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SIGNALING SYSTEM

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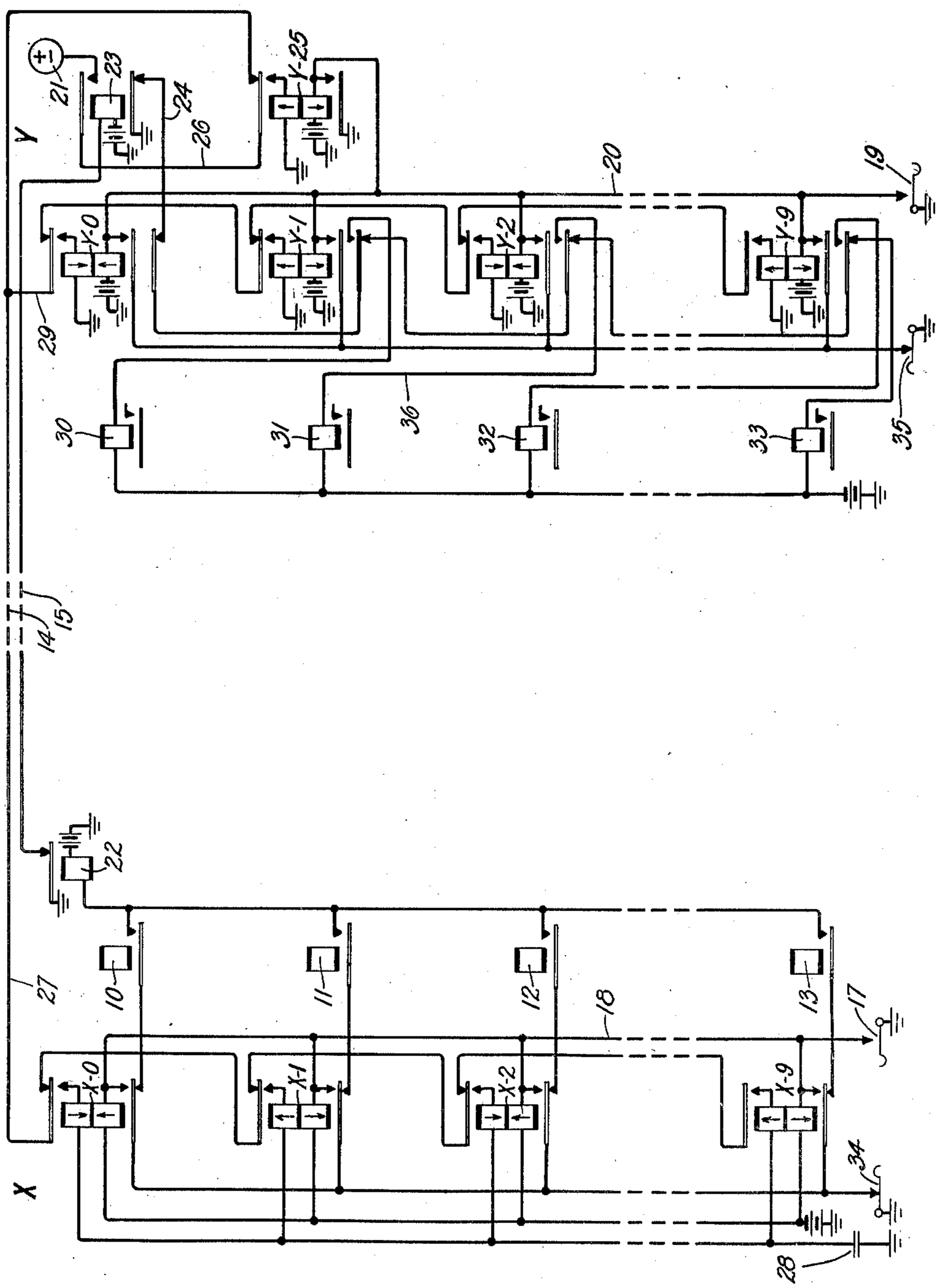


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# UNITED STATES PATENT OFFICE.

