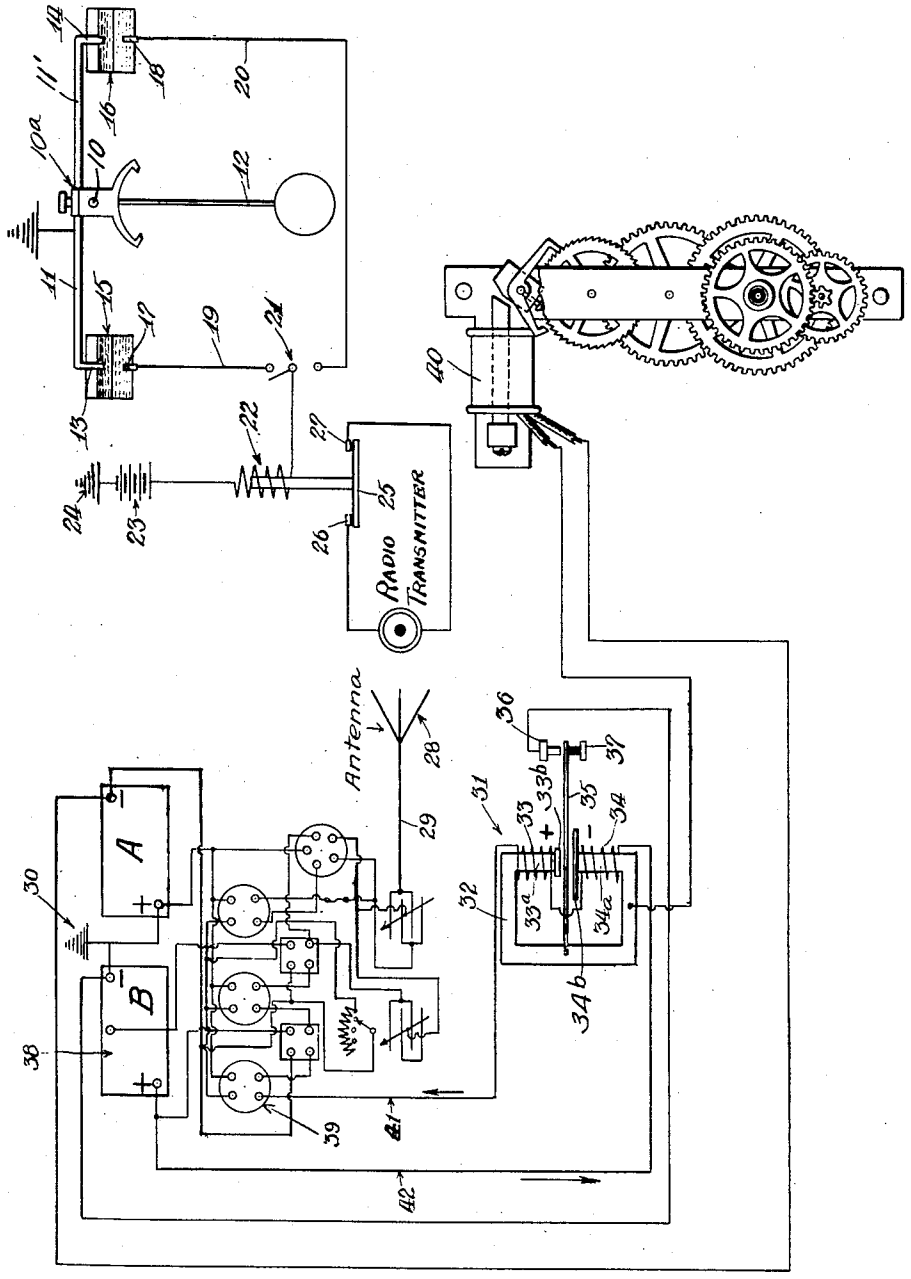
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ELECTROMAGNETIC RELAY

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ELECTROMAGNETIC RELAY

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1 Claim. (Cl. 175—339)

This invention relates to a system of radio control and has special reference to a system for remotely controlling devices such as secondary clocks, telegraph sounders, typewriters and the like by radio.

More particularly, this invention relates to a system employing a transmitting agent such as a master clock associated with a radio transmitter for sending periodic impulses, a radio receiving set tuned to receive the impulses transmitted, and a relay operated upon receipt of the impulses directed from the receiving set, the relay, in turn, operating the secondary electric clock or other device.

Heretofore, in so far as applicant is aware, there have been devices which are said to be adapted to be utilized in correcting clocks by Hertzian waves transmitted through space from a central station at which a standard time piece is located. These devices are corrective in function and do not actually operate the clock. Applicant contemplates the operation of a secondary clock by impulses sent periodically, preferably by seconds, from a master clock, the operation of the secondary clock being effected and controlled by a relay susceptible to the slightest electrical impulse but not affected by mechanical vibration or shocks.

