remaining frames.

Accordingly, a principal object of the invention is to provide new and improved sequence timing means.

Another object of the invention is to provide new and improved sequence timing means having modular construction and which is easily adjustable.

Another object of the invention is to provide new and improved timing means for sequences requiring more than one revolution of the timing shaft without gearing.

Another object of the invention is to provide new and improved sequence timing means which may be adjusted on the job with simple tools and without cutting of cams.

Another object of the invention is to provide new and improved timing means which are flexible, easy to repair, and durable in construction.

These and other objects of the invention will be apparent from the following specification and drawings, in which:

Figure 1 is a side view of a sequence timer embodiment of the invention.

Figures 2, 2A, and 3 are detail views of a single frame of the embodiment of Figure 1.

Figures 5 and 5A are detail views of the detent wheel.

Figures 4, 4A, 6 and 6A are detail views of the actuator arms.

Referring to the figures, the invention generally comprises a base 1 on which a series of frames 2, 3, and 4 and so forth are mounted by means of screws 5, 6 and 7

which fit in slots 8 which are cut into the feet of the frame member.

Each frame comprises a piece of sheet metal or other equivalent material having a pair of feet 10 and 11. The frames are generally square in shape but are cut out in the center portion to accommodate the timing shaft 12. At the top of the frame is mounted a switch having a pair of contacts 13 and 14. The contact 14 is stationary and is mounted on an insulating block 15 secured to the frame. The contact 13 is movable up and down by movement of a leaf spring 16 which is mounted on another insulating block 17. The leaf spring 16 holds the contacts normally closed and they are opened by means of a roller 18 mounted on the leaf spring 16 by means of bracket 19. Other switch modifications may be used, for instance, a double pole arrangement with a stationary contact mounted above the movable contact. Also, the switch may be made normally open by mounting the stationary contact above the movable contact.

The roller 18 rides on the wheel 20 which is rotatably mounted on the frame 2 by means of shaft 21. The wheel is freely rotatable except that it has a series of detent notches equally spaced around its surface as shown in Figure 5. The small notches 22, 23 and so forth hold the switch contacts open and large notches 24, 25 permit the contacts to close. The cam wheel is adapted to be actuated by the actuating arms 26, 27 which contact pins 30, 31, 32 on either side of the cam wheel mounted intermediate the detents.

The actuating arms 26 and 27 are mounted on the timing shaft 12 which is mounted on the bearing bracket 33 and driven by motor 34. The actuating arm 26 is clamped to the timing shaft 12 by means of set screws 35 and 36 in hub 26'. The actuating arms are generally used in pairs, one to turn the switch on and one to turn the switch off. For instance, the arm 26 contacts pins on one side of the wheel 20 which may, for instance, position small detents to open the switch and the arm 27 operates pins on the other side of the wheel 20 which may position large detent notches to close the switch. Both arms 26 and 27 may be separately clamped to the drive shaft or one of them may be clamped to the other one by means of the clamp 37. The wheel 20 is preferably a molded plastic piece of nylon or other long-wearing equivalent material.

Figure 5 illustrates a typical arrangement for the wheel wherein the large and small detent notches are alternately located and their respective actuating pins are alternately located on opposite sides.

In operation the wheel of Figure 5 would alternately open the switch when the small notches contact the switch roller 18 and close the switch when the large notches engage the roller 18. As the roller 18 goes from a small notch to a large one, it is first opened by the high points on the wheel and then snapped closed in a very rapid manner. The wheel surfaces are not smooth curves but have sharp breaks along the outer periphery to provide fast opening and closing of the contacts.

Various arrangements may be made with different sequences of detents on the wheels.

The normally closed switch can be set to have any ratio of on to off time per revolution. It can be adjusted to be closed very briefly once per revolution or to be opened very briefly once per revolution, or any setting in between.

Furthermore, it can be set to close for a full 360° and then open for the next 360°, by lining up the actuator arms in parallel. In slow speed applications there is a mechanical advantage in the actuator linkage and detent arrangement which causes the switch to open faster than is possible with conventional cams, and on closing, there is freedom of rotational mounting of the detent wheel

which permits the switch to snap shut faster than is possible with conventional cams.

