

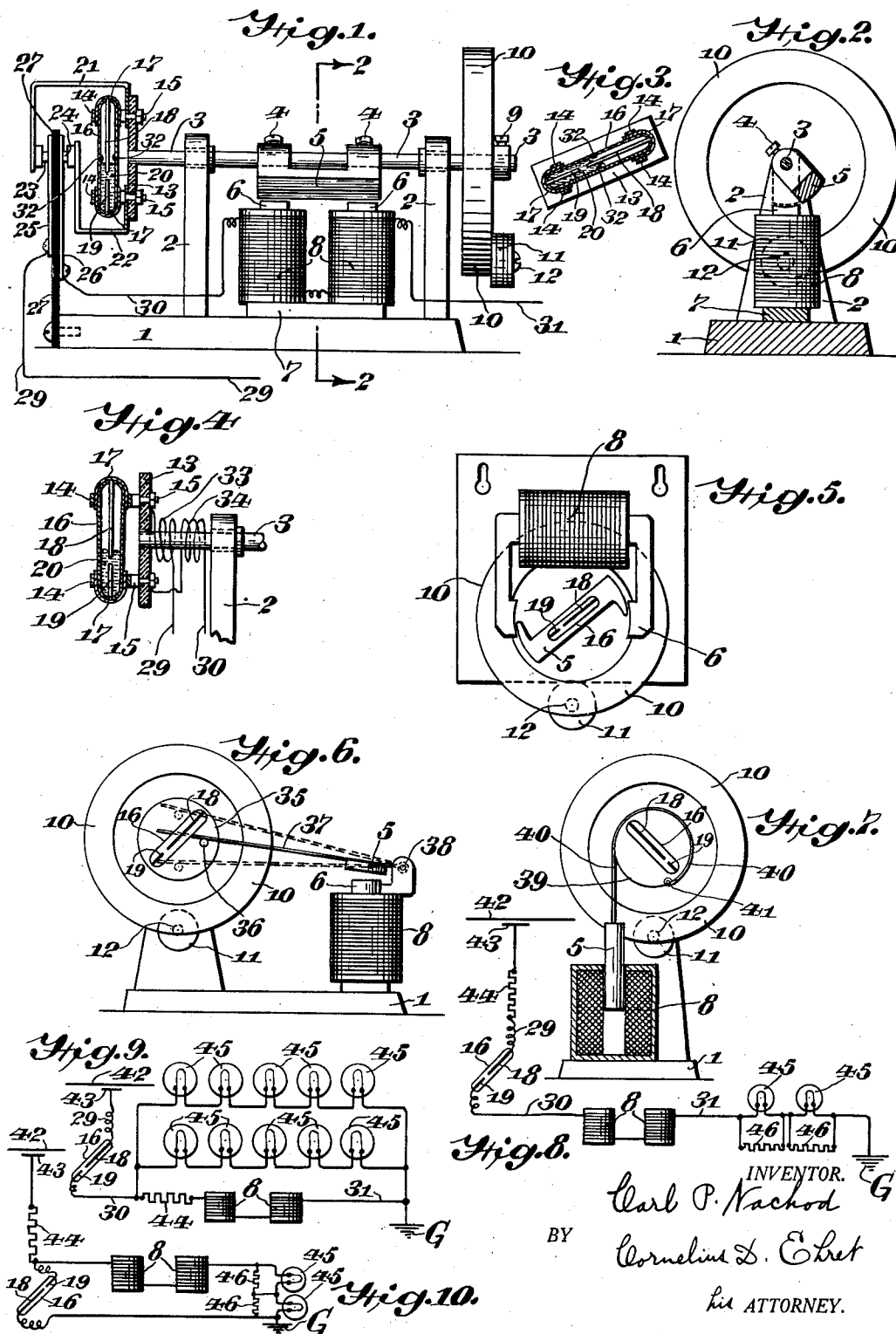
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PERIODIC CIRCUIT CONTROLLER

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PERIODIC CIRCUIT CONTROLLER.

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My invention relates to apparatus for effecting periodic control of a circuit, and more particularly for effecting a series of circuit closures and interruptions for rendering operative, and more particularly for controlling, visual, audible or other signals or indicators at grade or level crossings of railroads, and in kindred relations.