One of the objects of this invention is to provide a system for operating a secondary clock or other similarly actuated mechanism from a transmitting agency through electrical waves.

Another object of this invention is to provide a simple, practical system of the above character for remotely controlling devices through a positively operated relay.

Other objects and advantages will hereinafter be more fully pointed out and for a more complete description of the characteristic features of this invention, reference may now be had to the following description and the accompanying drawing, in which latter:

The figure is a wiring diagram of one form of system of radio control embodying the features of this invention.

Referring now to the drawing, the system shown therein comprises a master clock control, a radio receiving unit, a relay and a secondary electric clock, or other devices subject to remote control such as telegraph sounders, registers, typewriters, and the like.

Referring first to the master clock control, the device shown comprises a master clock of the usual character such as the one employed at the United States Government station at Arlington, Virginia, the illustration showing but a fragmentary portion consisting of a small metal block 10*a* fastened on the pallet shaft 10 having the usual pallet points and the pendulum 12 depending therefrom. The block 10*a* is grounded to the frame of the clock and has a pair of horizontally extending arms 11 and 11' extending adjustably on opposite sides thereof and depending end portions 13 and 14, respectively, from the horizontally extending portions for dipping into containers 15 and 16, the latter being filled substantially with mercury and having a film of oil thereover to prevent deterioration of the mercury. Electrodes 17 and 18 extend through the bottom surface of the containers a substantial distance into the mercury and have wires 19 and 20 connected respectively to said electrodes and extending therefrom. The wires 19 and 20 lead to a single-pole-double-throw switch 21, the single pole thereof being connected to one end of the winding of the relay 22, the other end of the winding being connected through a battery 23 to the ground 24 of the clock. The relay 22 has the usual pair of contact members 26 and 27 which are bridged by the armature 25 to close the circuit through a radio transmitter.

In the operation of the device thus far described, when the depending portion 13 of the arm 11 dips through the film of oil and into the mercury in the container 15, the circuit is closed through the wire 19 and the single-pole of the double-throw switch 21 to energize the magnet of the relay 22 to attract the armature and thereby make contact with the terminals 26 and 27 whereby the radio transmitter is energized. The secondary clock which is to be controlled has a predetermined beat and, therefore, the pendulum 12 is so regulated to dip the arm portion 13 into the mercury to energize the radio transmitter and thereby to send impulses at such a predetermined rate.

In case an abnormal condition should exist in the circuit just described, then the pole of the single-double-throw switch may be operated to the other side of the switch whereby a dip of the depending portion 14 of the arm 11' into the mercury in the container 16 would energize the circuit through the wire 28 to the switch 21 and thence to the relay 22 and through the battery to the ground of the clock frame. However, it may be desirable to have both arms 11 and 11' energize their respective circuits whereby the number of impulses sent through the radio transmitter will be doubled since it is usual in

secondary clocks to have a 60 beat or 120 beat movement.

Referring now to the radio receiving set, this may be of any desired type, although the short wave set has been found preferable. We will hereinafter show and describe a radio receiving set operated by dry cells, although it is to be understood that the radio receiver may be operated through any desirable source of power and that a set such as is commonly known to the trade as an all-electric receiving set may be employed in this connection. The receiver illustrated in the drawing comprises one of a number of well known short wave hook-ups having a wave length coil such as are employed in short wave sets. The antenna 28 picks up the waves transmitted from the radio transmitter just described and sends the impulses through a lead-in-wire 29 to the terminal of a variable condenser, and thence through the usual operating parts of a radio receiving set to the ground 30.

Referring now more particularly to the relay 31, the latter comprises a vertically extending permanent magnet 32 having a tempered iron core in the shape of a capital G in side elevation. A coil 33 is disposed on the upper depending T-head portion 33*a* of the core representing the north pole of the G-shaped magnet and a second coil 34 on the lower upwardly extending T-head portion 34*a* of the core portion representing the south pole in substantial axial alignment with coil 33. It will be noted that the face surface 34*b* of the T-head of the lower core is substantially greater than the face surface 33*b* of the T-head of the upper core. Armature 35 is tiltably mounted on the other vertically extending full leg of the core of the magnet and extends between the enlarged face surfaces of the ends of the portions 33*a* and 34*a*, the free end of the armature being adapted to operate between a terminal 36 and an insulated pin 37, both of the latter members being adjustable to limit the vertically tiltable movement of the armature 35. One end of the coil 34 is connected with one end of the coil 33, the other end of the coil 33 being connected to the plate side of the tube 39 constituting the last stages of amplification of the radio receiving set, and the other end of the coil 34 extending to the plus side of the "B" battery 38. Terminal 36 is connected to the positive of the A battery, as shown in the figure.

