July 15, 1941. E. O. THOMPSON 2,249,674

CIRCUIT CONTROLLING AND IMPULSE SENDING DEVICE

Original Filed July 20, 1938 3 Sheets-Sheet 1

Fig. 1.

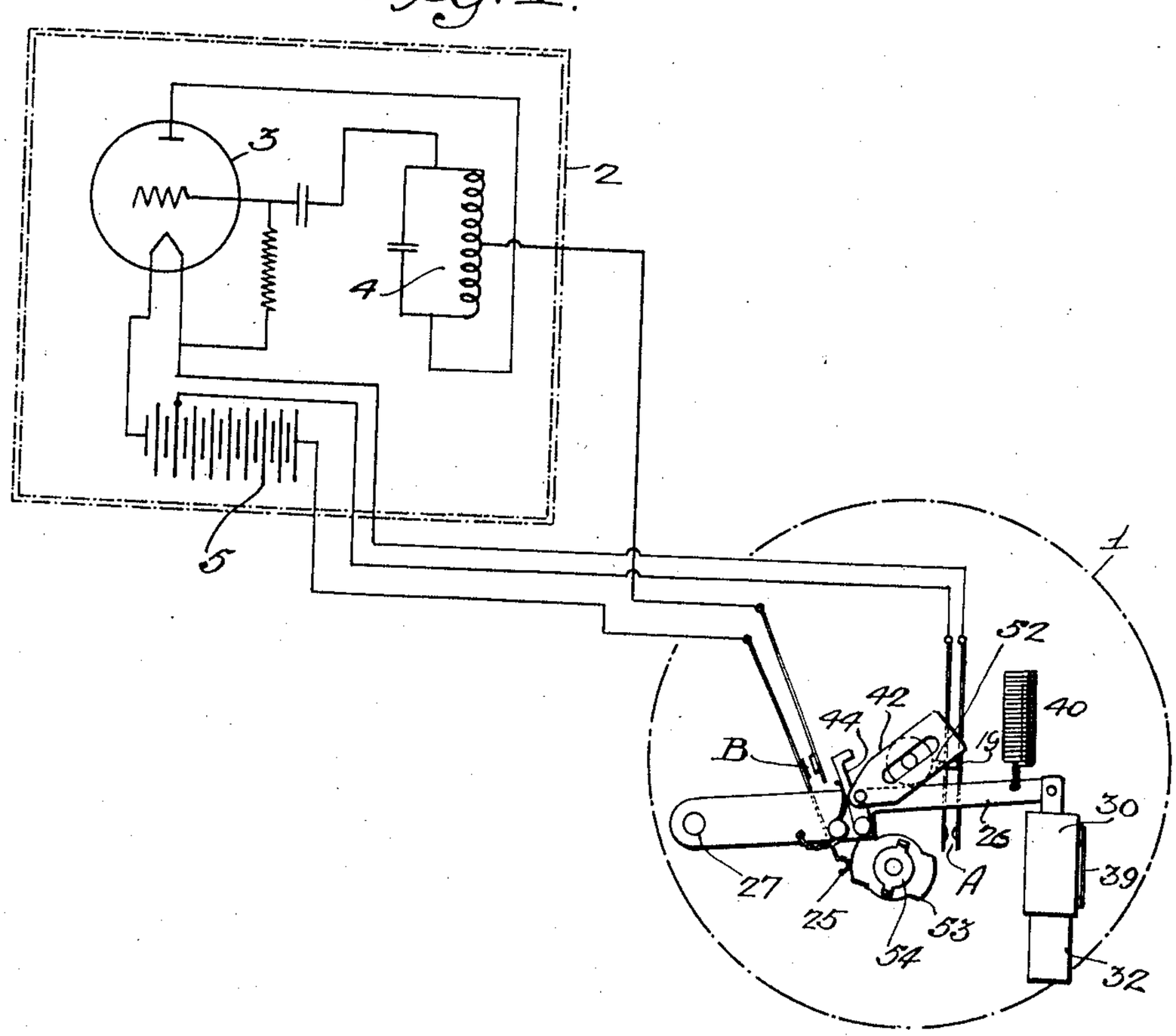
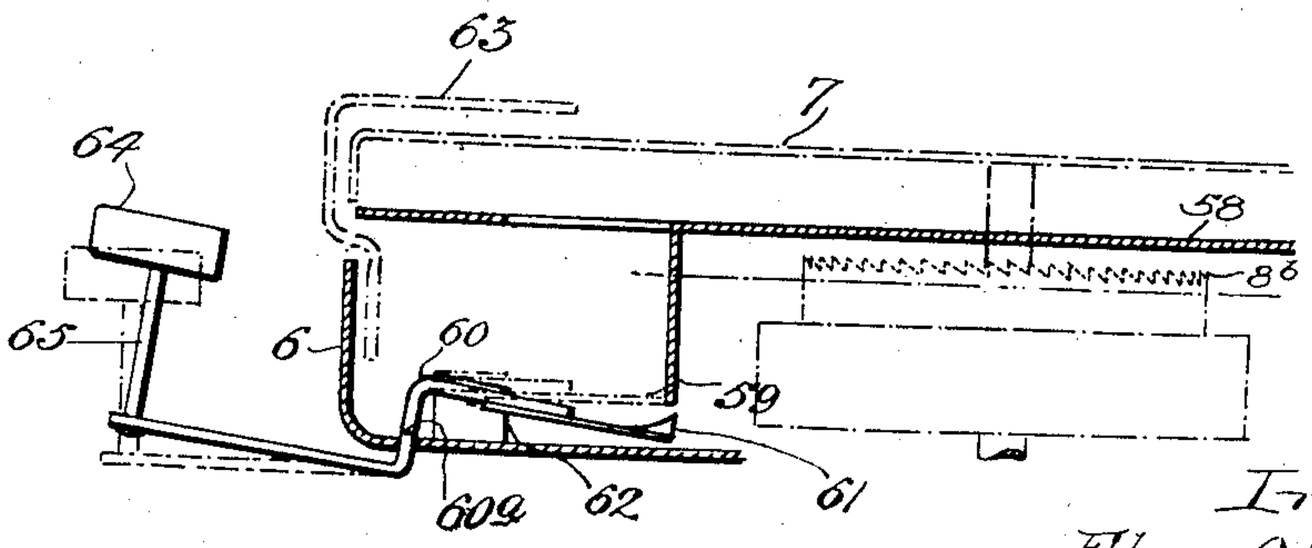


