

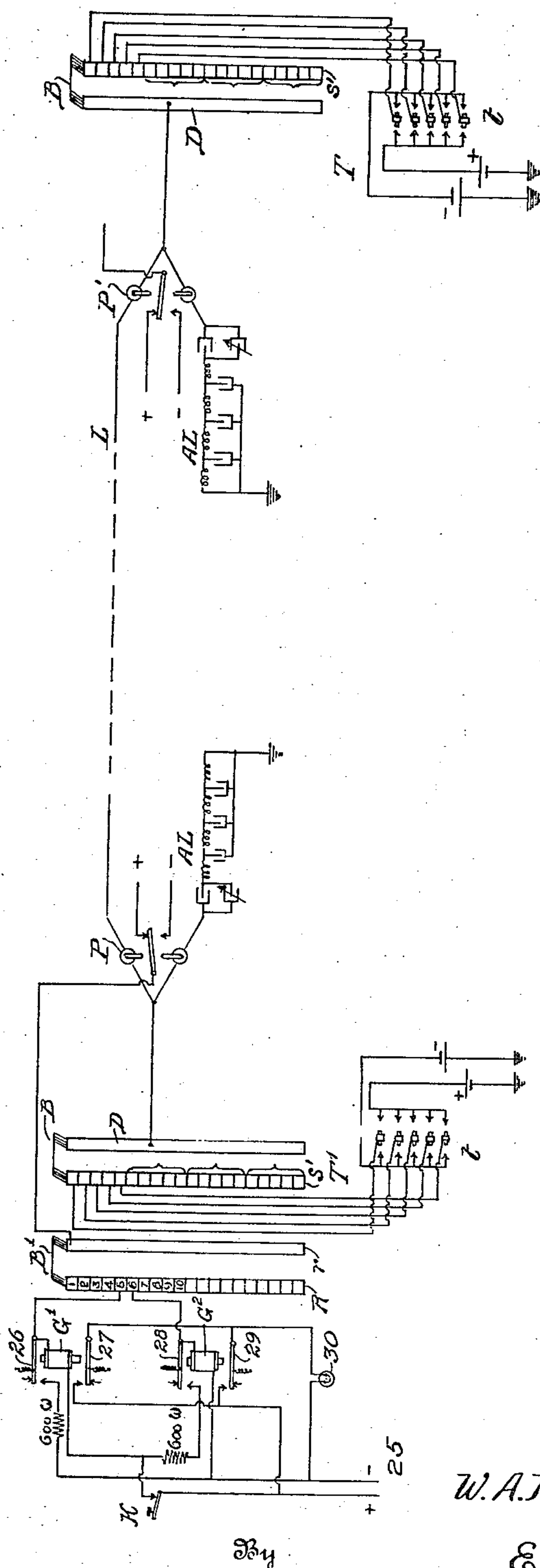
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TROUBLE INDICATOR FOR TELEGRAPH SYSTEMS

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TROUBLE INDICATOR FOR TELEGRAPH SYSTEMS.

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To all whom it may concern:

Be it known that I, WALTER A. HOUGHTALING, a citizen of the United States, residing at Dunellen, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Trouble Indicators for Telegraph Systems, of which the following is a specification.

This invention relates to multiplex systems of automatic telegraphy, wherein the code signals sent out by the transmitter at one end of the line or cable and received by the recording instruments at the other end of the line, are directed and controlled by distributors, usually of the rotary type, and which must be maintained in synchronism.

It frequently happens during certain hours of the day when business is light, that all of the available circuits of the multiplex system are not required for the transmission of telegrams and therefore, certain of the lines of the multiplex are idle. It is desirable, however, to maintain these idle lines or channels in condition to be instantly used in case of the failure of any of the active circuits or in case of an increase in the volume of business. Inasmuch as the idle lines are not under the direct observation of the operators or of the testing and regulating attendants, it is possible that trouble might develop in one of these circuits without the knowledge of anyone until it is required for service. The object of my invention is to provide means for indicating, either audibly or visibly, trouble of any character as soon as it develops.

The principal troubles which are likely to occur are due to the following causes, viz:—loss of synchronism, open circuit, grounded circuit, crossed line, and intermittent ground due to the swinging of the line so that it becomes crossed or grounded for short intervals. My trouble indicator will function when any of these troubles develop.

This invention is illustrated diagrammatically in the accompanying drawings, in which only so much of a multiplex telegraphic equipment has been shown as will be necessary to a clear understanding of the system.

The operation of my apparatus is based on the fact that the transmitters in the multiplex system are connected to the segments of successive quadrants of the distributors in a manner to send to line alternate positive

and negative pulses or current impulses; that is, the marking signals controlled by one quadrant of the distributor are positive while the marking signals of the next succeeding quadrant are negative. This insures four changes of polarity on the line per revolution of the rotary distributors. Thus, in systems employing the five-unit code, each quadrant is divided into five transmitting segments, so that the polarity will change as the brushes pass from the fifth to the sixth segments, and likewise in passing from the tenth to the eleventh, from the fifteenth to the sixteenth and from the twentieth to the first.

According to the method of correcting phase displacement between the synchronous distributors at the transmitting and receiving ends of a line employed on the Western Union lines, as disclosed in the Yorke and Benjamin Patent No. 1,215,605, dated February 13, 1917, the "corrected distributor" is provided with a "correcting relay" in the main line by which the correcting mechanism of that distributor is directly controlled. Each current reversal affords an opportunity for correction, but the correction mechanism operates only when, at the time of one or more of such reversals, one distributor is sufficiently out of phase with respect to the other distributor, to require correction.

