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ELECTRICAL APPARATUS

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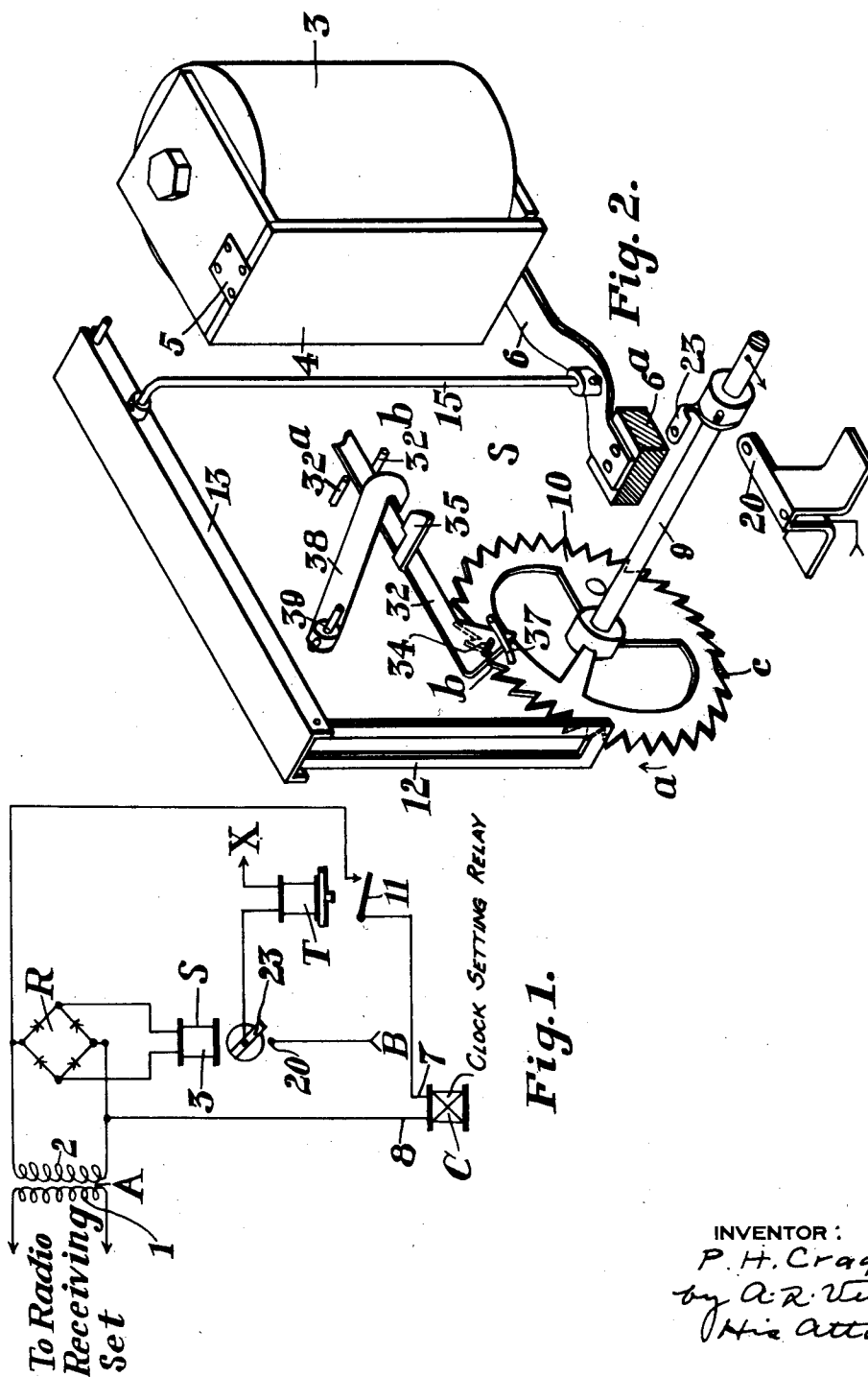


Fig. 1.

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UNITED STATES PATENT OFFICE

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ELECTRICAL APPARATUS

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My invention relates to electrical apparatus, and particularly to electrical apparatus embodying means whereby the last impulse of a code made up of a series of current impulses may be impressed on an electric circuit without impressing on the circuit any of the impulses preceding the last impulse.

My invention is particularly useful in its preferred form for employment in connection with a radio receiving set for automatically operating a clock setting relay or other similar apparatus upon the reception of the last impulse of the Arlington time signals. As is well known, the Arlington time signals comprise a series of modulated current impulses arranged in ten groups, one group being sent out during each half minute of a five minute period, and the last group being followed by one long impulse the beginning of which indicates the accurate time. These groups, with the exception of the last group, are made up alternately of 29 and 25 impulses, each of which is of a half second duration. The first impulse of each group begins at the beginning of the half minute period, and the impulses of each group are separated from each other by half second intervals so that there is a pause of one and one-half, or four and one-half seconds, as the case may be, between succeeding groups. The last group is made up of only twenty impulses, after which there is a pause of ten and one-half seconds followed by a one second impulse, the beginning of which indicates the correct time. For clock setting purposes, it is desirable to impress only the last impulse of this series on the circuit with which the clock setting relay is connected, and my invention provides a convenient means for accomplishing this result.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claim.