Fig. 11.



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CIRCUIT CONTROLLING AND IMPULSE SENDING DEVICE

Original Filed July 20, 1938 3 Sheets-Sheet 2

Fig. 2.

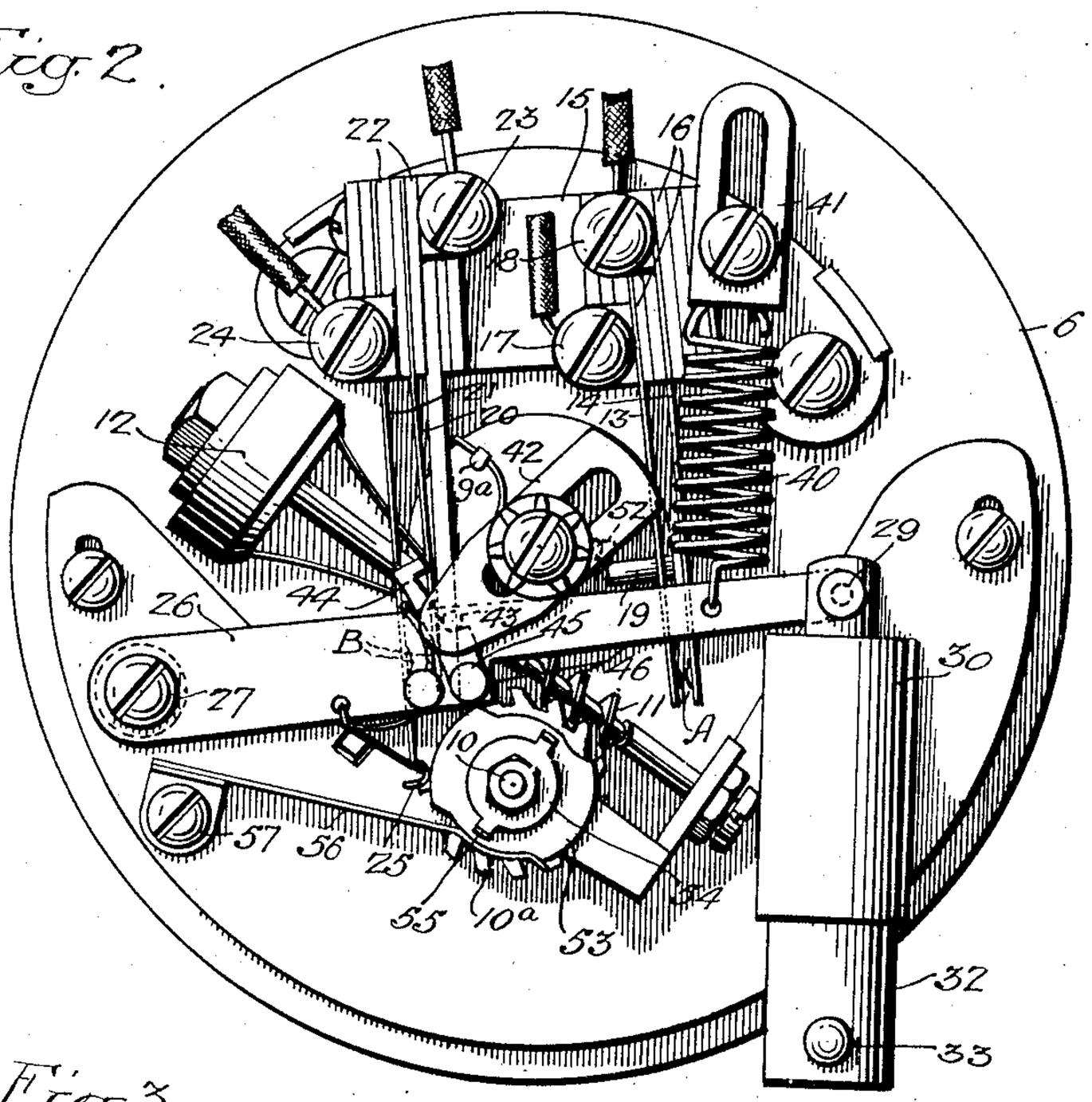
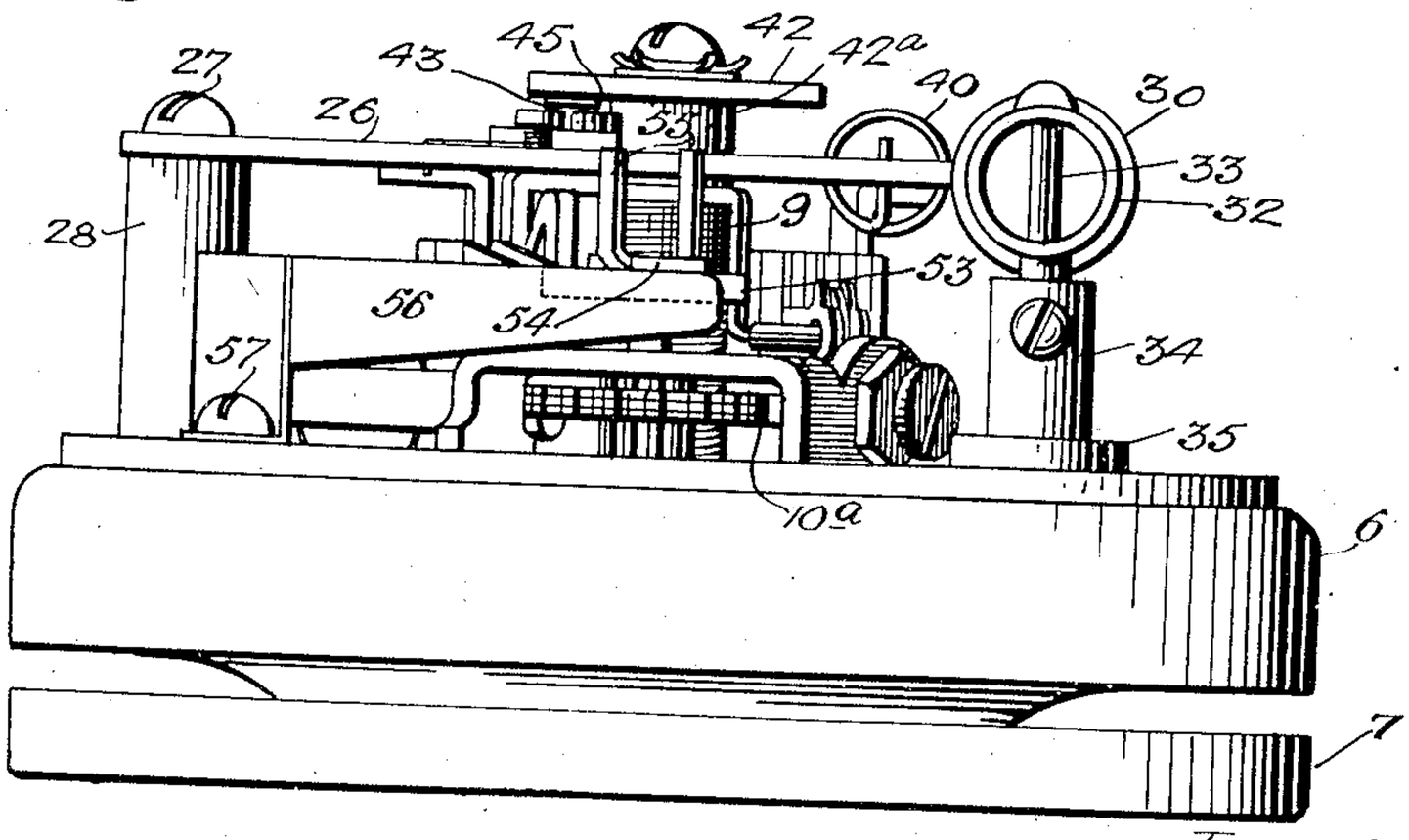