In accordance with my invention, a mechanical system, having considerable inertia and a suitable natural period of oscillation about an axis of rotation, is controlled by an electro-magnet whose circuit is controlled by a circuit closer and interrupter movable with the aforesaid mechanical system and controlling in addition to the circuit of the electro-magnet the circuit or circuits of the signaling or indicating devices.

Apparatus of the character described is utilizable for controlling electric lamp signals or indicators adjacent crossings of railroads, and particularly electric railroads, along whose trackway or adjacent whose trolley wire or contact conductor are disposed means for bringing apparatus of the character described into connection with the source of current on passage of a train or car before it reaches the crossing.

My invention resides in apparatus of the character hereinafter described and claimed.

For an illustration of some of the various forms my invention may take, reference is to be had to the accompanying drawing, in which:

Fig. 1 is a side elevational view, partially in section, of apparatus embodying my invention.

Fig. 2 is an end elevational view and in part a vertical section on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary end elevational view of the circuit closer disposed in one of the various angular positions to accord with the position of the armature indicated in Figs. 1 and 2.

Fig. 4 is a fragmentary side elevational view, partly in vertical section, of a modified structure for effecting connections with the periodically operated circuit closer and interrupter.

Figs. 5, 6 and 7 are views of modifications of my invention.

Figs. 8, 9 and 10 are diagrams of circuit arrangements utilizable in accordance with my invention.

Referring to Figs. 1, 2 and 3, upon the base 1 are carried the standards 2 forming bearings for the rotatable or oscillatory shaft 3, to which is secured by screw 4 the armature 5 of an electro-magnet having the poles or cores 6 co-acting with the yoke 7 and provided with the coils or windings 8. Secured to the shaft 3 by the screw 9 is the inertia member 10, of any suitable form, and having its mass or weight distributed in any suitable way about the axis of rotation of the shaft 3, but preferably in the form of a fly wheel or disk whose center of gravity coincides with the axis of rotation of shaft 3.

The shaft 3 and the parts attached there-to are biased towards a normal position, as by a spring, or, as indicated, by the weight structure 11 comprising a plurality of weights hung upon the screw 12 secured to the member 10, utilization of a plurality of weights serving to effect adjustment of the biasing force acting upon the oscillatory system and adjustment of the period of oscillation.

Carried by the shaft 3 and angularly adjustable thereon is the member or bracket 13, of insulating material. The clips 14 are disposed upon the ends of posts 15 carried by the member 13. In the conducting clips 14 is held the circuit closer and interrupter comprising any suitable structure, but in the example illustrated, and as preferred, comprising a glass or non-conducting tube 16, preferably completely closed and sealed and carrying on its ends the metallic caps 17 engaging and electrically connecting with the contact clips 14. Disposed within the chamber 16 are the conducting rods or contacts 18 and 19, whose ends are spaced from each other and which extend through the wall of the chamber 16 and electrically connect with the caps 17. Enclosed within the chamber 16 is any suitable contacting means, preferably a conducting fluid 20, such as mercury, adapted to bridge and connect the contacts 18 and 19 with each other.

For effecting electrical connection with the contacts 18 and 19 there are provided the metallic brackets 21 and 22, secured to and electrically connecting with the posts 15 and

clips 14. The members or brackets 21 and 22 carry at the axis of rotation of the shaft 3 the contacts 23 and 24, respectively, engaging the co-acting fixed contacts 25 and 26, respectively, carried by any suitable structure, as, for example, the fixed member 27 of insulating material. By employing the contacts 23 and 24 at the axis of rotation of the structure the friction between those contacts and their co-acting contacts 25 and 26 has a minimum moment as affecting the oscillatory system comprising the shaft 3 and attached parts.

As indicated, the circuit closer and interrupter structure comprising contacts 18 and 19 is in series with the electro-magnet 8, thereby controlling its circuit and in turn controlled by the electro-magnet. As indicated in Fig. 1, the conductor 29 may connect the contact 25 with a source of current, which is accordingly connected through the brush or contact 23 and bracket 21 with the contact 18. Contact 19 is connected through bracket 22 with the brush or contact 24 and through it with the contact 26, which connects by conductor 30 with one terminal of the winding of the electro-magnet 8, whose other terminal connects with the conductor 31, which leads to the other terminal of the source of current.

