

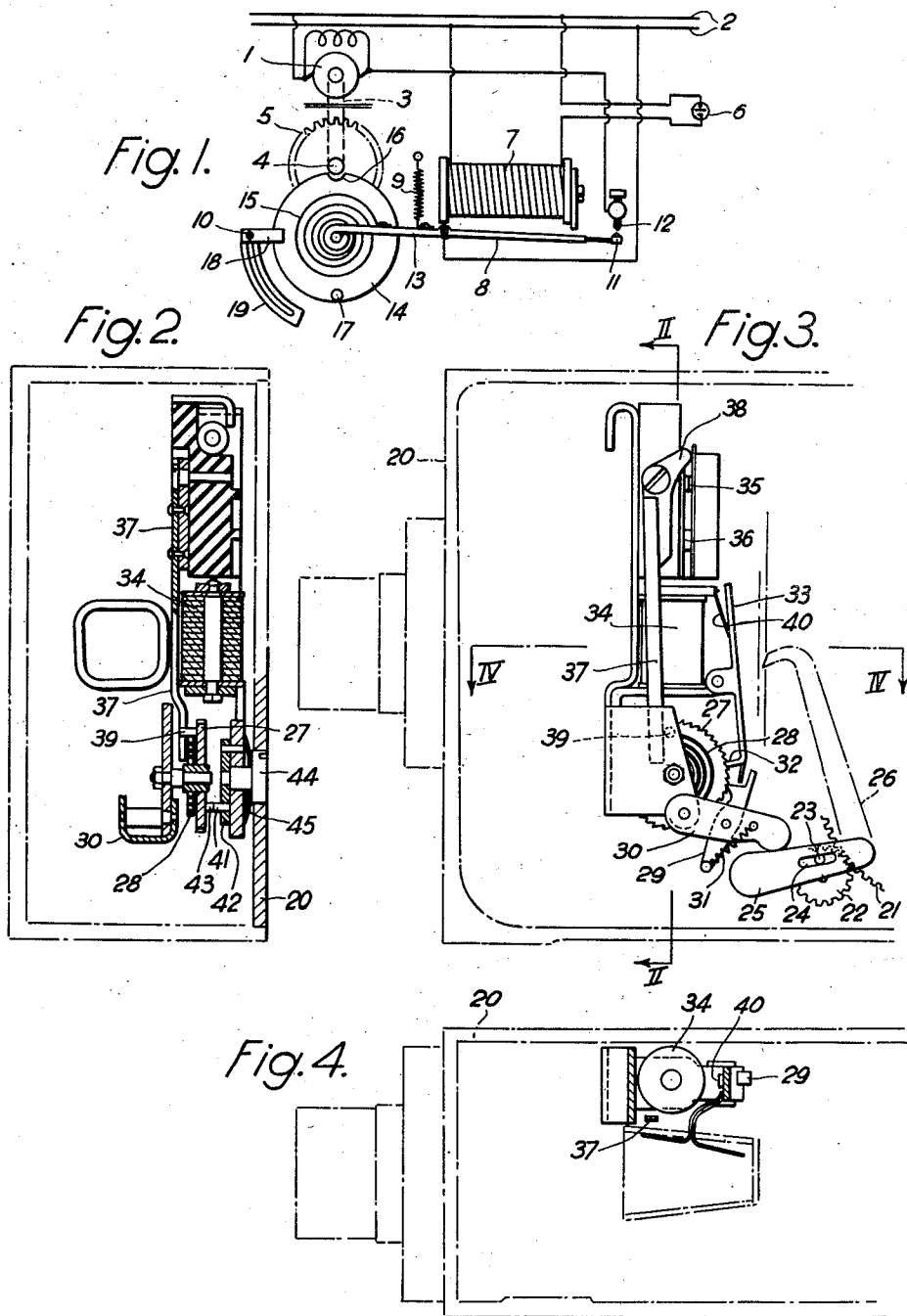
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DELAY ACTION CONTROL SWITCH

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DELAY ACTION CONTROL SWITCH

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1

2

This invention is a delay action control device. Its purpose is to enable a change of electrical circuit connections to be made at a predetermined interval after a control operation.