Fig. 3.



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CIRCUIT CONTROLLING AND IMPULSE SENDING DEVICE

Original Filed July 20, 1938 3 Sheets-Sheet 3

Fig. 8.

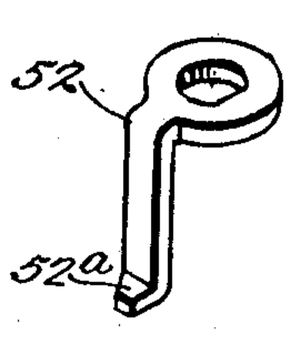


Fig. 5.

Fig. 6

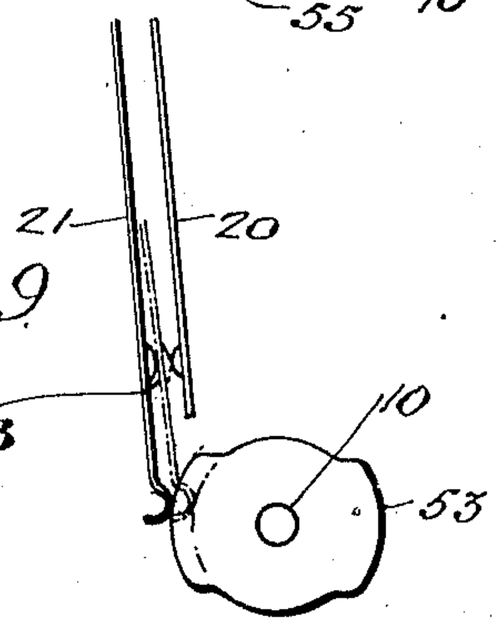


Fig. 7

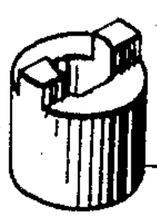


Fig. 10

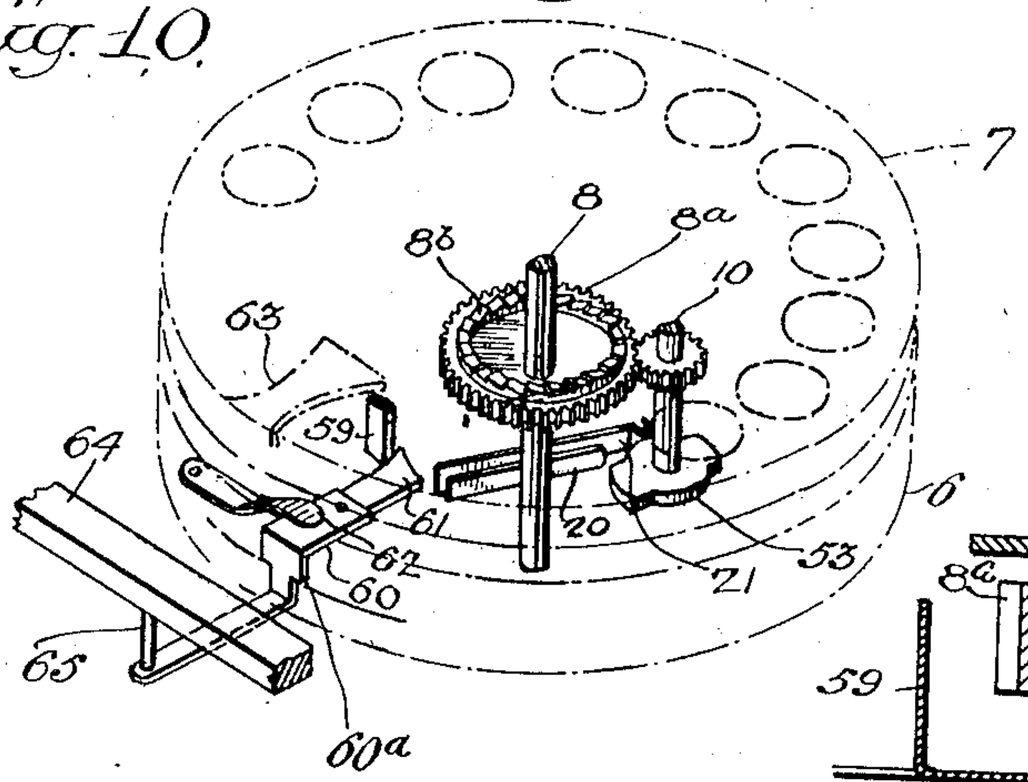
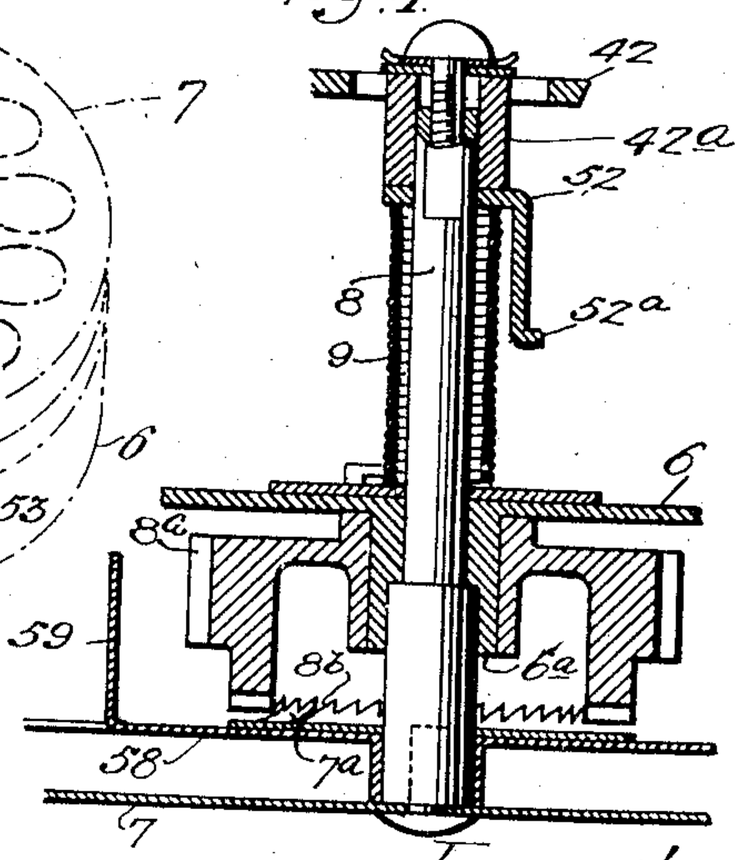


Fig. 4



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Patented July 15, 1941 2,249,674

UNITED STATES PATENT OFFICE

2,249,674

CIRCUIT CONTROLLING AND IMPULSE SENDING DEVICE

Elmer O. Thompson, Grasmere, N. Y., assignor to Philco Radio and Television Corporation, Philadelphia, Pa., a corporation of Delaware

Original application July 20, 1938, Serial No. 220,367. Divided and this application March 28, 1941, Serial No. 385,751

8 Claims. (Cl. 177—380)

This invention relates to electrical circuit controlling and impulse-sending mechanisms and, more particularly, to a novel device of this character by means of which an impulse-generating device may be conditioned for proper operation before voltage impulses are applied to it. The invention relates further to a novel control signal-generating apparatus comprising a signal generator and a manually-operable impulse-sending device adapted to control the operation of the generator. This application is a division of application Serial No. 220,367, filed July 20, 1938.

The invention is capable of general application but it is particularly applicable to a remote control system of the type disclosed and claimed in the copending application of Milton L. Thompson, Serial No. 220,356, filed July 20, 1938, wherein the control signals from the generator are utilized to control the operation of a radio receiver.

