

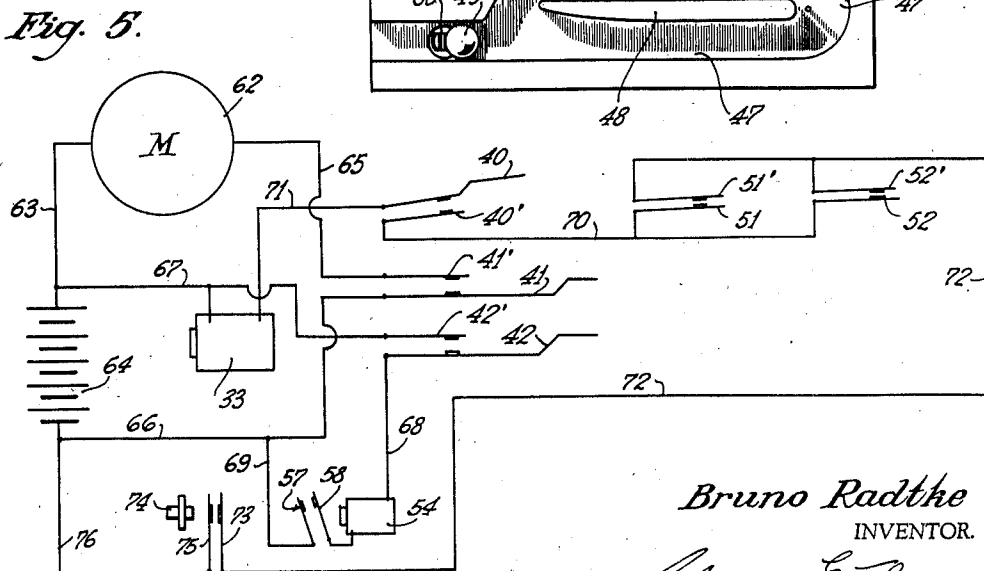
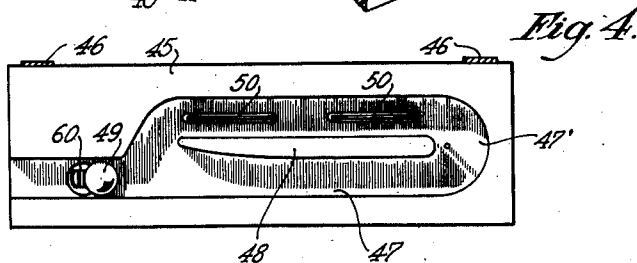
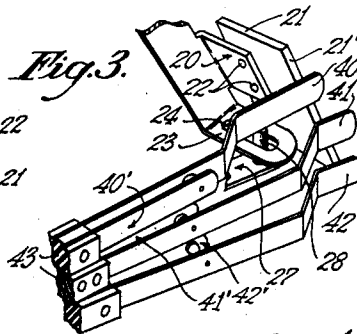
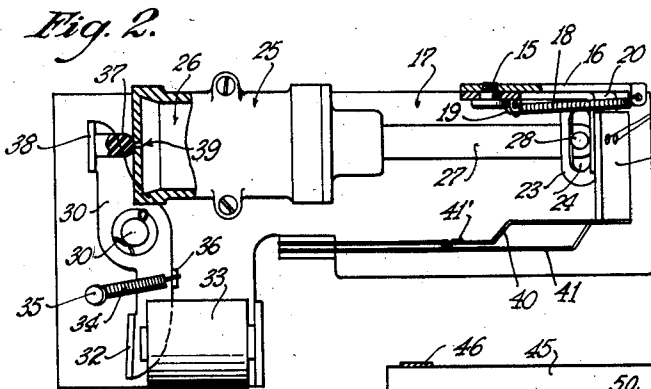
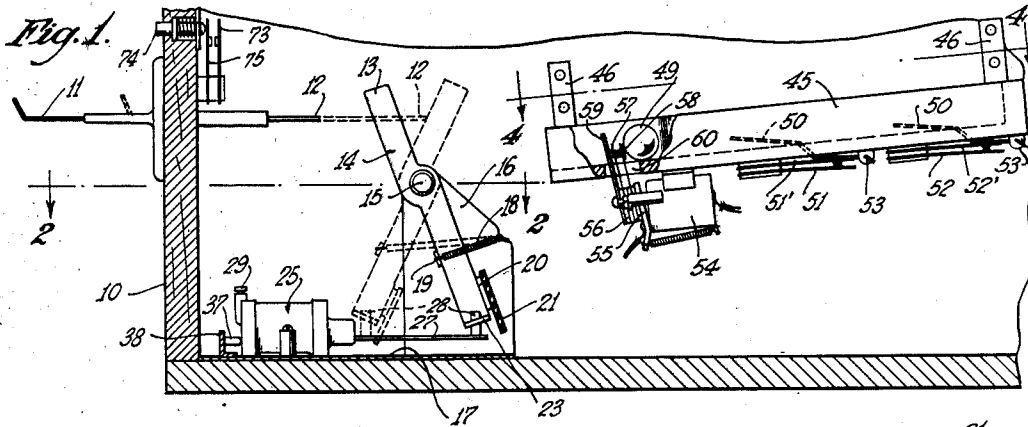
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2,192,620

