April 10, 1951 R. H. HICKEY 2,548,604

AUTOMATIC RESETTING TIMING SWITCH

Filed May 20, 1948 2 Sheets-Sheet 1

Fig. 1

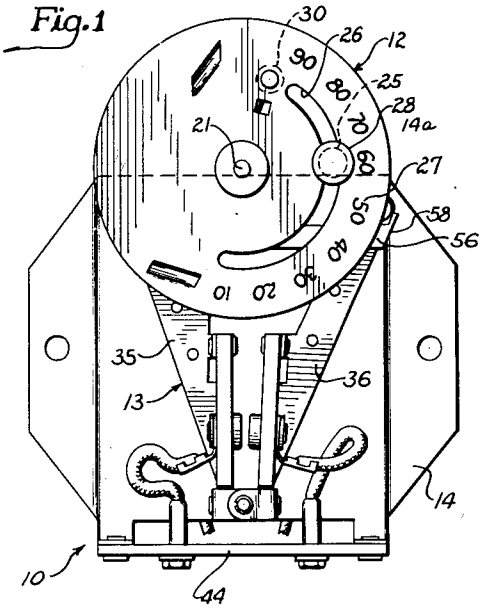


Fig. 2

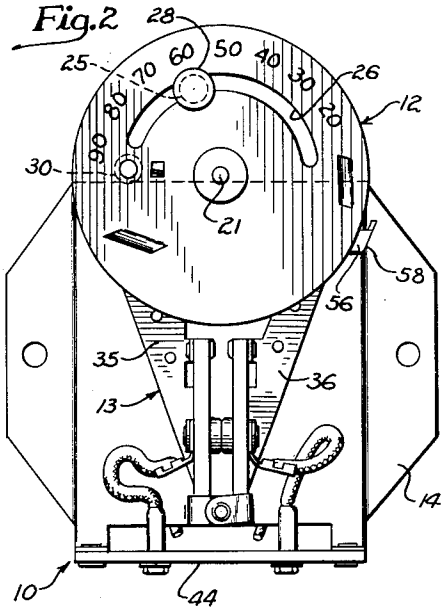


Fig. 3

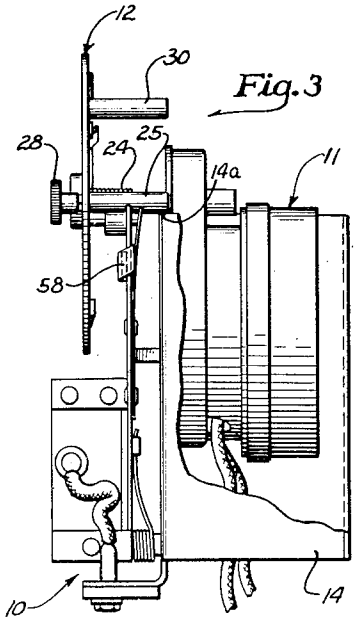


Fig. 4

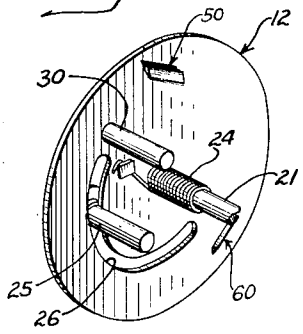
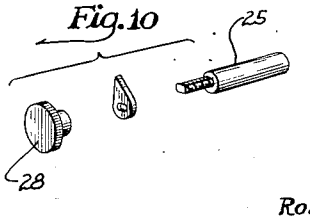


Fig. 10



Inventor
Robert H. Hickey
by: Richard E. Burns
Atty.