One object of the present invention is to provide an impulse-sending device or mechanism embodying novel means for delaying the sending of impulses for a time interval sufficient to permit the impulse-generating device to properly condition itself for operation.

Another object of the invention is to provide an impulse-sending device which is adapted to initiate the conditioning of the impulse-generating device and which embodies novel means for permitting the generating device to become properly conditioned for operation prior to the sending of impulses.

A further object of the invention is to provide a novel control signal-generating apparatus of the character above mentioned, wherein the impulse-sending device is adapted to initiate conditioning of the generating device and embodies novel means for delaying the application of impulses to the generating device so as to permit the latter to become properly conditioned for operation prior to the generation of control signal impulses under the control action of the impulse-sending device.

Other objects and features of the invention will be apparent hereinafter.

In the accompanying drawings:

Fig. 1 is a diagrammatic illustration of the control signal, generating apparatus provided by the invention;

Fig. 2 is a rear face view of the impulse-sending device;

Fig. 3 is an elevational view of this device in inverted position;

Fig. 4 is a detail sectional view taken axially of the central shaft;

Fig. 5 is a detail view showing more clearly the co-operative operation of certain parts of the impulse-sending device;

Fig. 6 is a sectional view of the time-delay or retarding mechanism;

Figs. 7 and 8 are perspective views of certain elements of the device;

Fig. 9 is a fragmentary view illustrating more clearly the operation of one of the switches;

Fig. 10 is a perspective view of a portion of the mechanism illustrating one of the principal features of the invention and showing the entire impulse-sending mechanism in phantom outline; and

Fig. 11 is a fragmentary sectional view illustrating the same feature more clearly.

Referring first to Fig. 1 of the drawings, the impulse-sending device is shown at 1 and is arranged to control the operation of a generator 2 which, in the present instance, comprises a simple vacuum tube oscillator. The impulse sender will be described presently.

Referring to the generator 2, there is provided a vacuum tube 3 and associated circuits to constitute a simple oscillator including the tuned circuit 4. The battery 5 supplies the voltages for the filament and plate circuits of the tube, and it will be noted that the filament circuit is controlled by the switch contacts A of the impulse-sending device 1, while the plate circuit of the oscillator tube is controlled by the switch contacts B of the impulse sender. Briefly, the impulse sender functions to operate the contacts B intermittently, to thus intermittently close the plate circuit of the oscillator and cause the latter to generate successive signal impulses. In other words, the impulse sender 2 controls the application of voltage impulses from battery 5 to the plate of tube 3, and in effect, the impulse sender sends control impulses to the generator 2 to effect intermittent operation thereof. The impulse-controlling contacts B are maintained open, however, to prevent operation of the oscillator until after the filament circuit contacts A have been closed for a time sufficient to enable the filament to reach its proper electron-emission temperature. This function is effected by a novel time-delay mechanism embodied in the impulse sender 1 as described hereinafter. In this manner, it is assured that the generator will generate signal impulses properly when the operation of contacts B is commenced. This feature enables the generator to be maintained

in inoperative condition when the apparatus is not being used, and the provision of contacts A and their operating means eliminates the necessity of providing a separate switch for energizing the electron emission element of the oscillator tube. In further accordance with the invention, the duration of certain signal impulses generated by the oscillator may be controlled manually by a novel mechanism which enables the operator to maintain the contacts B in closed position, as described hereinafter.

As stated above, the apparatus provided by this invention may be employed in the radio control system of the above-mentioned copending application which utilizes certain control signal impulses of relatively long controllable duration to control the volume level of a radio receiver, while at the same time employing different numbers of short impulses to effect selective tuning of the radio receiver.

Referring now to the other figures, and particularly Figs. 2 to 4, the impulse-sending mechanism is generally similar to the impulse sender employed in telephone systems, comprising a rotatable finger-operated dial which functions to condition the device for subsequent intermittent closure of switch contacts to thus generate a number of successive electrical impulses, the number of impulses depending upon the operation of the dial in any particular instance. Such a device is disclosed, for example, in the United States Patent to Alexander E. Keith, No. 1,279,352, granted September 17, 1918. In the present instance, there is provided the usual stationary support 6 and the usual perforated dial 7, which is attached to a central shaft 8 rotatably supported by the bearing 6*a* (see Fig. 4). A spring 9 surrounds shaft 8 and has one end anchored to the stationary support at 9*a* and its other end secured to the shaft, so that the spring normally maintains the shaft and dial in normal rest position and resists rotation thereof. As in the conventional impulse sender, when the dial is rotated, energy is stored in the spring 9 and, when the dial is released, this energy is expended to return the shaft and dial to their normal rest positions. During this return movement, the shaft 10 is rotated to effect the intermittent operation of the impulse-sending contacts B, as described hereinafter. A gear 8*a* is rotatably mounted on bearing 6*a* (see Fig. 4) and meshes with a pinion on shaft 10, as shown in Fig. 10. The gear 8*a* has ratchet teeth 8*b* which cooperate with a pawl 7*a* carried by the dial to effect rotation of gear 8*a* only during return movement of shaft 8 and the dial. The gear wheel 10*a* which is mounted on shaft 10 operates a worm 11 to drive a speed governor 12, the function of which is to maintain the movement of the shaft 10 at a uniform slow rate so that the impulses will be uniformly timed. The mechanism described thus far is largely conventional and is generally similar to that disclosed in the Keith patent above mentioned.