CIRCUIT CONTROL

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CIRCUIT CONTROL

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17 Claims. (Cl. 272-138)

This invention relates broadly to control mechanism, and more particularly to circuit control mechanism of particular use in amusement and similar apparatus, though not restricted to such use.

One of the important objects of the invention is the provision of a control means including an operating member by means of which a switching device may be actuated for a determined length of time, selectively operable means for cutting short this period of time to restore the switching mechanism to its initial condition, and periodically operable switch means in circuit with the selectively operable means so that the period cannot be cut short unless the selectively operable means is actuated at substantially the moment when the periodically operable switch means is operated.

Another and more particularly stated object is the provision of a control apparatus including a main control for operating a switch mechanism, a dashpot for maintaining the switch mechanism in operated condition for a predetermined length of time, selectively controlled electromechanical means for rendering the dashpot inoperative and to cut short the predetermined period, and a novel periodically operable switch mechanism in circuit with the selectively operable electromechanical means and arranged so that the selective operation of the latter must occur at a particular time determined by the periodically operable switch means.

Another object of the invention is the provision of a time-delay mechanism in the form of a dashpot or similar elastic fluid operated time-delay device and electromechanical valve means for controlling the action of the elastic fluid in the dashpot or time-delay device to change the normal period of operation of the latter.

Another object is the provision of a dashpot and electromagnetic valve means therefor operable to change the rate of escape (or influx) of air in the dashpot and correspondingly change the normal time-delay action thereof.

Yet another object is the provision of a periodically operable switch for cooperation in the aforesaid circuit control and including a closed circuitous raceway with a ball therein and electromagnetic means operably controlled by the weight of the ball thereagainst and effective to project the ball repeatedly around its circuitous path, and switch means in the path of the ball and periodically operated by the latter as it repeats its circuit around the raceway.

In addition to the foregoing particularly de-

scribed objects, other novel aspects of the invention, both in matters of construction and features of operation, will appear as the following description proceeds in view of the drawing, in which:

Fig. 1 represents a fragmentary side section through a control unit embodying the present invention and showing part of the control mechanism in side elevation;

Fig. 2 is a top plan view of the electromagnetically controlled dashpot unit as viewed along lines 2-2 of Fig. 1 and drawn to enlarged scale;

Fig. 3 is an enlarged perspective of the switch mechanism cooperating with the dashpot structure as seen in Fig. 2;

Fig. 4 is a top plan view of the periodically operable switch or ball switch, as viewed along lines 4-4 of Fig. 1; while

Fig. 5 is a diagram of the entire control circuit.

One of the preferred embodiments of the invention includes a housing 10 on which is mounted a manually operable reciprocable control 11 having disjoined engagement at its inner end 12 with one end portion 13 of a switch operating lever 14 pivotally mounted between its ends as at 15 on an upstanding flange plate 16 of a bracket 17 conveniently mounted within the housing. A normal spring 18 attached at one of its ends to the bracket 16 and at its opposite end to an ear 19 on the lever arm 14 urges the latter in an anti-clockwise direction into a normal position as seen in Fig. 1.

Near its lower end the switch operating lever or arm 14 has a lug 20 (Fig. 3) extended laterally therefrom and substantially at right angles thereto and to which is secured a fiber or other insulating plate 21 by means such as rivets 22. The lower end portion of the switch operating arm 14 is also bent at right angles thereto to provide a lower offset extension 23 having stamped therein an elongated slot 24.