Assuming the parts at rest, with the biasing weights 11 adjacent their lowermost position where the center of gravity of the system is lowermost as indicated in Figs. 1 and 2, and with the contact device 16 disposed, for example, in the position indicated in Fig. 3, and the armature 5 occupying the position indicated in Fig. 2, upon operation of the track instrument, trolley contactor or other equivalent circuit closing means, current will flow through the conductor 29 to contact 18, thence through the mercury 20 to contact 19, and thence through the electro-magnet 8 to the other terminal of the source of current. This will energize the magnet 8, causing it to exert an attractive force upon the armature 5, causing it to move to the magnet poles 6, thereby rotating the shaft 3 and all parts attached thereto. When the armature 5 reaches the position of maximum attraction thereon by the poles 6, it will be substantially in the vertical position indicated in dotted lines in Fig. 2, but the attractive force will have no rotative effect upon the shaft 3 and attached parts. When the armature 5 reaches the last mentioned position, or a position either in advance of it or beyond it, the circuit will be broken, because of movement of the mercury 20 along the tube 16 to position in which it no longer bridges the contacts 18 and 19. Angular adjustment of the circuit closing device 16 upon the shaft 3 will determine the angular position of the parts at which circuit rupture or circuit closure takes place. Upon the attraction of the arma-

ture 5 as above described, the inertia member 10, in addition to the contact device 16, is rotated, and the biasing weights 11 raised. Due to the inertia of the system, it will after the initial rotation in clockwise direction, as viewed in Fig. 2, continue in such direction after rupture of circuit at contacts 18, 19, or before or after deenergization of magnet 8, causing the amplitude of oscillation to be great enough to open the circuit at contacts 18 and 19 and to hold it open for a suitable time. After deenergization of the magnet 8 the inertia of the system is overcome by the weight 11, causing the rotative movement to cease and the system to return by a rotative swing in opposite direction, again carrying the armature to the right of the poles 6, as viewed in Fig. 2, and again closing circuit at contacts 18 and 19, whereupon the system will be given another impulse by the magnet 8. This cycle of operations is repeated, and the period of each oscillation and the amplitude of oscillation may be controlled and adjusted by varying the weight 11 and the inertia or mass of the member 10 and other parts rotating therewith.

While there is inherent in a contacting device of the character of the circuit closer and interrupter 16 described a time lag or retardation in the matter of circuit closure and interruption due to the time necessary for the mercury or equivalent to flow from one part of the tube 16 to another, such retardation or time lag may be accentuated by restricting the bore of the tube 16 between its ends, for example, as indicated at 32, 32.

The contacting device 16, armature 5, inertia member 10 and weight 11 are all angularly adjustable with respect to the shaft 3 and with respect to each other, and the adjustment of any one or more of them may be effected suitably to control the period of oscillation and its amplitude.

While, as described in connection with Fig. 1, it is preferred to use the contacts or brushes 23 and 24 in the axis of rotation of the shaft 3 for maintaining electrical connection with the moving circuit closer 16, any other suitable mode of obtaining such connection may be utilized. For example, as indicated in Fig. 4, there may be coiled around the shaft 3, but out of contact therewith, the spiral spring conductors 33 and 34, connecting with the posts 15 and through them with the contacts 18 and 19, respectively, and connecting at their other ends with the conductors 29 and 30.

While the magnet system as indicated in Figs. 1 and 2 is effectual, and desirable because of simplicity and cheapness of manufacture, it will be understood that my invention comprehends utilization of other types of magnet systems, including those indicated in Figs. 5, 6 and 7, all of which impart periodic impulses to the oscillatory system.

In Fig. 5 there co-act with the opposed

poles 6 of the electro-magnet 8 the Z-shaped armature 5, secured to the shaft which carries the inertia member 10 and the contacting device 16. In an arrangement of this character the force exerted by the magnet upon the rotating system is prolonged through a relatively great angle.

In the arrangement shown in Fig. 6, the shaft carrying the inertia member 10 and contact device 16 is provided with a disk 35 carrying a pin 36, upon which engages the lever 37 pivoted at 38 and carrying the armature 5 of the electro-magnet. When the magnet is energized and the armature 5 attracted, the lever 37 will be moved downwardly, as to the dotted position indicated, thereby rotating the system, which may swing beyond, and upon return the pin 36 will pick up the lever 37, carrying it to an upper position such as indicated by dotted lines.