April 10, 1951 R. H. HICKEY 2,548,604

AUTOMATIC RESETTING TIMING SWITCH

Filed May 20, 1948 2 Sheets-Sheet 2

Fig. 5

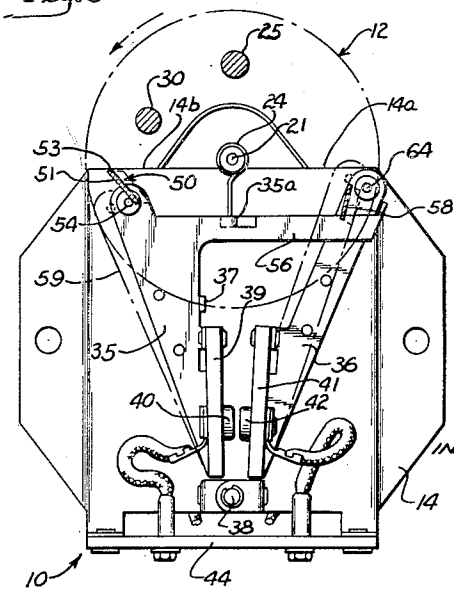


Fig. 6

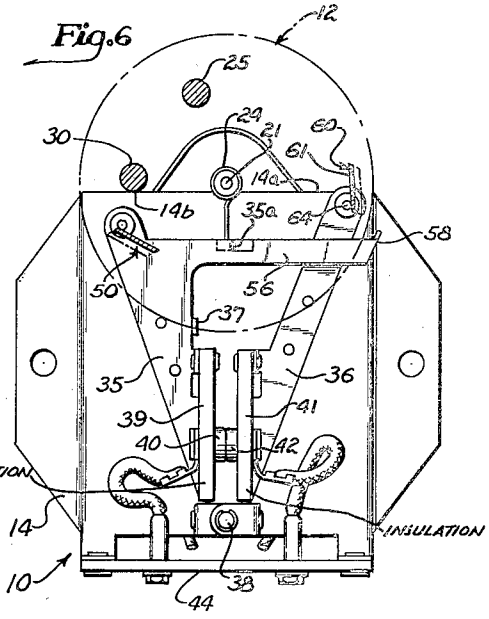


Fig. 9

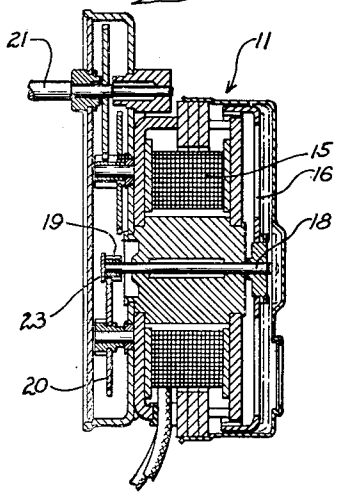


Fig. 9a

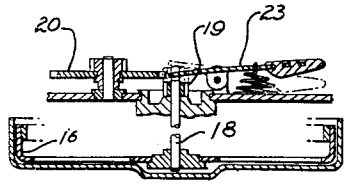


Fig. 7

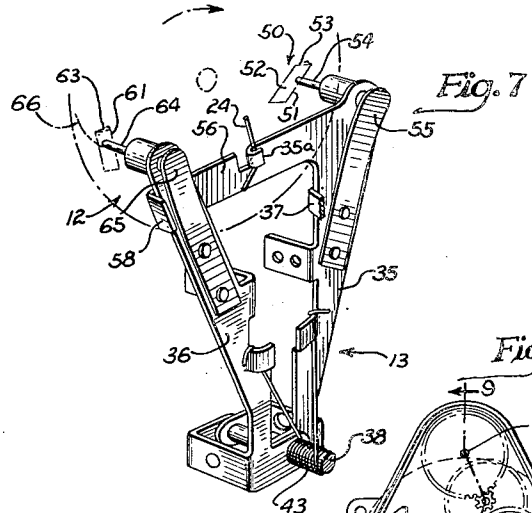
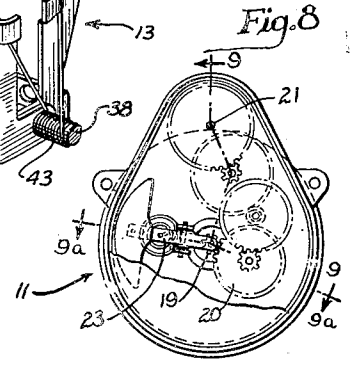


Fig. 8



Inventor
Robert H. Hickey
by Richard E. Burn
Atty.

Patented Apr. 10, 1951

2,548,604

UNITED STATES PATENT OFFICE

2,548,604

AUTOMATIC RESETTING TIMING SWITCH

Robert H. Hickey, Glastonbury, Conn., assignor to Haydon Manufacturing Company, Inc., Torrington, Conn., a corporation of Connecticut

Application May 20, 1948, Serial No. 28,083

11 Claims. (Cl. 200—33)

1

The present invention relates to timers and more particularly to an improved automatically resetting timing switch.