Mounted on the bracket 17 remote from the upstanding portion 16 thereof is a time-delay device in the form of an elastic fluid escapement mechanism such as the dashpot 25 (Figs. 1 and 2). In the present embodiment, the dashpot is preferably of a type shown and described in my allowed application Serial No. 715,573 (September 27, 1937), and includes a cylinder 26 in which is disposed a reciprocable piston (not shown) having a reciprocable piston rod 27 provided at its outer free end with a laterally extending pin 28 which is disposed in the elongated slot 24 in the offset lower end portion of the switch operating arm 14 (see also Fig. 3), such that the clockwise

pivotal movement of the switch operating arm 14 sets the dashpot to retard the return movement of the arm by the normal spring 18.

In operation, the dashpot or time-delay device 25 is similar to other forms of this class of device insofar as a fluid such as air or oil or the like is adapted to retard movement of a piston in proportion to the escape of the fluid from one chamber or region to another, and the present device is provided (Fig. 1) with an adjustable escape-ment valve 29 by means of which the ingress of air to the cylinder 26 may be controlled to vary the time-delay of the dashpot piston and rod 27 in its movement back to normal position after 15 having been set by an operation of the arm 14.

In addition to the adjustable vent or valve means 29 of Fig. 1, there is provided an electro-mechanical control for the dashpot in the form of a member 30 pivotally mounted on the bracket 20 17 between its ends on pin means 31 and having one of its end portions struck up to provide a lateral armature extension 32 attractable by an electromagnet 33 also mounted on the bracket 17 to pivot the arm or member 30 in an anti-clockwise direction against the tension of a normal spring 34 anchored at one end 35 to the bracket and in its opposite end to an ear 36 on the member 30 and normally urging the latter in a clockwise direction so as to press a valve plug member 30 37, disposed on an offset portion 38 of the member 30, firmly against an auxiliary escape vent 39 in the end wall of the dashpot. Thus, the energization of the electromagnet 33 would pivot the arm 30 to withdraw the plug 37 from the escape 35 vent 39 to permit a sudden influx of air into the cylinder, which in turn would permit the piston to be quickly restored to its normal position.

Mounted on the bracket 17 at one side of the dashpot is a bank of switches of the leaf spring variety, in this instance three, and each having 40 an elongated operating spring or arm 40, 41, or 42 extending in vertical planes along side an edge 21' of the insulating plate 21 on the switch operating arm 14 (Fig. 3), and each having a stationary cooperating contact spring 40', 41', or 42', all of the contact springs being mounted on 45 insulating means 43 in the well-known manner.

The uppermost leaf spring unit 40-40' is arranged so that the end of the operating spring 50 40 is offset inwardly for engagement with the edge 21' of the insulating plate on the main switch operating arm 14 so that the contacts 40-40' are normally closed, whereas the other two operating springs or arms 41 and 42 are 55 mounted so that their offset end portions, while similarly engaging the edge 21' of the insulating plate, are normally disposed in open circuit relation with their respective stationary contact springs 41' and 42'. By virtue of this arrangement, when the switch operating arm 14 is urged 60 in a clockwise direction by a control 11, the insulating plate 21 is moved out of engagement with the respective offset end portions of the leaf spring contact assembly so that the upper switch unit 40-40' assumes an open circuit position due 65 to the set or bias of the spring member 40 for this purpose, while the two lower spring units 41-41' and 42-42', because of their bias move into closed circuit relation, the several switches 70 remaining in this condition until the main switch operating lever or arm 14 is permitted to return to its normal position by the dashpot 25 whereupon the switch members will be restored to their normal condition as viewed in Fig. 3.

75 The novel periodic switch includes in one of its

forms a block 45 of wood or the like (Fig. 1) mounted in an inclined position in the housing 10 by means of brackets 46 secured to the wall portions thereof, and as seen from above in Fig. 4, this block 45 is routed out to provide an elongated 5 circuitous raceway 47 having an elongated central partition wall 48 on one side of which are disposed in sequence operating arms 50 of a pair of roll-over switches adapted to be operated by the passage of a ball 49 normally impounded in 10 the raceway. These roll-over switches are also of the leaf spring variety and include a pair of light contact arms 51 and 51' (Fig. 1) and 52 and 52', the operating arms 50 of each being pivotally mounted on the block out of the raceway on 15 bracket portions 53 with the opposite offset end portions of the arms 50 extending upwardly through elongated slots in the floor of the raceway 47. As the ball 49 passes successively over the arms 50, each of the latter is depressed and 20 moves the contact springs 51' and 52' into contacting engagement with their cooperating springs 51 and 52.