To this end the invention provides a timing device or counter which turns against the action of a re-setting spring, and is set in rotation by a control operation, such as the closing of a master switch, the timing device or counter operating electrical contacts to effect the desired change of circuit connections only after a predetermined extent of rotation.

More specifically the invention is concerned with control by effecting electrical circuit connections in apparatus which includes a constantly rotating shaft; and a further object of the invention is to utilise such constantly rotating shaft for driving the timing device.

To this end the invention provides a control device for use in connection with apparatus including a rotating shaft in which an initiating control operation, such as the closing of a master switch, establishes a driving connection between the rotating shaft and the timing device, the timing device being thereby rotated until it effects the desired change of circuit connections after a predetermined amount of turning.

A further object of the invention is to make it possible to vary at will the length of the interval which elapses between operation of a master control and the consequent change of circuit connections. To this end the invention provides stationary and moving co-operating abutments, the latter upon the rotating timing device, and one of them adjustable, which abut one upon the other and thereby limit the movement of the timing device under its re-setting spring. A further and particular object of the invention is a delay action control device of very simple construction capable of adaptation to any apparatus which includes a constantly rotating shaft and suited for electrical actuation from a distance. Such control device includes a relay the circuit of which is governed by a master switch, and the armature of which effects the desired change of circuit connections by operating contacts, and also includes a timing device having as one element a disc with a notched periphery mounted for rotation upon the relay armature in proximity to the constantly rotating shaft of the apparatus. Retraction of the relay armature brings the periphery of the disc into frictional contact with the rotating shaft before the armature has moved far enough to effect a change of circuit connections, and the timing device is then driven by the shaft until the

notch in the periphery of the disc registers with the shaft, whereupon the armature is further retracted and the change of circuit connections is effected.

By way of illustration of the many purposes and kinds of apparatus to which the delay action control device of the invention may be applied may be mentioned the instance of an electrically driven camera associated with a fire-arm for recording the effect of fire from the weapon; it must be clearly understood that the invention is not limited to this illustrative application. It is common to cause such a recording camera to start when the trigger of the weapon is pressed and to stop when the trigger is released. But to obtain a full record of the effect of fire the camera should continue running after the trigger is released until the last projectile has reached its target. For this the delay action control device of the invention readily provides. The master control operation of releasing the trigger, instead of stopping the camera, sets the timing device in operation, and the camera is switched off only when the timing device has performed a predetermined extent of travel. For economy of film, which is especially important when the recording camera is carried on an airplane, it is desirable to make the length of over-run of the camera beyond the instant of release of the trigger correspond to the muzzle velocity and effective range of the particular weapon with which the camera is associated; this, therefore, is an instance where the delay action control device may conveniently be fitted with means for varying the extent of the delay.

The delay action control device is capable of embodiment in many different forms. By way of illustration two forms are shown in the accompanying drawings. The invention is not to be regarded as limited to these particular constructions; the scope of the invention is to be gathered from the appended claims.

Figure 1 shows diagrammatically a construction of the invention for use in any apparatus which includes a constantly rotating shaft.

Figure 2 is an end elevation in section on the line II—II of Figure 3.

Figure 3 is a side elevation and

Figure 4 a plan in section on the line IV—IV of Figure 3, of a construction of the invention particularly intended for recording cameras used with weapons.

Figure 1 shows an electric motor 1 supplied from a source represented by main conductors 2. As indicated by the mechanical connection 3

shown in dotted lines the motor drives an apparatus, for example a kinematograph camera, which being no part of the invention is not shown. The motor 1 also drives with, or through, the driven apparatus a gear wheel 5 upon a shaft 4, which therefore rotates constantly so long as the motor is turning.

A master switch 6 controls the circuit of a relay 7 which may be supplied from the mains 2. The pivoted armature 8 of the relay is retracted by a spring 9 so long as the relay is unexcited. On its free end it carries a yielding mounted contact 11, which when the relay is excited, abuts upon a fixed contact 12. The contacts 11 and 12 are included in the supply circuit of the motor 1, which therefore is interrupted by their separation.