It is an object of the present invention to provide a resetting timer which includes a driving member rotated slowly upon the passage of time but which nevertheless produces fast making and fast breaking of a set of heavy duty electrical contacts.

It is another object of the invention to provide an improved timer for operating a switch after a predetermined interval following energization of the timer, but which is restored or reset to its initial condition when the timer is de-energized.

It is a further object to provide an improved electrical timer which is positive in operation even under heavy overloads, which is simple and inexpensive of construction and which is inherently trouble-free, enabling use in applications in which reliability is essential.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a front view in elevation of a timer embodying the present invention.

Fig. 2 is similar to Fig. 1 showing the relative positioning of the parts at the end of a preset time interval.

Fig. 3 is a side elevation with the mounting plate partially removed to reveal the driving motor.

Fig. 4 is a detailed perspective view of the preferred form of operating disk.

Fig. 5 is a view much the same as Fig. 1 but with the operating disk removed in order to show the switch arms in greater detail.

Fig. 6 is a view similar to Fig. 5, showing the positioning of the switch arms after expiration of a predetermined time interval.

Fig. 7 is a detailed perspective view of the switch arms.

Fig. 8 is a plan view of the switch operating motor and integral clutch with the case partly broken away.

Fig. 9 is a section taken along the line 9—9 of Fig. 8 with the driving motor energized.

Fig. 9*a* is a section taken along the line 9*a*—9*a* of Fig. 8, showing the clutch disengaged upon de-energization of the motor.

Fig. 10 is an exploded detailed view of the adjustable stop.

While the invention is susceptible of various modifications and alternative constructions and uses, I have shown in the drawings and will

2

herein describe in detail one embodiment of the invention. It is to be understood, however, that I do not intend to limit the invention by such disclosure, but aim to cover all modifications and alternative constructions and uses falling within the spirit and scope of the invention as expressed in the appended claims.

Referring now to the drawings, the complete timer shown at 10 may be divided into three portions for purposes of convenient discussion, although it will be understood by one skilled in the art that the novel and improved result is due to the cooperation and interaction between such portions. The first portion or sub-assembly is a combined motor and clutch 11. The latter serves to rotate an operating disk indicated generally at 12 which in turn acts upon a switch arm assembly shown generally at 13. These parts are mounted on a supporting bracket 14. The motor and clutch assembly 11 is generally of the type which produces a relatively slow timed rotation of an output shaft after energization of the motor but which uncouples the output shaft from the driving motor when the motor is de-energized. A representative motor of this type is disclosed in Figs. 8 and 9 and in further detail in the Schellens Patent 2,334,040 which issued on November 9, 1943. It will be noted that the motor includes a stator 15 cooperating with a rotor 16 fastened to a slidable shaft 18. Mounted on the outer end of the shaft 18 is a pinion 19 which forms one element of a clutch. A cooperating gear 20 forms the other element of the clutch and is connected to a train of gearing and thence to an output shaft 21. As disclosed in Fig. 9*a*, the rotor shaft 18 is normally biased into its disengaged position by a spring-biased lever 23. Upon energization of the motor, however, the rotor 16 is magnetically drawn against the force of bias, causing meshing of the gears 19, 20 and application of torque to the output shaft. As will be apparent to one skilled in the art, such driving mechanism is merely exemplary, and other motor and clutch devices operating in the same general manner may be employed without departing from the present invention.

The operating disk 12 is rigidly fastened to the motor output shaft 21 by means of a press fit or the like, so that the disk is rotated slowly in a counterclockwise direction (as viewed in Figs. 1, 2, 5 and 6) upon the passage of time. In practicing the invention an adjustably positioned stop is employed to preset the initial angular position of the disk and the switch mechanism, to be later

described, operates when the disk 12 is rotated into a predetermined terminal position. Further, a return spring is arranged constantly to bias the disk 12 against the motor torque and in a direction to cause engagement of the adjustable stop. In the present instance the stop consists of an adjustable stop pin 25 which projects outwardly from the disk 12 and may be adjusted to occupy a desired position in an arcuate slot 26. The pin 25 is in threaded engagement with a knurled knob 28 (Fig. 10) to facilitate clamping in adjusted position. The positioning of the stop is at all times indicated by the cooperating scale 27 which is calibrated in either seconds or minutes.