At the lower end of the wooden block 45 and on the under side thereof, there is mounted an 25 electromagnet 54 having an armature 55 to which is secured on insulating means 56 a pair of contact springs 57 and 58 extending in front of a relatively rigid arm 59 up through an opening 60 in the bottom of the block for engagement 30 with the ball 49 when the latter is in its normal position at the lower end of the raceway, the contact springs 57 and 58 being adequately light so that the weight of the ball normally urges these two contact springs together against the relatively 35 rigid supporting arm 59. It may be remarked here that the contacts 57 and 58 are arranged in a particular manner in circuit with the electromagnet 54 such that when the latter is energized and the armature 55 pulled up, the ball 49 will be projected toward the end 47' of the raceway, 40 returning over the switch operating arms 50 to re-engage and close the contacts 57 and 58 (which have meanwhile opened because of the absence of the ball to energize the magnet 54) 45 and effect a momentary reenergization of the kicker magnet 54 to reproject the ball out over the same path, this operation being repeated so long as the main power circuit is closed through the kicker unit 54-57-58, as will be more particularly pointed out hereinafter. 50

It will be apparent that the circuit of the ball 49 in the raceway 47 is fixed and the rate of movement of the ball substantially constant within rough limits, depending largely upon the 55 constancy of the power source which supplies the electromagnet 54, so that the periodicity of operation of the switches 50-51-51' is substantially uniform, it being understood that this uniformity in periodic operation of these 60 switches can be held to rather close limits depending upon the degree of constancy required.

As illustrative of the operation of the novel control circuit and apparatus, there is shown in Fig. 5 a motor 62 connected by a conductor 63 65 to one side of a battery 64, the opposite side of the motor being connected by a conductor 65 to the stationary contact 41' of one of the normally open leaf springs, the companion switch contact 41 of which is connected by conductor 66 to the 70 opposite side of the battery 64. Thus, when the springs 41-41' are closed, the motor 62 will operate, and this operation occurs when the main switch operating arm 14 is in the dotted line position shown in Fig. 1, at which time also the 75

spring switch contacts 42—42' are closed, establishing a circuit via conductor 67 from one side of the battery through the switch and a conductor 68 to one side of the kicker electromagnet 54, through the winding of the latter to the kicker arm contact 58, the companion kicker arm contact 57 being connected by a conductor 69 to the conductor 66 and hence to the opposite side of the battery. Thus, with the main switch arm 14 in the operated or dotted line position corresponding to closed circuit condition of the two lowermost leaf spring switches, the motor 62 will operate and the kicker electromagnet 54 will operate periodically to project the ball 49 around the raceway 47, each time the ball returns to close the contacts 57—58 the kicker electromagnet 54 being energized to reproject the ball.

When the two switches 41 and 42 are closed corresponding to the dotted line position of the operating arm 14, the first or upper leaf spring switch 40 is open, but only for a part of the predetermined period of time during which the return of the arm 14 to normal position is retarded by the delay device 25, it being observed in Fig. 3 that the offset end portion of the contact spring 40 is elongated to a greater degree than the corresponding offset parts 41 and 42 of the companion switches, the reason for this being that when the switch operating arm 14 has returned part way toward normal position (depending upon the length of the offset part of switch arm 40) the edge 21' of the insulating plate on the arm 14 will engage the offset end of the switch arm 40 appreciably sooner than either of the other offset switch arm portions 41 or 42 so that the top switch 40—40' (referring now to Fig. 5) will be closed while the remaining two switches 41 and 42 are open, and this results in connecting the dashpot tripping magnet 33 to the two ball switch contact arms 51 and 52 by a conductor 70 connected to the switch contact 40' and a conductor 71 leading from the opposite switch contact 40 to the magnet 33, the other side of this magnet being connected to conductor 67 and hence to one side of the battery 64. The cooperating spring contacts 51' and 52' are commonly connected by a conductor 72 to one contact spring 73 of a selectively operable switch mounted above the manual control 11 and operable by a button 74 to urge a contact 75 into circuit closing engagement with the other contact 73 and thus complete a circuit via conductor 76 back to the other side of the battery. It will be apparent that the valve operating electromagnet 33 can be energized only when the switch contacts 40—40' are closed along with one of the two ball or periodically operable switches 51 or 52 and responsive to a closing of the switch 73—75.