In the accompanying drawings, Fig. 1 is a diagrammatic view showing one form of apparatus embodying my invention. Fig. 2 is a perspective view showing, on an enlarged scale, certain of the operating parts of the selector S illustrated diagrammatically in Fig. 1, and also embodying my invention.

Similar reference characters refer to similar parts in both views.

Referring first to Fig. 1, the reference character A designates a transformer, the primary 1 of which is connected with the output circuit of a radio receiving set (not shown) so that the primary is supplied with current impulses corresponding to the Arlington time signals when such time signals are being transmitted. The secondary 2 of transformer A is connected with a selector S through a full-wave rectifier R which, may, for example, be of the well known copper oxide type. The secondary 2 of transformer A is also connected with the winding of an electromagnetic device, here shown as a clock setting relay C, over the front contact 11 of a relay T. The relay T is controlled by the contact 20—23 of selector S, and preferably has slow pick-up characteristics.

The selector S may be of any suitable form, but, as here shown, is of the general type described in Letters Patent of the United States, No. 1,004,566, granted to Edwin R. Gill on October 3, 1911, for a selective signaling device. Inasmuch as this selector is a well known piece of apparatus, only a brief description of the selector will be given here. Referring to Fig. 2, the selector comprises, as usual, an electromagnet 3, the armature 4 of which is supported by a spring 5, and has its lower and movable end attached to one end of a bowed spring 6, the other end of which is fastened to a fixed abutment 6^a. The bowed portion of the spring 6 is operatively connected by means of a connecting rod 15 with a pivoted propelling lever 13 in the movable end of which is journaled a propelling pawl 12. The propelling pawl 12 drives a toothed combination wheel 10, carried on a revoluble shaft 9, and biased in the direction indicated by the arrow *a* by suitable means not shown in the drawings. When the armature 4 is attracted to the poles of the electromagnet, it straightens the spring 6, thus raising the lever 13 and the propelling pawl 12. The return of the spring 6 to its normal position when the magnetic pull is discontinued causes the lever 13 to return to the position shown, and during the return

movement, the propelling pawl engages the combination wheel and moves the wheel forward one tooth. The return of the wheel to the starting position between successive strokes of the propelling pawl is prevented by a retaining pawl 34 which extends laterally from the end of a retaining lever 32 arranged to move in both the vertical and horizontal planes. The pawl 34 is arranged to drop by gravity behind successive teeth of the wheel 10 as the wheel is stepped around. The upper and lower limits of movement of lever 32 are determined by fixed stops 32^a and 32^b. A catch 35 projects from the side of the retaining lever 32. Directly above this catch a hook 38 hangs from a shaft 39 to which it is fixed, and with which it swings freely. The positions of the parts are such that, whenever the pawl 34 and catch 35 are raised, the hook 38 drops automatically into place under the catch and holds the pawl 34 on a level with the upper parts of the teeth of the wheel. Under these conditions, the shape of the particular tooth opposite the pawl will determine whether the pawl will or will not hold the wheel against its bias. If the top part of the tooth is normal to the plane of the wheel, the pawl will hold. If the top part of the tooth on the side adjacent the lever 32 is beveled, however, the bevel forces the pawl laterally away from the wheel, and the wheel returns to its normal position due to its bias, whereupon, an inclined pin 37 engages the tip of the lever 32 and restores the pawl 34 to its engaging position in the plane of the wheel 10. If a sufficient time interval elapses between successive energizations of the electromagnet 3, the hook 38 will be moved completely out of engagement with the catch 35 by means not shown in the drawings and the pawl 34 will drop into engagement with the lower part of a tooth on the wheel 10. The means for accomplishing this result is fully explained in the patent referred to above and need not be described here. Whether the pawl will or will not hold the wheel against its bias when the pawl is in this latter position again depends upon whether the part of the tooth which the pawl then engages is normal to the plane of the wheel or is beveled. When the wheel has been advanced into a predetermined position a contact arm 23 on the shaft 9 engages a fixed contact 20 and closes a contact 20—23 which may be used to control any electric circuit in a manner well known in the art.