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## SIGNALING SYSTEM.

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The present invention relates to signaling systems, and more particularly to a system for transmitting predetermined numbers of impulses over long circuits.

In telephone exchange systems employing machine switching apparatus, senders are used in which records of wanted line numbers are registered either under the control of a subscriber's dial or under the control of an operator's keyboard. It is often desirable to transfer such registrations to other points in the exchange, for example, from suburban to local senders, or from a sender in an originating office to a sender in an office at a tandem point. In certain cases the offices between which it is desired to transfer such registrations may be quite widely separated so that difficulty may be experienced in accurately effecting the transfer, particularly if direct current is used. The present invention was evolved with this problem in mind and effects the transfer of registrations by transmitting impulse series over the link or loop circuit connecting senders or offices, by employing current of sinusoidal wave form as generated, for example, by the usual type of low frequency ringing generator.

The invention is illustrated in one of its embodiments in the accompanying drawing in which a portion of a sending equipment is shown at X at the left of the drawing, and in which a portion of a receiving equipment is shown at Y at the right of the drawing.

In the embodiment of the invention selected for the purpose of illustration, a train of impulse counting relays is shown at the office X, which relays are alternately polarized and responsive in succession to successive half waves of alternating current generated at the distant office Y and transmitted thereto over an interoffice link. Groups of register relays, only one group of which is shown, are also provided at the office X, which may be selectively set in any well-known manner to register a line number to be transferred to the office Y. These register relays cooperate with the counting relays to measure the number of impulses to be transmitted in any series of impulses. At the office Y a second train of similar counting relays is also provided, these relays being successively operated by successive half waves of alternating current, corresponding relays of both counting relay trains being simultaneously operated. At the office Y a single group of register relays is disclosed, which relays are selectively controlled by the counting relays of such office. While only one group of register relays has been disclosed at the office Y, it is obvious that in accordance with practice well known in the art, as disclosed, for example, in Patent No. 1,388,887, issued August 30, 1921 to L. Polinkowsky, a plurality of groups of such register relays could be successively controlled by the train of counting relays to register a plurality of series of impulses transmitted over a link corresponding to registrations at the office X.

The counting relays $X^0$ to $X^9$ and the counting relays $Y^0$ to $Y^9$ and $Y^{25}$ are all of the same type, each having two differentially placed windings. Each relay is arranged to be initially energized over its lowermost winding and when so energized to lock over one of its armature contacts. Certain of the relays are so wound as to be positively polarized by their energizing windings, whereas others are wound to be negatively polarized. Each relay when so energized may be released by an impulse of current through its upper winding of such polarity as to establish a flux in opposition to the flux produced by its energizing winding. Thus, for example, the even numbered relays $X^0 \ldots Y^8$, $Y^0 \ldots Y^8$ may be polarized to be released only by an impulse of positive current through their upper windings, and the odd numbered relays $X^1 \ldots X^9$, $Y^1 \ldots Y^9$ and $Y^{25}$ may be polarized to be released only by an impulse of negative current through their upper windings.

It is believed that the invention may be best understood by a detailed consideration of the circuits and apparatus disclosed in the drawing. It will be assumed that it is desired to transmit a series of two impulses over the interoffice link 14, 15 and to register such impulses at the office Y, and that for that purpose the register relay 11 of the sender at office X has been operated in any desired manner. When the sender at the office X is in readiness to transmit the impulses corresponding to the number regis-

tered by the register relay 11, a circuit is established in any desired manner as by the momentary operation of contact 17, extending over conductor 18, through the lower windings of all of the counting relays of the train $X^0$ to $X^9$, inclusive, in parallel to battery. Likewise, when the receiving apparatus at the office Y is in readiness to receive and record the impulses to be transmitted, a circuit is established in any desired manner as by the momentary operation of contact 19, extending over conductor 20 through the lower windings of all of the counting relays of the train $Y^0$ to $Y^9$, inclusive, and the lower winding of relay $Y^{25}$ in parallel to battery. These relays upon energizing all lock, independent of contacts 17 and 19, over the front contacts of their innermost lower armatures to ground at the release contacts 34 and 35.