Upon an extension 13 beyond its pivot the armature 8 carries a rotatable disc 14. A spiral spring 15 anchored at one end to the disc 14 and at the other end to the armature 13, resists rotation of the disc and returns the disc to a zero position when it is otherwise unrestrained. In the periphery of the disc 14 is a semicircular notch 16 of slightly greater diameter than the shaft 4. The disc 14 carries on its face a projecting pin 17 in the path of which is a fixed but preferably adjustable abutment 18. As shown the abutment 18 is adjustable along the fixed arcuate slotted support 19 which is substantially concentric with the disc 14, and the abutment may be clamped in any position to which it is adjusted by the screw 10.

When the camera is not in action the circuit of the relay 7 is interrupted by the switch 6, the relay armature is not attracted, and the disc 14 is in the position indicated, save that the spring 9 holds the notch 16 in its periphery in engagement with the shaft 4; the shaft 4, the motor 1 and the camera are all at a standstill.

Upon the gunner pressing the trigger of the weapon with which the camera is associated the switch 6 is closed. The relay 7 is therefore excited, and attracts its armature 8, withdrawing the disc 14 from engagement with the shaft 4, and bringing the contacts 11, 12 together; the circuit of the motor 1 being thus closed the motor starts, and drives the camera and the gear wheel 5 and shaft 4 at a steady speed. The disc 14, being freed, is turned by its spring 15 until its projection 17 encounters the abutment 18.

When the trigger of the weapon is released the switch 6 is opened and the circuit of the relay is broken. The relay therefore releases its armature 8 and the armature is retracted by the spring 9 until the periphery of the disc 14 is brought into firm frictional contact with the now rotating shaft 4; this amount of retraction of the armature does not separate the contacts 11, 12. A driving connection is thus established between the driven apparatus, the camera, and the timing device or counter which is the disc 14 and the parts associated with it. The disc is rotated against the action of its spring 15, which is thereby wound up; and it continues rotating until the notch 16 is brought into register with the shaft 4, whereupon the spring 9 further retracts the armature 8, engaging notch 16 with the shaft 4 and separating the contacts 11, 12. The circuit of the motor is thus broken and the apparatus comes to a standstill, friction of the notch 16 with the shaft 4 contributing, if desired, to its arrest.

The separation of the contacts 11, 12 takes place when the disc 14 has rotated an extent predetermined by the position of the abutment 18, after release of the relay has established the afore-

said driving connection. The number of successive operations of the camera will depend on this predetermined extent of rotation of the disc 14 and the gear ratio of the driving connection between the camera and the disc; in effect the disc counts the revolutions of the shaft 4 and after a predetermined number causes the contacts 11, 12 to separate.

In the construction of Figures 2 to 4 the constantly rotating shaft, not shown, of a kinematograph camera 20 drives a gear wheel 21 meshing with a pinion 22; an eccentric pin 23 in the pinion 22 engages in a slot 24 in a pivoted arm 25 carrying the film feed pawl 26 of the camera. This mechanism is well known and forms no part of the present invention; it is shown because the drive of the timing device is taken from it. The timing device or counter comprises a ratchet wheel 27, which is under the control of a spiral spring 28 tending to turn the wheel clockwise in Figure 3. The wheel 27 can be turned against the action of its spring 28 by a pawl 29 carried upon a rocking arm 30 which rests upon and is rocked by the arm 25; a spring 31 both keeps the arm 30 in contact with arm 25 and tends to engage the pawl 29 with the ratchet wheel 27. A detent 32 carried by the armature 33 of a relay 34 normally retains the wheel 27 when wound against the action of its spring 28 by the pawl 29. The motor which drives the camera has in its circuit the contacts 35, 36, which normally rest in abutment but can be separated by rocking lever 37 the nose 38 of which engages one of the contacts, while the tail of the lever lies in the path of a pin 39 upon the ratchet wheel 27. A spring 40 retracts the armature 33 i. e. swings it clockwise in Fig. 3 when the relay 34 is not excited.