As pointed out in connection with Fig. 1, the electromagnet 3 of selector S is connected with the secondary 2 of transformer A through rectifier R and it will be apparent that each time a current impulse of the time signals is received the electromagnet 3 will become energized. For purposes of my invention it is desired that relay T controlled

by contact 20—23 of selector S will not become closed until after the last impulse of the last group of the time signals is received, and in order to accomplish this result I employ a combination wheel 10 in which the starting tooth *b* has the top of the tooth cut away in the usual manner, and in which the twentieth tooth has the side nearest the lever 32 beveled so that the retaining pawl will be disengaged from the wheel when this tooth is opposite the pawl. Furthermore, I place the contact arm 23 on the shaft 9 in such a position that this arm will engage the fixed contact 20 to close contact 20—23 when the pawl descends after electromagnet 3 has been energized by twenty successive impulses, and I also adjust the parts of the selector in such manner that the hook 38 will move out of engagement with the catch 35 to permit the pawl 34 to engage the bottom of a tooth of the combination wheel when a time interval elapses between successive energizations of the electromagnet 3 which is greater than that between the successive impulses of each group but which is less than that between successive groups.

With the parts of the selector arranged and constructed in this manner, the operation of the apparatus as a whole is as follows: Under normal conditions, electromagnet 3 is deenergized, and lever 13 occupies the position in which it is shown in Fig. 2. The hook 38 is out of engagement with the catch 35 and the retaining pawl 34 therefore engages the bottom of the starting tooth *b* of the combination wheel 10, so that the parts of the selector mechanism are in their normal starting positions. As soon as the reception of time signals commences, each impulse received energizes electromagnet 3, thereby raising pawl 12 to its upper position and, during the pause between successive impulses, electromagnet 3 becomes de-energized so that the pawl descends to its lower position under the action of spring 6, thus causing the combination wheel 10 to be advanced one tooth for each impulse which is received. When twenty such impulses have been received, the descent of the pawl following the twentieth impulse causes contact 20—23 to become closed. But this contact only remains closed for the brief interval of time between the twentieth and twenty-first impulse of each group during the first nine groups of impulses, because, due to the fact that the twentieth tooth of the combination wheel is beveled, as soon as the twenty-first impulse is received, the retaining pawl is forced away from the combination wheel and the combination wheel is returned by its bias to the position in which the inclined pin 37 engages the inclined end of the retaining lever 32. When the combination lever has returned to this position, the wheel will not start to notch up again until the first impulse of the next group

is received. This is due to the fact that the top of the starting tooth *b* is cut off, and the time interval which elapses between successive impulses of a group is not sufficiently long for the hook 38 to move out of engagement with the catch 35, so that the hook engages the catch and holds the retaining lever 32 in the position in which the retaining pawl 34 is out of engagement with the starting tooth, thereby permitting the wheel 10 to return to its initial position each time the electromagnet becomes energized. The time interval which elapses between successive groups, however, is sufficiently long so that the hook 38 moves out of engagement with the catch 35, and the pawl therefore drops to the bottom of the starting tooth during this pause, and the wheel is again notched up when the next group of impulses is received. It will thus be apparent that in each of the half minute intervals preceding the last such interval, the selector will step up to the position in which its contact is closed, and immediately release. In the final half minute interval, however, there are only twenty impulses, and when the propelling pawl descends after the twentieth impulse, the pawl will close the contact 20—23 and hold the contact closed until the reception of the final impulse which indicates the accurate time. Since the time interval which elapses between the twentieth impulse and the final impulse is nine and one-half seconds long, it follows that the contact 20—23 will remain closed for nine and one-half seconds before it is finally opened. When this contact is closed, relay T is connected with the terminals B and X of a suitable source of current not shown in the drawings. As previously pointed out relay T has slow pick-up characteristics, and I prefer to so proportion the parts of relay T that the relay will pick up when the relay is energized for a time interval which is less than nine and one-half seconds long but which is greater than the maximum time interval of four and one-half seconds between two successive groups. With the relay constructed in this manner it will be apparent that the relay will close its contact during the time interval preceding the final impulse, but that even if the contact of selector S should accidentally remain closed during the entire interval between successive groups the relay would not close its contact. When the contact 11 of relay T is closed, relay C is connected with the secondary 2 of transformer T, and since this contact becomes closed before the final impulse of the time signals is received, it follows that when the final impulse is received relay C is supplied with this impulse. This last impulse also releases the combination wheel of selector S and the contact of selector S therefore immediately opens. When this happens, relay T becomes de-energized, and

the parts are restored to the positions in which they are illustrated in the drawings.

While I have illustrated my invention as being particularly suitable for the automatic reception of the Arlington time signals it is understood that my invention is not limited to this use, but that it is equally applicable for use wherever it is desired to impress a particular impulse of a code made up of a series of current impulses on an electric circuit without impressing on the circuit the impulses preceding the particular impulse.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claim without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

Apparatus responsive to the Arlington time signals comprising a selector, means for supplying said selector with current impulses in accordance with the impulses of said time signals, a contact on said selector arranged to become closed only at the conclusion of the twentieth impulse of each group and to remain closed only until the next succeeding impulse is received, a slow pick-up relay controlled by said contact and arranged to become closed if said contact is closed for an interval of time which is longer than the interval of time between short and long groups, a winding, and means for supplying said winding with the final impulse of said time signals when said relay is closed.

In testimony whereof I affix my signature.

PAUL H. CRAGO.