To initiate the transmission of impulses of alternating current from the generator 21 which, for example, may be a ringing generator of the usual type capable of generating current at a frequency of 20 cycles, a circuit is established over the ring conductor of the interoffice link from ground at the back contact of relay 22, conductor 15 and to battery through the winding of control relay 23. Relay 23 energizes, disconnecting ground from conductor 24 at its lower back contact, and establishes a circuit from generator 21 over its upper front contact, conductor 26, upper front contact of negatively polarized relay $Y^{25}$ to ground. As soon as the generator 21 generates a negative half wave, the current then flowing through the upper winding of relay $Y^{25}$, which functions as a pick-up or sychronizing relay, will set up a flux in opposition to the flux set up by the lower winding of $Y^{25}$ and this relay will thereupon release.

With relay $Y^{25}$ released, the circuit previously traced to the upper armature of relay $Y^{25}$ becomes extended over the back contact of this armature to the tip conductor 14 of the interoffice link circuit, conductor 27, the upper armature and front contact of positively polarized relay $X^0$ to ground through condenser 28. The condenser 28 is inserted in this circuit at the office X to prevent any difference in ground potential existing between the two widely separated offices from adversely affecting the proper operation of the counting relays at the office X. A branch of the circuit just traced also extends over conductor 29 at the office Y, over the upper armature and front contact of positively polarized relay $Y^0$ to ground.

Since the current now flowing through the upper windings of relays $X^0$ and $Y^0$ is from the next succeeding positive half wave generated by the generator 21, the flux produced by the upper windings of these relays now opposes the flux produced by the lower windings thereof and these relays both release. The relay $X^0$ now extends the circuit from conductor 27, over its upper armature and back contact, the upper armature and front contact of relay $X^1$, through the upper winding of $X^1$ to ground through condenser 28. Similarly, relay $Y^0$ extends the branch circuit from conductor 14, over conductor 29, the upper armature and back contact of relay $Y^0$, the upper armature and front contact of relay $Y^1$, through the upper winding of relay $Y^1$ to ground.

On the next succeeding negative half wave generated by the generator 21, the negatively polarized relays $X^1$ and $Y^1$ are released in the manner previously described. Thus, on alternate half waves, corresponding X and Y relays are released until, upon the transmission of ten half waves over the conductors 14 and 29, that is, five positive and five negative half waves, the last relays $X^9$ and $Y^9$ of the two trains of counting relays become released, unless the transmission of impulses is arrested prior to the completion of ten full half waves.

In the case assumed the transmission of impulses will cease after the transmission of two half waves over the link circuit, and the release of counting relays $X^0$ and $X^1$ at the office X and relays $Y^0$ and $Y^1$ at the office Y, since the register relay 11 at the office X has been assumed to be operated. With relay 11 operated, as soon as relay $X^1$ releases, a circuit is established from ground at contact 34, over the lower armature and back contact of relay $X^1$, the contact of relay 11 to battery, through the winding of relay 22. Relay 22 energizes opening the operating circuit of relay 23, which releases, disconnecting the generator 21 from conductors 14 and 29, thereby preventing the transmission of further half wave impulses.

At its lower back contact, relay 23 establishes an operating circuit for the register relay 31 extending from ground at the back contact of relay 23, over the lowermost back contact of relay $Y^0$, the lowermost back contact of relay $Y^1$, the lowermost front contact of relay $Y^2$, conductor 36, winding of register relay 31 to battery. Thus, a register relay at the office Y having the same digital value as the register relay 11 at the office X has been operated.

Following the completion of the transmission of impulses, the remaining energized counting relays which were not released by current from the generator 21 may be released by opening the contacts 34 and 35 in their locking circuits in any desired manner. Inasmuch as the transmission of series of impulses having more or less impulses than two, as above described, will be obvious from an inspection of the drawing taken in connection with the description hereinbefore given, a further discussion of the op-

eration of the circuits will not be given herein.