The contacts A provided on the present device are carried by spring fingers 13 and 14 which are secured to a bracket 15 mounted on the support 6. The spring fingers are insulated from one another and from the bracket by means of suitable insulating disks designated generally by numeral 16, and there are provided screw terminals 17 and 18 for the respective contact fingers. The finger 13 has an aperture therein to accommodate an insulating pin 19 carried by the other contact finger 14. In the absence of pressure upon the pin 19, the resilience of the contact fingers maintains the contacts A in engagement with one another but when pressure is exerted upon the pin 19, the contacts are opened, as will be apparent.

The contacts B are carried by spring fingers 20 and 21 which are also mounted upon bracket 15 and are insulated from one another and from the bracket by means of insulating disks designated generally by numeral 22. There are also provided screw terminals 23 and 24 for the respective contact fingers 20 and 21. The contact finger 21 is extended beyond the contacts B and its end is bent to form a cam follower 25, the purpose of which will appear presently. In the absence of pressure upon the cam follower 25, the resilience of the contact fingers 20 and 21 maintains the contacts B in engagement with one another.

An arm or lever 26 is pivoted at one end about screw 27 on a post 28 extending from support 6. The other end of this arm is pivotally connected at 29 to the movable part 30 of a dash-pot mechanism. In the specific device shown, the part 30 comprises a cylinder, as shown more clearly in Fig. 6, slidably arranged on another cylinder 32 in telescopic fashion, the latter cylinder being held by a transverse pin 33 on a mounting post 34 which, in turn, is secured to a bracket 35 attached to the support 6. The ends of the cylinders 30 and 32 nearest the pivot 29 are closed to form an air chamber 36 (see Fig. 6). The cylinder 30 has a small opening 37 adjacent its end, which opening is closed by a small cap or cover 38 normally held against the opening by the spring arm 39 on which it is mounted. It will be seen, therefore, that when the cylinder 30 is moved downward, as viewed in Figs. 2 and 6 the air within the diminished space 36 will be forced out through the valve 37, 38 and when the cylinder 30 is subsequently moved in the opposite direction, the low air pressure within the space 36 will retard the movement of the cylinder 30 until the partial vacuum within space 36 has been destroyed by the ingress of air between the cylinder walls.

As clearly shown in Fig. 2, a spring 40 has one end attached to the arm or lever 26, while the other end of this spring is anchored by a lug on the adjustable yoke 41 which is carried by bracket 15. This spring tends to rotate the arm 26 counter-clockwise, as viewed in the figure, about its pivot 27. Therefore, when the arm 26 is rotated clockwise, moving cylinder 30 downward, as viewed in Fig. 2, the spring 40 is placed under tension and tends to rotate the arm 26 counter-clockwise against the retarding effect of the dash-pot mechanism above described.

On the end of shaft 8, there is provided a collar 42*a* (see Figs. 4 and 7) having opposed lugs on which there is mounted an adjustable arm 42 which is held by a screw and washer. The arm 42 carries a pin 43 which cooperates with a finger 44 pivotally mounted on the arm 26 at 45 adjacent the shoulder 46 of the arm 26. As shown more clearly in Fig. 5, a small spring 47 has one end anchored to the arm 26 at 48 and is wrapped about a pin 49 on the arm 26 and the other end of this spring engages the finger 44 urging it in a clockwise direction, as viewed in the figure. The finger 44 is recessed to provide a shoulder 50 on which the pin 43 may seat and the ends of finger 44 is formed to provide a projection or nose 51.

The shaft 8 also carries a switch actuating member 52 (see Figs. 4 and 8) whose end is

formed to provide a projection or lug 52a which is adapted to cam the insulating pin 19, as described hereinafter, to actuate the switch A.

On the shaft 10, there is mounted an insulating cam 53 which is adapted to actuate the cam follower 25 and thus actuate the switch B, as will be described presently. Adjacent the cam, there is also mounted on the shaft 10 a ring or collar 54 having diametrically spaced projections or fingers 55 which are adapted to cooperate with the shoulder 46 on cam 26 in the manner hereinafter set forth. A spring finger 56 has one end anchored to the support 6 at 57 while its other end engages the cam 53. The free end of the spring finger 56 is shaped to conform to the low portions of cam 53 so that it tends to maintain the cam in the position shown in Fig. 2.

Considering the operation of the mechanism thus far described, normally, with the shaft 8 and the dial 7 in rest position, the parts are disposed as shown in Fig. 2 with the switch contacts A and B open. Therefore, as may be seen from Fig. 1, the generator 2 is normally inoperative. Suppose now that it is desired to generate a certain number of impulses which will be determined by the operation of the dial; that is to say, each finger aperture in the dial will correspond to a certain number of impulses and, in order to generate a desired number of impulses, the dial will be operated by inserting the finger in the corresponding finger aperture and rotating the dial until the operator's finger engages a stop 63 (see Fig. 10), as in the ordinary telephone inpulse sender. When the dial is rotated, the shaft 8 is caused to rotate counter-clockwise, as viewed in Fig. 2, and the cam projection 52a, which normally maintains the switch contacts A open, immediately releases the insulating pin 19 (see Fig. 5), permitting the contacts A to close. Thus, the filament circuit of the oscillator tube shown in Fig. 1 will be closed immediately, causing the filament to be heated by the current flowing therethrough. During the initial movement of arm 42, the pin 43 remains seated on the shoulder 50 of the pivoted finger 44, since the spring 47 causes the finger 44 to follow the pin. At the same time, the pin pressing upon shoulder 50 moves arm 26 clockwise about its pivot, through the medium of finger 44, against the restraining action of spring 40. Thus, the cylinder 30 of the dash-pot mechanism is moved downward as viewed in Figs. 2 and 5, expending the air from the dash-pot chamber 36 and creating the vacuum therein, as above described. When the nose 51 of finger 44 strikes the adjacent collar 42a on shaft 8, as shown by the dot-and-dash illustration in Fig. 5, the finger 44 is no longer able to follow the pin 43 and the pin rides off the shoulder 50, thus releasing the arm 26. The dash-pot mechanism, however, prevents arm 26 from being moved immediately by spring 40.