As noted above, the pin 25 determines the initial position of the disk 12 by limiting the rotation of the disk under the influence of the biasing spring 24. It will be apparent that any desired type of cooperating abutment may be used for the pin 25 and, in the present instance, the pin 25 strikes a ledge 14*a* on the supporting bracket 14. Similarly, a stop is provided for limiting the movement of the disk after the switching operation has been completed. To this end a permanently mounted stop 30 is used which, upon striking a ledge 14*b* on the bracket 14, causes blocking of the gear train and consequently stalling of the motor. The motor is of adequate rating so that stalling in the course of normal operation does not result in overheating.

Turning now to the contact arm assembly 13 in greater detail (Figs. 5, 6 and 7), it will be seen that it includes a contact making arm 35 and a contact breaking arm 36, which are preferably arranged in V relation for rotation about a common pivot 38 at the lower portion of the switch assembly. The arm 35 includes an insulated contact block 39 carrying a contact 40 thereon while the cooperating arm 36 carries a block 41 bearing an opposed electrical contact 42. Both of the contacts are brought out to a terminal strip 44 by appropriate pigtails.

To enable snap action of the contacts and to simplify actuation of the contact arms 35, 36, both of the latter are biased in the same direction. In the case of the arm 35 bias is derived from the spring 24 which, as previously noted, serves also to bias the disk 12 against the driving torque of the motor 11. As shown in Fig. 7, the spring 24 engages a tab 35*a* formed integrally on the arm 35. A stop 37 on the supporting bracket limits the distance that the arm 35 may move in its direction of bias. In the case of arm 36 bias is derived from a coil spring 43 wound about the pivot 38 and stressed in a direction tending to separate the switch arms. The torque applied by the spring 43 about the pivot 38 is preferably less than that exerted by the spring 24.

In accordance with one of the aspects of the invention a cam is provided on the operating disk for moving both of the switch arms into a cocked position and then releasing the "make" arm to bring the contacts into engagement. Simultaneously with the movement of the cam into its effective operating position, a one-way stop mounted on the operating disk is interposed in the path of movement of the "break" arm to prevent opening of the contacts. In the present embodiment the cam indicated at 50 is integrally formed on the operating disk 12 and presents a sharp leading edge 51 arranged at an angle to the radius of the disk. The back side 52 of the cam is tapered to merge smoothly with the body of the disk. Preferably the cam is formed by an integral tab struck from the metal of which the disk is formed. Upon rotation of the disk in a clockwise direction as viewed in Fig. 7 (and in a counterclockwise direction as viewed in the remainder of the figures), the leading edge 51 of the cam causes a lateral swing of the contact arm 35. To facilitate the latter a pawl, comprising a pin 54, is mounted on the upper end of the arm 35 and is pressed against the disk 12 by means of a leaf spring 55. Upon advancement of the abrupt edge 51 the switch arm 35 is moved into a "cocked" position. However, since the surface 52 of the cam is inclined, the cam is effective only in one direction and the pawl merely drops over the edge 51 when the disk is moved in the reverse or returning direction.

To prevent separation of the contact arms during the cocking movement, the arm 35 is provided at its upper end with a transversely extending yoke 56 having a bent-over tab 58 thereon which is arranged to grasp the arm 36. It will thus be apparent upon inspection of Fig. 5 that interference between the pawl 54 and the cam 50 will cause both the arms to be swung as a unit into the dotted position shown at 59. As the disk 12 is still further advanced, the pawl 54 will proceed along the edge 51 finally dropping off of the cam at its outer extremity 53. The "make" arm 35 is thus released for movement in a direction to close the contacts 40, 42. The positioning of the arms immediately upon such release is disclosed in Fig. 6.

To prevent the "break" arm 36 from moving in unison with the "make" contact arm 35 upon drop-off of the latter, a one-way radial stop 60 is interposed in the path of movement of the "break" arm. The stop 60, similarly to the one-way cam 50, is formed integrally on the operating disk 12. It is so arranged as to present a sharp inwardly facing edge 61 and an inclined surface on the back or outwardly facing side thereof. Mounted on the "break" arm 36 for cooperation with the one-way stop 60 is a spring pressed pawl 64 which is biased toward the disk 12 by means of a leaf spring 65. It will be apparent therefore that as the disk is rotated into the position shown in Fig. 7, the pawl 64 will follow the path indicated by the dot-dash line 66 dropping from the abrupt edge 61. Here the pawl is retained since the operating disk 12 is blocked against further advancement by the stop 30 and its corresponding abutment 14*b* (see Figure 6). As a result the switch arms are retained in the position shown in Fig. 6 as long as the driving motor 11 remains energized.