What is claimed is:

1. In a signaling system, a circuit, a train of impulse counting relays at each end of said circuit, alternate ones of each of said trains of relays being positively polarized and the remaining relays of each train being negatively polarized, means for impressing successive half waves of alternating current successively and simultaneously upon corresponding relays of each train whereby said relays become successively operated, and means associated with one train of said relays for determining the number of relays in each train that shall be operated.

2. In a signaling system, a circuit, a train of impulse counting relays at each end of said circuit, a polarizing winding on each of said relays, means for energizing said windings whereby alternate ones of each of said trains of relays become positively polarized and the remaining relays of each train of relays become negatively polarized, a second winding for each of said relays, means for impressing successive half waves of alternating current successively and simultaneously upon the second windings of corresponding relays of each train whereby said relays become successively operated, and means associated with one train of said relays for determining the number of relays in each train that shall be operated.

3. In a signaling system, a circuit, a train of differentially wound counting relays at each end of said circuit, means for energizing and locking said relays over one winding of each, the energizing windings of said relays being so disposed that alternate relays of each train become positively polarized and the remaining relays of each train become negatively polarized, means for impressing successive half waves of alternating current successively and simultaneously upon the second windings of corresponding relays of each train whereby said relays become successively released, and means associated with one train of said relays for determining the number of relays in each train that shall become released.

4. In a signaling system, a circuit, a train of impulse counting relays at each end of said circuit, alternate ones of each of said trains of relays being positively polarized and the remaining relays of each train being negatively polarized, means for impressing successive half waves of alternating current successively and simultaneously upon corresponding relays of each train whereby said relays become successively operated, and selectively operated means cooperating with one of said trains of relays for disassociating said first means from said trains of relays when a desired number of said relays in each train have become operated.

5. In a signaling system, a circuit, a train of impulse counting relays at each end of said circuit, alternate ones of each of said trains of relays being positively polarized and the remaining relays of each of said trains being negatively polarized, means at one end of said circuit for impressing successive half waves of alternating current successively and simultaneously upon corresponding relays of each train whereby said relays become successively operated, and a polarized relay responsive to a half wave of one polarity from said means for associating said means with said circuit only when said means is in condition to impress a half wave of current on said circuit of a certain polarity.

6. In a signaling system, a circuit, a train of differentially wound counting relays at each end of said circuit, a differentially wound pick-up relay, means for energizing and locking all of said relays over one winding of each, the energizing windings of said relays being so disposed that alternate relays of each train become positively polarized, remaining relays of each train become negatively polarized and said pick-up relay becomes polarized oppositely to the first relays of each train, means for impressing alternating current first upon the second winding of said pick-up relay whereby when said current is of the proper polarity said relay releases, and means then controlled through the release of said pick-up relay to impress successive half waves of alternating current successively and simultaneously upon the second windings of corresponding relays of each train whereby said relays become successively released.

7. In a signaling system, a circuit, a train of impulse counting relays at each end of said circuit, alternate ones of each of said trains of relays being positively polarized and the remaining relays of each of said trains being negatively polarized, means at one end of said circuit for impressing successive half waves of alternating current successively and simultaneously upon the corresponding relays of each train whereby said relays become successively operated, register means associated with one train of relays for determining the number of relays in each train that shall become operated, and means associated with the other train of relays selectively operated in accordance with the number of relays so operated.

8. In a signaling system, a sending station, a receiving station, a circuit for connecting said stations, a train of impulse counting relays at each station, alternate ones of each of said trains of relays being positively polarized and the remaining relays of each of said trains being negatively polarized, means at one station for impressing successive half waves of alternating current on said circuit

and successively and simultaneously upon corresponding relays of each train whereby said relays become successively operated, means controlled at said sending station for associating said first means with said circuit, register means at said sending station for causing said first means to become disassociated from said circuit when a desired number of said relays in each train have become operated, and register means at said receiving station selectively operated in accordance with the number of relays so operated in the train thereat.

In witness whereof, I hereunto subscribe my name this 26th day of May, A. D. 1927.

WILLIAM C. BEACH.