When the dial is released, the shaft 10 rotates in a counter-clockwise direction, as viewed in Fig. 2, and one of the fingers 55 abuts against the shoulder 46, which has been moved into the path of fingers 55 by the downward movement of arm 26 (see Fig. 5). The rotation of shaft 10 and cam 53 is, therefore, interrupted before a low portion of the cam has engaged the cam follower 25, and the switch contacts B are maintained open. When the vacuum effect of the dash-pot mechanism has diminished sufficiently to permit the spring 40 to rotate arm 26 clockwise, as viewed in Figs. 2 and 5, the shoulder 46 releases the finger 55 and permits the shaft 10 and cam 53 to rotate under the influence of spring 9 until the parts are returned to their normal positions shown in Fig. 2. During this return movement, the cam 53 actuates the follower 25 to intermittently close the switch contacts B, as indicated in Fig. 9. The time delay provided by the dash-pot mechanism thus prevents operation of the generator 2 until the filament of tube 3 has been heated for a time sufficient to raise it to its emission temperature. The switch contacts B are then caused to close intermittently to cause the oscillator to generate successive signal impulses.

It will be noted that the operation of the device may be varied by adjusting the arm 42 and also by adjusting the yoke 41 since the arm 42 serves as an operating link to actuate arm 26 during the time that pin 43 is seated on shoulder 50. The amount that arm 26 is moved about its pivot may be varied by adjusting arm 42. The adjustment of this arm also varies the time interval before the projection 51 strikes the adjacent collar 42a on shaft 8 and, therefore, varies the point in the operating cycle at which the pin 43 disengages from shoulder 50. The adjustment of yoke 41 varies the tension of spring 40 and, therefore, varies the force tending to rotate the arm against the action of the delay mechanism. Bearing in mind that the finger dial is rotated different angular amounts, depending upon the number of impulses which it is desired to send, the arm 42 and the yoke 41 should be so adjusted that the pin 43 will disengage itself from shoulder 50 when the dial is actuated by means of any one of its finger holes and the shoulder 46 of arm 26 acts as a stop to interrupt rotation of shaft 10 in each instance.

The device also embodies means for controlling the duration of certain signal impulses, which feature is claimed in the parent application of which this application is a division. The mechanism provided for this purpose is shown in Figs. 10 and 11, wherein the dial impulse sender is shown in upright position in dot-and-dash perspective. Only so much of the mechanism as is necessary to illustrate and describe this further feature of the invention is shown in these figures. On the plate 58 of the dial there is provided a laterally turned arm 59. A detent member 60 extends through an opening in the bottom of the casing 6 so that it may rock on its shoulders 60a to move into or out of the path of the arm 59. A leaf spring 62 engages the detent member 60 and normally maintains its end 61 out of the path of arm 59. A depressible bar 64 is carried by pin 65 which, in turn, is attached to the outer extending end of detent member 60. When the bar 64 is depressed, the detent member 60 is rocked against the restraining action of spring 62 to bring the end 61 into the path of the arm 59 of the rotatable plate 58. The operator usually employs the index finger of either hand to operate the dial and, when the finger strikes the finger stop 63, the bar 64 may be depressed by means of the thumb. It is important to note that the bar may be depressed by the thumb or a finger of either hand so that the device is readily usable by left-handed persons as well as right-handed persons.

When it is desired to generate impulses of uniform short duration, the bar 64 is not depressed and the device is operated and functions as above described to generate the short impulses. When it is desired, however, to generate a pulse of longer controllable duration, the bar 64 is

depressed when the finger strikes the finger stop 63, as above mentioned. It will be apparent that the angular position of arm 59 will determine the point in the operating cycle at which the rotation of shaft 10 is interrupted and will determine which of the successive impulses may be prolonged by depressing the bar 64. For example, the arm 59 may be so disposed angularly that it interrupts the rotation of shaft 10 when the switch contacts B have closed to send the last one of the several impulses. It will be apparent, of course, that in such case the number of short impulses ahead of the prolonged impulse will be determined by the number of impulses which are sent, or, in other words, by the particular finger hole of the dial which is used. Thus, if the dial contains nine finger holes, by means of which any number of impulses from two to ten may be sent and if the bar 64 were depressed in each instance, dialing the lowest number of impulses would cause a single short impulse followed by the long impulse, dialing the next larger number of impulses would cause two short impulses followed by the long impulse, and so on. In any case, as long as the bar 64 is maintained in depressed position, the last impulse of the series will continue until the bar is released, at which time the detent member 60 releases arm 58 and allows the mechanism to move to the rest position.

While the present invention is not concerned with the use to which it may be desired to put the device, it might be mentioned that in the said copending M. L. Thompson application the volume level of the remotely controlled radio receiver is controlled by sending either a short pulse followed by a long pulse or two short pulses followed by a long pulse. The short pulse or pulses determine the direction of variation of the volume control while the long pulse determines the amount of variation. Such use is illustrative of the uses to which the present device may be applied.