The motor 62 may be used to drive a desired form of amusement apparatus in which an object is to stop the motor before the lapse of time determined by the time-delay device or dashpot 25, but the motor cannot be stopped until a part of this time period has elapsed to permit the switch 40—40' to be closed. Moreover, even when the switch 40—40' is closed, the selectively operable switch is ineffective to stop the motor unless it is actuated during one or two short periods of time when the ball 49 is passing over either of the ball switch operating arms 50. However, if the manipulator of the apparatus operates the selective switch button 74 at that instant of time which satisfies the foregoing pre-

requisites, the circuit will be closed through the contact 73—75 and either of the ball switch contacts 51—51' or 52—52' and the time-delay controlled switch 40—40' to energize the magnet 33 and pivot the arm 30 counter-clockwise (Fig. 2) to withdraw the plug 37 from the escapement vent 39, thereby nullifying the delaying action of the dashpot and permitting a substantially instantaneous return of the switch arm 14 to open the two switches 41—41' and 42—42', thereby de-energizing the motor 62 and the ball kicker 54, whereupon the foregoing cycle of operation may be repeated by another operation of the control 11.

The foregoing particularly described details of construction and operation are not to be construed as a limitation of the invention to such forms or modes of operation, but are set forth for purposes of illustration, and the appended claims are intended to include within their call all variations and rearrangements in form or location or function of the particularly specified means herein disclosed.

I claim:

1. Control means including a main switch operating arm, switch mechanism operable by said arm when the latter moves in a particular direction, time-delay means for controlling the rate of movement of said arm in said particular direction, selectively operable electrical means for cutting short the operation of said time-delay means, a periodically operable switch means in circuit with said selectively operable means such that the latter can be effectively actuated only at a particular time when said periodic switch means is operated, and a controlled instrumentality in circuit with said first-mentioned switch mechanism.

2. In combination, control apparatus including a controlled electrical device, a time-delay switch mechanism in circuit with said device for controlling the period of operation of the same, electrical means operable to cut short the normal period of operation of said time-delay switch mechanism, together with a selectively operable switch means and a periodically operable switch means arranged in circuit with said electrical means for cutting short the period of said time-delay switch mechanism, whereby the circuit of said controlled device may be altered only when said selectively operable switch means and said periodically operable switch means are actuated substantially at the same time.

3. Control mechanism including a controlled electrical instrumentality, a time-delay switch arranged in circuit with said instrumentality, a periodically operable switch and electrically operable drive means therefor energized through said time-delay switch selectively operable switch means connected in circuit with said periodically operable switch, and electrically operated means for cutting short the normal time-delay period of said time-delay switch to de-energize said controlled instrumentality when said selectively operable switch and said periodically operable switch are actuated at substantially the same time.

4. Control mechanism including a controlled electrical instrumentality, a time-delay switch arranged for operation to energize said instrumentality for a predetermined period of time and provided with electrically operated means for cutting short said period of time to de-energize said instrumentality before the normal expiration of said period, a periodically operable and elec-

trically driven switch operably energized by said time-delay switch, and selectively operable switch means arranged in circuit with said electrically operated means for cutting short the time-delay period and said periodically operable switch, whereby said instrumentality may be de-energized provided said selectively operable switch means and said periodically operable switch means are actuated at substantially the same time.

5. In combination, a controlled electrical instrumentality, time-delay switch mechanism operable to energize said instrumentality for a determined length of time, an electrically driven periodically operable switch energized by said time-delay switch and having periodically opening and closing contact means, a selectively operable switch arranged in circuit with said contact means and electromechanical means for cutting short the normal delay period of said time-delay switch, whereby said electrical instrumentality may be de-energized provided the selectively operable switch and periodically operable switch means are actuated at substantially the same time.

6. In combination, an electrically operable instrumentality and time-delay switch means for energizing the same a determined length of time, selectively operable switch means, an electrically driven periodically operable switch means energized by said time-delay switch means and arranged in circuit with said selectively operable switch means and electromagnetic mechanism co-operable with said time-delay switch means and arranged to change the normal time-delay period of said delay switch means and thus effect de-energization of said electrically operable instrumentality only when said selectively operable switch means and said periodically operable switch means are actuated together.