In a preferable application the nylon detent wheel has four deep notches and four shallow notches, Figure 5, to program its switch alternately on and off. The wheel can be fabricated with any combination of deep and shallow notches to provide useful combinations. For instance:

(1) All deep notches. Each actuator arm, front or back, will momentarily open the switch and close it on each pass. Thus one switch on a bank could open momentarily eight times in one revolution without gearing while other switches in the same bank could be set to open and close once in the same revolution.

(2) One deep notch and seven shallow notches. One switch could be made to remain closed for one revolution out of eight or any part of one revolution out of four.

(3) Two deep notches, diametrically opposed, and six shallow notches. One switch could be timed to remain closed for one complete revolution out of four or any part of one revolution out of two.

(4) Two deep notches, adjacent, and six shallow notches. One switch could be timed to be closed for two complete revolutions except for a short open period centered on the two long closures, then remain open for six complete revolutions.

Or one switch could be timed to have two closures, one momentary and the other the balance of 360°, in one revolution and remain open for two complete revolutions.

Adjustment of each frame may be made separately, either in place or by easily removing without even interrupting the remaining operation. Adjustments of the actuating arms on the shaft may be made with a simple Allen head wrench. The relative angular position of clamped arms may be made with a simple wrench which may be easily inserted between frames.

Therefore, the present timer is completely adjustable and extremely flexible. Any number of operations may be controlled by adding frames. Variation from a few degrees of operation to many cycles of the timing cycle are possible without gearing.

The need for pre-cut cams and the effect of wearing of cam surfaces is eliminated. Complicated gearing is not necessary for more than one timing cycle control. The single shaft arrangement is very good for miniaturization.

The actuator arms need not be rotatably mounted but may be reciprocating members.

The detent wheel works equally well in either direction so that it may be used with a reversing actuator arm.

The apparatus is not position-sensitive but may be mounted at an angle or inverted.

Many modifications and arrangements will occur to those desiring to practice the invention, particularly in the arrangement and number of notches and actuator arms. An infinite combination of the disclosed members is possible since varying numbers of detents and actuator arms may be used with one wheel. Also, more than one switch may be mounted per wheel for particular operations. The size of the members may be varied depending on the amount of current interrupted and electrical power controlled.

I claim:

1. In an adjustable sequence timer, a frame, a normally closed switch mounted on said frame having a roller attached to one contact, a detented wheel rotatably mounted on said frame in peripheral contact with said roller, said wheel having pins equally spaced on each side thereof, said pins on one side being staggered from those on the other side, said wheel having large detents for closed position of said switch and small detents for open position of said switch, and infinitely adjustable actuator arm means rotatably mounted on a driven shaft and adapted to rotate said wheel by contacting said pins, said actuator arm means comprising two arms each connected to actuate said pin members on opposite sides of said rotatable wheel, and means to adjust the angle of separation of said two arms smoothly from 0 to substantially 360°.

2. An adjustable sequence timer comprising a plurality of frames, a switch mounted on each frame and having a roller attached to one contact, a plurality of detented wheels rotatably mounted one on each frame in contact with said roller, said wheel having pins equally spaced on each side thereof, said pins on one side being staggered from those on the other side, said wheels having large detents for one position of said switch and small detents for a second position of said switch, and motor driven infinitely adjustable actuator arm means adapted to operate said switches in predetermined sequence by rotating said wheels by contacting said pins.

3. Apparatus as in claim 2 wherein said actuator arm means comprise two arms each connected to actuate said pin members on one side of one of said rotatable wheel, and means to adjust the angle of separation of said two arms.

4. In an adjustable sequence timer, a frame, a switch mounted on said frame having a roller arm attached to one contact, a wheel detented along its periphery and rotatably mounted on said frame in peripheral contact with said roller arm, said wheel having pins equally spaced on at least one side thereof, said wheel having at least one large detent for one position of said switch and at least one small detent for a second position of said switch, and motor driven cam actuator arm means mounted on a base and adapted to rotate said cams.

5. Apparatus as in claim 4 wherein a plurality of said frames are removably mounted on said base so that one or more frames may be removed without interfering with remaining operations.

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