Upon de-energizing the motor 11, driving torque is released and the disk 12 is accordingly free to return under the action of the biasing spring 24 on the disk shaft 21. Rotation of the disk in the return direction thus causes the pawl 64 to drop off the end 63 of the stop 60 thereby opening the electrical contacts and resetting the disk 12 automatically to its initial position.

The resetting timer disclosed herein has been found to be particularly well suited for controlling the plate circuits of rectifier tubes or the like. It is a well known fact that application of plate voltage to a rectifier tube should be deferred until after the filament has had an opportunity to come up to full operating temperature. In use, therefore, the timer motor winding is arranged in parallel with the circuit feeding the filament. As a result of closure of the contacts 40, 42 after a predetermined time in-

terval, the plate voltage will be applied to the tube safetly and the possibility of tube damage is minimized.

While interruptions of short duration are sufficient to enable the operating disk 12 to return to its initial position under the action of the spring 24, nevertheless it is to be noted that instantaneous interruptions persisting only for a few cycles will not cause resetting. The reason for this is that the disk 12, to cause opening of the contacts, must move sufficiently to enable the pawl 64 to drop from the end 63 of the stop 60. By making the stop 60 of the proper length readily determined by one skilled in the art, the pawl 64 will not reach the drop-off point during extremely short current interruptions, and consequently electrical contact will be maintained. The latter constitutes safe practice since the tube filament has sufficient thermal inertia so that the drop in temperature is not appreciable.

Because of the relatively slow rotational advancement of the operating disk, the torque available at the disk is appreciable even though the motor may have a small power output. Accordingly, relatively strong operating springs may be employed so that the snap action both on making and breaking the electrical circuits is positive and reliable. The possibility of the contacts sticking because of current overload may therefore be reduced to a minimum.

Furthermore, the present construction enables the drop-off point 53 of the cam 50 to be made extremely sharp so that the instant of making contact may be predetermined with a high degree of accuracy.

I claim as my invention:

1. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising a rotatable member adapted to be rotatively advanced by said drive shaft, first and second opposed electrical contacts both biased in the same direction, means including a cam on said rotatable member for moving said contacts in unison against the force of said bias and then releasing said contacts, a stop arranged on said rotatable member for positioning thereby to restrain said first contact against movement and thereby to enable the second contact to move relatively thereto, and a return spring for biasing the rotatable member against motor torque so that upon cessation of such torque said stop is retracted and said first contact freed for relative movement.

2. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising means to rotate said drive shaft in a reverse direction when said clutch is disengaged, means including an operating disk adapted to be driven by said drive shaft, a pair of biased electrical contacts, and means including a cam on said disk means for moving said contacts in unison against said bias and then releasing the first contact for independent movement under the influence of said bias means on said disk to hold the second contact so that the two contacts are brought together, means to bias said contacts apart and means to hold the first contact while allowing the second contact to move independently thereof as said holding means on the disk releases the second contact upon the reverse rotation of the disk thereby separating the contacts.

3. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising means including an operating disk adapted to be driven by said drive shaft from an initial position, a pair of opposed electrical contacts both biased in the same direction, means including a cam on said disk means for moving said contacts in unison against said bias and then releasing one of them for relative movement with respect to the other under the influence of said bias for controlling an associated electrical circuit, and a return spring for restoring the operating disk to its initial position upon cessation of motor torque.

4. In a timer having a drive shaft arranged to be advanced at a predetermined rate by an electrical motor and including a clutch for disengaging the same automatically upon deenergization of the motor, the combination comprising means including an operating cam driven by said drive shaft, a pair of relatively movable contact arms having opposed electrical contacts thereon, and means biasing both of said arms in the same direction, said cam means being arranged to move said contact arms in unison against said bias with the contacts separated from one another and then to release one of said arms to cause closure of said contacts, and means including a stop positioned by said drive shaft in the path of movement of the other of said arms for maintaining the contacts closed until de-energization of the motor.

5. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising means including an operating disk adapted to be driven by said drive shaft, a pair of relatively movable electrical contacts both biased in the same direction, means including a cam on said disk means for moving said contacts in unison against the force of said bias and then releasing said contacts, and a stop on said disk means so arranged as to restrain one of said contacts against movement to enable the other contact to move relatively thereto for operation of an associated electrical circuit.