7. In combination, an electric motor, time-delay switch means operable to energize said motor for a determined length of time, selectively operable switch means, electrically driven periodic switch means energized by said time-delay switch means and arranged in circuit with said selectively operable switch means for operation at substantially the same time as said periodically operable switch means to energize electrical mechanism forming part of said time-delay switch means, whereby the normal delay period of said last-mentioned switch means may be cut short to stop the operation of said motor before the conclusion of said determined length of time.

8. A controlled circuit including an electrical instrumentality, a master switch mechanism normally controlled by a dashpot and adapted to be operated to energize said instrumentality for a predetermined time, selectively operable electromagnetic means for interrupting the normal operation of said dashpot to cut short said predetermined period, said electromagnetic means including a selectively operable switch arranged in circuit with a periodically operable electrically driven switch mechanism also arranged in circuit with said instrumentality and said master switch mechanism and arranged such that actuation of said selectively operable switch will be effective to cut short the predetermined period as aforesaid only when said selectively operable switch is operated simultaneously with said periodically operable switch.

9. A control circuit including an electric motor, a master switch mechanism operable to energize said motor, an electrically driven automatic, periodically opening and closing switch also ener-

gized by operation of said master switch, an elastic-fluid time-delay device cooperable with said master switch to hold the same in operated condition for a determined length of time and having electromagnetically operating valve means operable to cut short said period of time, a selectively operable interrupting switch said periodically operable switch being arranged in circuit with said selectively operable switch and said electromagnet means so that said electromagnetic valve means will be actuated responsive to an operation of said selectively operable switch provided the latter is operated at a time when said periodic switch is also operated.

10. Control mechanism in accordance with claim 9 wherein said electromagnetic valve means is further controlled by said master switch in a manner such that a portion of said predetermined period of time must elapse before said selectively operable switch means can be effective for operation as set forth.

11. In combination, a controlled electrical instrumentality, a master switch mechanism including a movable switch operating element and a plurality of switching members, means for actuating said movable operating element to operate said switching members, means for restoring said movable operating element from switch actuating position to a normal ineffective position, dashpot means cooperable with said movable operating element and effective to maintain the latter in switch operating condition for a predetermined period of time, electromagnetic valve means for said dashpot and arranged for operation to cut short the normal time-delay period thereof, an electrically driven periodically operating switch and with a selectively operable switch arranged in circuit with said electromagnetic valve means and effective to energize the latter when said selectively operable switch and said periodically operating switch are actuated at the same time.

12. A control circuit in accordance with claim 11 in which said periodically operating switch is energized by one of said master switching members.

13. A control circuit in accordance with claim 11 and further characterized in that said electromagnetic valve means is arranged in circuit with one of said master switching members so as to be operable only during a certain part of said predetermined period of time.

14. Control means in accordance with claim 11 wherein both said periodically operating switch and said electromagnetic valve means are operably controlled by switching members of said master switch so as to be effective for the purpose of cutting short said predetermined period only during a certain portion of that period.

15. Control circuit means in accordance with the combination of claim 11 in which said electrically driven periodically operating switch means is in the form of a member providing a circuitous ball race with ball operated switch means disposed in said race for actuation by said ball in its circuitous movement therein, said ball operated switch means being arranged in circuit with said selectively operable switch for the purpose aforesaid, together with electromagnetic ball projecting means extending into said race and provided with ball operated switch means in circuit with said electromagnetic projecting means and said master switch, a ball in said race, said race being arranged to provide a low region adjacent said projecting means, whereby said ball

will normally be disposed against the latter and said switch means thereof, said projecting and switch means being arranged in said circuitous path so as to be repeatedly engaged by said ball as the latter travels in its cycle so long as said electromagnetic projecting means is actuated by said master switch.

riod of operation of the dashpot and switch means.

17. In combination, a dashpot, switch means arranged to be set in closed circuit condition from a normal open circuit condition, spring means arranged to return the switch means to normal condition from set condition, a dashpot coacting with said switch means to regulate the rate of return to said normal condition, a normally closed air relief valve for said dashpot and adapted to be opened to hasten the restoration of said switch means to normal condition, and electrically operated means for opening said relief valve and connected in a control circuit with said switch means so that the electrically operated means can be actuated only during a certain time between the setting and restoration of said switch means.

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16. In combination, a dashpot provided with an air relief valve, electromagnetic means arranged to operate said valve, and switch means arranged in a control circuit with said electromagnetic means and arranged to be operated during a period of time determined by said dashpot, said switch means and control circuit being arranged in such manner that the electromagnetic means can be energized to operate said valve only during a predetermined interval in the pe-