As in the construction of Figure 1 the relay 34 is controlled by a master switch, not shown, which completes its circuit when fire is opened and breaks its circuit when the trigger of the weapon is released. The extent of delay in stopping the camera after the master switch is opened is determined by an abutment 41 upon a disc 42, this abutment extending into the path of a second pin 43 upon the ratchet wheel 27. The disc 42 can be turned by inserting a screwdriver in the slot of a head 44 upon the stem of which the disc is mounted, and the disc is frictionally held where set by dished spring 45.

When the master switch is closed the relay 34 attracts its armature 33, and lifts the detent 32 out of engagement with the ratchet wheel 27. Also the tail of the armature engages the end of the pawl 29, and lifts that also out of engagement with the ratchet wheel. Consequently the ratchet wheel is free to turn under the action of its spring 28, and rotates clockwise in Figure 3 until its pin 43 encounters the abutment 41. The ratchet wheel 27 is idle so long as the relay 34 is excited. The pawl 29 is rocked idly to and fro out of engagement with the ratchet wheel 27. When the trigger is released the armature 33 is retracted by its spring 40 and both the detent 32 and the pawl 29 re-engage the ratchet wheel. Consequently the ratchet wheel 27 is now rotated against the action of its spring 28, until its pin 39 encounters the end of the lever 37 and moves the lever over, to the left in Figure 3, causing it to separate the contacts 35, 36, so interrupting the circuit of the camera motor and bringing the camera to rest.

This rotation of the ratchet wheel 27 takes place tooth by tooth, one tooth for each revolution of the wheel 22. Thus the wheel 27 in effect counts the revolution of the wheel 22 and there-

5

fore the cycles of operation of the camera, and after an extent of rotation determined by the position of the abutment 41 and the number of teeth on the wheel 27 between that position and the position of the pin 39, causes the contacts 35, 36 to be separated.

I claim:

1. A delay action control device for apparatus which includes a constantly rotating shaft comprising in combination with said shaft a master switch, a relay, an exciting circuit for said relay controlled by said master switch, an armature rocked by said relay, a timing device including a disc mounted for rotation upon said armature in such proximity to said shaft that the periphery of said disc is brought into frictional contact with said shaft upon retraction of said armature, a spring wound by the rotation of said disc, and electrical contacts operated by said timing device after a predetermined extent of rotation of said disc.

2. A delay action control device for apparatus which includes a constantly rotating shaft comprising in combination with said shaft a master switch, a relay, an exciting circuit for said relay controlled by said master switch, an armature rocked by said relay, a timing device including a disc with a notched periphery mounted for rotation upon said armature in such proximity to said shaft that the periphery of said disc is brought into frictional contact with said shaft upon retraction of said armature, a spring wound by the rotation of said disc, and electrical contacts operated by said timing device when the notch in the periphery of said disc registers with the shaft.

3. A delay action control device for apparatus which includes a constantly rotating shaft comprising in combination with said shaft a master switch, a relay controlled by said master switch, an armature rocked by said relay, a fixed contact,

6

a moving contact mounted on said armature, a timing device including a disc with a notched periphery mounted for rotation upon said armature in such proximity to said shaft that the periphery of said disc is brought into frictional contact with said shaft upon the retraction of said armature before the fixed and moving contacts are separated by such retraction, the registering of the notch in the periphery of the disc with said shaft permitting sufficient further retraction of said armature to separate said contacts.

4. A delay action control device for apparatus which includes a constantly rotating shaft comprising in combination with said shaft a master switch, a relay, an exciting circuit for said relay controlled by said master switch, an armature rocked by said relay, a timing device including a disc mounted for rotation upon said armature in such proximity to said shaft that the periphery of said disc is brought into frictional contact with said shaft upon retraction of said armature, a spring wound by rotation of said disc as a result of such frictional contact, co-operating members one of them upon said disc positioned to abut and thereby limit the rotation of said disc by said spring, one of said co-operating members being adjustable, and electrical contacts operated by said timing device after a predetermined extent of rotation of said disc.

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