In the operation of the system thus far described, when an impulse is received in the radio receiver, an impulse flows from the plus side of the "B" battery 38 through the lower magnet coil 34, the upper magnet coil 33 and back to the battery through the elements of the tube 39. When the radio set is in operation and no impulses are received from the radio transmitter, the electromagnet 40 therefore is energized whereby the iron circuit is completed by reason of the core portion 33*a* attracting the armature 35 and holding the same against the terminal 36. This action of the armature closes the circuit therethrough to the frame of the magnet 31, thence to one terminal of the magnet 40 of the secondary clock or other instrument to be controlled, the other side of the magnet of the secondary clock being connected to the negative side of an "A" battery, or to any battery or source of power. It may be desirable to employ a higher voltage for controlling a typewriter or other machine, and this may be conveniently arranged independently of the radio circuit, the connection shown herein being purely illustrative.

The secondary clock illustrated in the drawing is of the type shown and described in Patent No. 1,587,047, patented June 1, 1926 and issued to the applicant of the present application. The clock comprises a frame in which are mounted a series of shafts connected by gearing in the usual manner. When the escapement and the associated weighted beveled armature are disposed as shown in the drawing, the armature moves from one position to the other to engage the core of the magnet to draw down one of the pallet points to engage one of the teeth of the escapement wheel thereby causing the wheel to move a predetermined amount. When the electric impulse ceases the weighted armature moves the other of the pallet points downwardly to engage a tooth of the escapement wheel to move the same a distance in the same direction, the same predetermined amount as before described with reference to the other pallet point. The wheel preferably has 60 teeth and when an oscillatory movement of the armature is completed, the wheel will have moved a distance equal to 1/60th of its circumference. This, of course, may be varied at will.

With reference to the operation of the entire system when no impulse is received from the radio transmitter and the receiver is energized, the armature 35 normally occupies a position against the terminal 36 to complete a circuit through the device to be remotely controlled such as the hereinbefore described secondary electric clock. To deenergize this latter circuit, an impulse is received by the receiver and flows from the plus side of the "B" battery 38 through the lower magnet coil 34, upper magnet coil 33, and back to the battery through the elements of the tube 39, whereby the magnetic attraction of the core portion 33*a* for the armature 35 is overcome by the core portion 34*a* and the armature is moved downwardly out of contact with terminal 36 against the insulating pin 37.

The armature 35 is so positioned that, even when resting upon the insulating pin 37, it will be biased toward the upper or north pole limb of the permanent magnet 32, as a result of which it will naturally attempt to come in contact with the pole face 33*b*, but will be prevented from so doing by reason of the fact that the extreme free end of the armature 35 will touch the contact 36, thereby closing the circuit through the electromagnet 40. This accomplishes two very important results: first, accidental jars will not tend to disturb the circuit; and, second, when the impulse is received and is of sufficient duration—say one-tenth of a second—there will be time to overcome the lag of the magnet and insure the pulling down of the armature 35 toward the south pole of the magnet. This effect is enhanced by making the terminal of the lower limb of the magnet 34*a* larger by extending it into the form of a plate 34*b*. As soon as the impulse received through the ether ceases, the natural magnetism of the magnet will again assert itself, thereby pulling the armature 35 upward into contact with the contact pin 36, whereby the current flowing through the coil of the electro-magnet 40 is again re-established; and as a result thereof, the armature connected with the pallet of the clock movement is attracted toward and comes in

contact with the core of the said electromagnet 40.

It will thus be seen that with each impulse received by the radio receiver there will be an interruption in the secondary circuit, which consists of the battery, the circuit wires, and the electromagnet 40, whereby, under the weight of the armature connected with the pallet, the said armature will drop and the pallet will actuate the escapement wheel as already described, particularly in connection with the already mentioned prior patent of the same inventor, namely, Patent No. 1,587,047, June 1, 1926.

As the result of this operation, it can properly be said that the clock mechanism is directly driven by the impulses which are received from the radio transmitter itself. The present device differs from all previously known electric devices for showing time in that it is positively driven by impulses received at definite intervals of time, while the prior art devices concern themselves merely with periodic adjustments whereby clocks that are either in advance of or behind the true time are brought into synchronism with the master clock. The present clock, on the contrary, is at all times in direct accord with the master clock because each impulse, as received and amplified by the circuits hereinabove described, serves directly to actuate the clock itself. This is an essential and important feature of the present invention.

While but one embodiment of this invention is herein shown and described, it is to be understood that various modifications thereof may be apparent to those skilled in the art without departing from the spirit and scope of this invention and, therefore, the same is only to be limited by the scope of the prior art and the appended claim.

I claim:

An electromagnetic relay comprising the combination of a G-shaped permanent magnet formed of arms having two opposed pole pieces of opposite polarity at the gap of said magnet, one of said pole pieces being considerably larger than the other, coil windings on the two opposing poles of said magnet, the windings being so arranged that when current is passed through the coils the electromagnetic field set up will be opposed to the polarity of one of the arms of the magnet, a movable armature pivotally attached to the magnet body and horizontally disposed between the said poles, and means for biasing said armature toward one of the poles of said magnet.

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