6. In a timer having a drive shaft arranged to be advanced at a predetermined rate by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising a pair of arms supporting electrical contacts, means biasing said contact arms in the same direction, means associated with said drive shaft including a cam for moving said first arm against the force of bias, means mounted on one of said arms and engaging the other arm so that said arms are moved in unison against the force of bias, said cam being so constructed and arranged as to release said first arm after predetermined rotation of said drive shaft, and a stop for retaining said second arm against return movement in unison with said first arm, the relative movement between the arms serving to operate the electrical contacts supported thereby.

7. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising a pair of electrical contacts, first

and second contact arms for carrying said electrical contacts, means biasing both said contact arms in the same direction, means associated with said drive shaft including a cam for moving said first arm against the force of bias, a yoke mounted on one of said arms and embracing the other arm so that said arms are moved in unison against the force of bias, said cam being so constructed and arranged as to release said first arm after predetermined rotation of said drive shaft, and a stop for retaining said second arm against return movement in unison with said first arm, the relative movement between the arms serving to operate the electrical contacts carried thereby.

8. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising an operating disk connected to said drive shaft for rotation therewith, an adjustable stop on said disk for predetermining the initial angular position thereof, a fixed stop on said disk for causing the motor to halt upon rotation of the disk into a predetermined final position, a pair of relatively movable contacts both biased in the same direction, means including a cam on said disk for moving said contacts in unison against the force of said bias and then releasing said contacts, a stop on said disk arranged to restrain one of said contacts against movement to enable the other contact to move relatively thereto for operation of an associated electrical circuit, and a return spring biasing said disk for rotation in a direction opposite to that in which it is driven by the motor for returning the disk to its initial position upon disengagement of said clutch incident to de-energization of said motor.

9. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising an operating disk mounted on said shaft, a cam arranged near the periphery of said disk, said cam being comprised of a struck out tab presenting an abrupt leading edge oriented at an angle to the radius of said disk and having a drop-off point at the end thereof, a first contact arm having a pawl thereon and movable upon advancement of said cam to a cocked position prior to drop-off, a stop on said disk, said stop being comprised of a struck out tab having an abrupt edge substantially perpendicular to the radius of said disk, a second contact arm having a pawl engaged by the abrupt edge of said stop and retaining said second arm against movement, said cam and said stop being so arranged on said disk that the first arm reaches a drop-off point on said cam upon continued movement of the latter with said second arm being restrained by said stop against retreating movement relative to said first arm to effect operation of said contacts.

10. In a timer the combination of a motor, a drive shaft adapted to be rotated by said motor, a clutch means connecting said motor and said shaft so that said shaft is disconnected from said motor upon de-energization of said motor, means to rotate said drive shaft in a reverse direction upon disconnection, a disk adapted to be driven by said drive shaft, a "make" contact arm and a "break" contact arm carrying electrical contacts, means biasing the "make" contact arm, means including a cam on said disk means for moving both of said contact arms in unison against said bias and then releasing the "make" contact arm for independent movement, a stop on said disk for holding the "break" contact arm so that the electrical contacts are brought together, a stop means for holding the "make" contact arm and means biasing the two contact arms apart so that the stop on said disk releases said "break" arm allowing it to move away from the "make" arm and thereby separate the contacts when said drive shaft is rotated in a reverse direction.

11. In a timer having a drive shaft arranged to be rotated by an electric motor and including a clutch for disengaging the same automatically upon de-energization of the motor, the combination comprising an operating disk connected to said drive shaft for rotation therewith, an adjustable stop on said disk for predetermining the initial angular position thereof, a fixed stop on said disk for causing the motor to halt upon rotation of the disk into a predetermined final position, a pair of biased electrical contacts and means including a cam on said disk for moving said contacts in unison against said bias and then as said disk moves into its final position releasing one of the contacts for independent movement under the influence of said bias to control an independent electrical circuit, and a return spring biasing said disk for rotation in a direction opposite to that in which it is driven by the motor for returning the disk to its inital position upon disengagement of said clutch.

ROBERT H. HICKEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,334,040	Schellens	Nov. 9, 1943
2,335,403	Gallagher	Nov. 30, 1943
2,352,215	McFall	June 27, 1944
2,398,994	Bazley	Apr. 23, 1946