In Fig. 7 there is attached to the shaft carrying the inertia member 10 and the contact device 16 a disk or drum 39, upon whose periphery bears a belt, cord or chain 40, or equivalent, attached at its one end 41 to the disk 39 and at its other end to the solenoid core 5 co-acting with the solenoid winding 8. By this structure again, periodic rotative impulses are given to the oscillatory system.

The apparatus described may be utilized in various circuit arrangements, of which Figs. 8, 9 and 10 are examples, any suitable type of circuit closer serving to connect the apparatus with a source of current.

In Fig. 8, 42 represents a contact conductor or trolley wire of an electric railway system, and 43 represents a contact disposed adjacent the conductor 42 and adapted to be brought into electrical communication therewith in any suitable way, upon passage of a car or train. The contact 43 is connected, preferably through a resistance unit 44 and through the conductor 29, with the contact device 16. In series with the winding of the electro-magnet 8 are connected the electric incandescent lamps 45, 45, the circuit being completed to the ground or return conductor G. In shunt to each of the lamps 45 is preferably connected a resistance unit 46, whereby if any one of the lamp filaments burns out the circuit will not be permanently opened, but will be operative as regards control of the remaining lamp.

The contact 43 is preferably located at a point reached by a car or train in advance of the crossing at which the lamps 45 are placed. Upon passage of a car or train the apparatus is set into oscillation so long as the contact 43 remains in communication with conductor 42, and during this period of connection the apparatus will oscillate and periodically open and close the circuit through the magnet 8 and filaments of the lamps 45, which latter burn at great brilliancy so as to be observable not only at night, but in daytime as well. The

apparatus accordingly effects a flashing of the signal lights, compelling attention and giving notice that a train or car is approaching the crossing.

In Fig. 9 a plurality of groups of lamps 45 is connected in parallel with each other and in parallel with the magnet winding 8, in series with which latter may be utilized the resistance unit 44. Here again the lamps are flashed by periodically opening and closing the circuit by the device 16 so long as the contact 43 is in communication with the conductor 42.

In Fig. 10 the magnet winding 8 and the lamps 45 are in series with each other, but the contact device 16 is connected in shunt circuit to them, whereby the magnet winding 8 and the lamps 45 are energized when the contacts 18 and 19 are not bridged by the mercury, and are deenergized when these contacts are bridged by the mercury. Accordingly, and as indicated in Fig. 10, the position of the tube 16 is reversed as regards the position of the contacts 18 and 19, whereby with the parts in normal position, that is, when contact 43 is not in communication with conductor 42, the circuit between contacts 18 and 19 is open, as distinguished from closed, as indicated in Figs. 1, 5, 6, 7, 8 and 9.

As indicated in Fig. 2, and the same is true of the modifications of Figs. 5, 6 and 7, in the normal position of the apparatus, that is, when the circuit of the magnet is not energized and the parts are at rest, the armature or core of the solenoid of the electro-magnetic system is in a position intermediate the position of maximum attraction on the armature or core by the magnet system and either of the extreme positions between which the system oscillates.

The time lag or retardation of circuit closure and interruption hereinbefore referred to is of advantage in that upon circuit closure by the device 16 the electro-magnet will not only be energized, but will continue to be energized until movement of the oscillatory system to a position corresponding substantially with the position of maximum attraction of the electro-magnet upon its armature or core, the system continuing further in the same direction after circuit interruption, and during the next half oscillation or return swing the circuit of the electro-magnet is maintained open until the oscillatory system reaches a position carrying the armature or core to a position beyond its normal position. The time lag or retardation accordingly increases during one-half oscillation the length of time the electro-magnet is energized, and in the succeeding half oscillation increases the length of time the electro-magnet is deenergized, with the result that the amplitude of oscillation of the system is increased beyond the magnitude it would otherwise have without the time lag effect.

What I claim is:

Apparatus of the character described comprising a base, shaft-supporting structure carried by said base, a shaft journaled in said
5 structure, an inertia disk carried by said shaft, a weight carried by said disk at or adjacent its periphery, an electro-magnet, a contacting armature for oscillating said shaft, a
10 circuit closer comprising a plurality of contact members moving with said shaft and controlling the circuit of said magnet, con-

tacts disposed in the axis of rotation of said system and rotating therewith and connected with said contact members, and stationary
15 contacts with which said contact members respectively engage in the axis of rotation of said shaft.

In testimony whereof I have hereunto affixed my signature this 15th day of October, 1923.

CARL P. NACHOD.