While the apparatus provided by the invention is particularly adapted for use in the system of the M. L. Thompson application as above mentioned, it is not limited to such use and may be used in any instance where it may be employed to advantage. Moreover, although the generating device 2 of the apparatus illustrated is also the receiver of impulses from the impulse-sending device, it will be understood that the impulse sender may be used in combination with any other form of impulse-receiving device whose operation is to be controlled by the impulse-sending device.

Although a single preferred form of the apparatus has been illustrated and described for the purpose of disclosure, it will be understood that various modifications may be made without departing from the scope of the invention.

I claim:

1. In a device for controllably generating electrical signal energy, means for generating signal energy, said generating means requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said generating means, normally disengaged contacts on said impulse sender for controlling the operation of said generating means, means including an energy storing element for operating said contacts when energy is stored in said element, normally disengaged contacts on said impulse sender for preconditioning said generating means, manual means on said impulse sender for storing energy in said element and for closing said last-mentioned contacts, and means for delaying operation of said first-mentioned contacts by said energy storing element for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation.

2. In a device for controllably generating electrical signal energy, means for generating signal energy, said generating means including a conditioning circuit and an output circuit, and requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said generating means, normally disengaged contacts on said impulse sender for controlling the output circuit of said generating means, means including an energy storing element for operating said contacts when energy is stored in said element, normally disengaged contacts on said impulse sender for energizing said conditioning circuit, manual means on said impulse sender for storing energy in said element and for closing said last-mentioned contacts, and means for delaying operation of said first-mentioned contacts by said energy storing element for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation.

3. In a device for controllably generating electrical signal energy, means for generating signal energy, said means including a space discharge device having a filament and a space current circuit, an impulse sender for controlling said generating means, normally open contacts on said impulse sender for controlling the space current circuit of said space discharge device, means including a spring for operating said contacts when energy is stored in said spring, normally open contacts on said impulse sender for energizing said filament, a finger dial on said impulse sender for storing energy in said spring and for closing said last-mentioned contacts, and means for delaying operation of said first-mentioned contacts by said spring for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation.

4. In a device for controllably generating electrical signal, energy, means for generating signal energy, said generating means requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said generating means, a pair of adjacently-disposed normally-open contacts on said impulse sender for controlling the operation of said generating means, means including an energy storing element for closing and opening said contacts intermittently when energy is stored in said element, a pair of adjacently-disposed normally-open contacts on said impulse sender for preconditioning said generating means, manual means on said impulse sender for storing energy in said element and for closing said last-mentioned contacts, and means for delaying operation of said first-mentioned contacts by said energy storing element for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation.

5. In a device for controllably generating electrical signal energy, means for generating signal energy, said generating means requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said

generating means, normally disengaged contacts on said impulse sender for controlling the operation of said generating means, other normally disengaged contacts on said impulse sender for preconditioning said generating means, a rotatable shaft, a spring for normally maintaining said shaft in a rest position and for rotating said shaft to said position whenever it is moved therefrom, manually operable means for rotating said shaft from said position and for simultaneously storing energy in said spring, means operable by said shaft upon its rotation from said position to close said last-mentioned contacts, means operable by said shaft during its return motion to actuate said first-mentioned contacts, and means for delaying the operation of said first-mentioned contacts by the spring-driven shaft for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation.

6. In a device for controllably generating electrical signal energy, means for generating signal energy, said generating means requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said generating means, a pair of adjacently-disposed normally-open contacts on said impulse sender for controlling the operation of said generating means, a second pair of adjacently-disposed normally-open contacts on said impulse sender for preconditioning said generating means, a rotatable shaft, a spring for normally maintaining said shaft in a rest position and for rotating said shaft to said position whenever it is moved therefrom, manually operable means for rotating said shaft from said position and for simultaneously storing energy in said spring, means operable by said shaft upon its rotation from said position to close said last-mentioned contacts, means operable by said shaft during its return motion to close and open said first-mentioned contacts intermittently, and means for delaying the operation of said first-mentioned contacts by the spring-driven shaft for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation.

7. In a device for controllably generating electrical signal energy, means for generating signal energy, said generating means requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said generating means, a pair of adjacently-disposed normally-open contacts on said impulse sender for controlling the operation of said generating means, a cam-carrying shaft for closing and opening said contacts intermittently, a spring for rotating said shaft, a pair of adjacently-disposed normally-open contacts on said impulse sender for preconditioning said generating means, manual means on said impulse sender for storing energy in said spring and for closing said last-mentioned contacts, and means for delaying operation of said first-mentioned contacts by said spring-driven shaft for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation, said delaying means comprising a spring-biased detent element rendered operative by said manual means to prevent rotation of said shaft, and a dash-pot arranged to retard movement of said detent element to inoperative position by its biasing spring.

8. In a device for controllably generating electrical signal energy, means for generating signal energy, said genergating means requiring preconditioning for a short interval prior to signal generation, an impulse sender for controlling said generating means, a pair of adjacently-disposed normally-open contacts on said impulse sender for controlling the operation of said generating means, a cam-carrying shaft for closing and opening said contacts intermittently, a spring for rotating said shaft, a pair of adjacently-disposed normally-open contacts on said impulse sender for preconditioning said generating means, manual means on said impulse sender for storing energy in said spring and for closing said last-mentioned contacts, and means for delaying operation of said first-mentioned contacts by said spring-driven shaft for a predetermined interval following the closing of said last-mentioned contacts, to permit proper conditioning of said generating means for operation, said delaying means comprising a spring-biased detent element, an adjustable linkage operable by said manual means to move said detent element to a position where it prevents rotation of said shaft, and a dash-pot arranged to retard return movement of said detent element to its inoperative position by its biasing spring.

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