The manner in which my trouble indicator is applied to the system above referred to will be understood by referring to the accompanying drawing. P and P' represent the main line polar relays at each end connected to the main line L and to the artificial lines AL, the usual transmitting arrangements being indicated conventionally at T and T'.

The automatic transmitters indicated at t, may be of the tape controlled type shown in U. S. Patent to G. R. Benjamin, No. 1,298,440 connected to segments of the transmitting ring s' of a multiplex rotary distributor D, the current impulses of the code signals being transmitted to the line L as the brush B traverses the segments.

R indicates the receiving ring and r its cooperating solid ring on the rotary multiplex distributor at one station. When operating on an idle circuit, positive impulses are normally received on the segments 1, 2, 3, 4 and 5, and negative impulses are re-

ceived on the segments 6, 7, 8, 9 and 10. Under this normal condition no current can flow either in the relay G' or the relay G^2 , since both terminals of relay G' are connected to positive battery and both terminals of relay G^2 are connected to negative battery. If, however, the distributors at the sending and the receiving stations are not in exact synchronism, the phase relationship between them is altered and the impulses received on the distributor ring R, does not always change from positive to negative as the brush B' passes from segment 5 to segment 6. If, for instance, the change occurs as the brush passes from segment 4 to segment 5, then a negative impulse is received on segment 5, so that current will flow through the relay G' to plus battery 25. Relay G' is thus energized and attracts its armatures 26 and 27. Current now flows through the coil of relay G' from the plus battery 25 through the normally closed switch button K, returning to negative battery 25 by way of armature 26 and its co-operating contact. This maintains the relay energized even after the brush has passed over segment 5. A circuit is also closed from the battery 25 through the signal lamp 30 by way of the armature 27 and its contact. The attention of the attendant is thereby called to the fact that the distributors are out of synchronism. The light is extinguished by depressing the button K to break the circuit through the relay G' .

If instead of changing between the segments 5 and 6, the polarity should change as the brush passes from segment 6 to segment 7, then segment 6 would receive a positive charge and current would flow through relay G^2 to negative battery 25, thereby attracting its armatures, closing a "locking" circuit through armature 28 and lighting the signal lamp 30 through the armature 29.

It is apparent, therefore, that any departure from exact synchronism and phase relationship causes a change in current polarity at some point in the receiving ring other than normal, which results in the operation of either one or both of relays G' and G^2 , thereby actuating the signal.

It will be evident that in case an open circuit develops, the signals sent out by the sending ring of the distributor at the home station are received on the receiving ring of the same distributor at the home station. Inasmuch as there is usually a phase difference of one or more segments between these two rings, the polarity reversals that occur between segments 5 and 6 on the sending ring will fall on the receiving ring between the segments 6 and 7 or later, thus actuating the relay G' or the relay G^2 and operating the signal in the manner previously described.

If the line becomes grounded, the impulses sent at the home station are of opposite polarity to those normally received from the distant station and consequently the signal will be operated as above described.

If the line becomes crossed or becomes temporarily grounded at intervals due to the swinging of the line wire, false signals are received which interfere with the synchronous operation of the two distributors and consequently the signal indicator will be operated as before.

If this device is to be used only at one end of the line, it should be located at the terminal where the receiving distributor runs slower than the sending distributor, and in case the line is so short that the time lag or time required for a signal to pass from the sending station to the receiving station is less than the time required by the brushes to pass from one segment to another, then a special combination such as the letter "e" should be locked in the second channel.

I claim:—

1. In a system of synchronous telegraphy, having a sending and a receiving station and a single line connected in duplex arrangement between said stations, the combination with the usual duplex line relays, of distributor equipments at such stations operating in synchronism and normally maintaining a predetermined order of current polarities in said line, and a trouble indicator comprising a signal device, a relay controlling the operation of said signal device and means effective under a non-synchronized condition of said distributors for actuating said relay, said means comprising opposite polarities adapted to be connected respectively to said signal relay under the control of the armature of said line relay.

2. In a system of synchronous telegraphy, having a sending and a receiving station and a single line connected in duplex arrangement between said stations, the combination with the usual duplex line relays, of distributor equipments at such stations operating in synchronism and normally maintaining a predetermined order of current polarities in said line, and means for indicating an abnormal condition in the system, comprising a relay having one terminal connected to a segment of the receiving ring of the distributor at the receiving station, a current source connected to the other relay terminal having a polarity the same as that of the current impulses normally received by said segment, the polarity of said impulses being controlled by the line relay, and a signal device controlled by said relay.

3. In a multiplex telegraph system, having synchronously operating distributors connected to the transmission line, said line being connected in duplex arrangement with

the usual duplex line relays at each station, means for indicating an abnormal condition in the system comprising two relays having one of their terminals connected to adjacent segments on the receiving ring of one of said distributors, and the opposite terminals connected respectively to opposite poles of a current source, and controlled by the line relay, and a signal device controlled by the armatures of said relays.

4. In a multiplex telegraph system, having synchronously operating distributors connected to the transmission line, means for indicating an abnormal condition in the system comprising two relays having one of their terminals connected to adjacent segments on the receiving ring of one of said distributors, and the opposite terminals connected respectively to opposite poles of a

current source, each relay having a pair of armatures, a holding or retaining circuit controlled by one armature of each relay and a signal device controlled by the other armature of each relay.

5. In a telegraph system, a line connecting two stations and connected in duplex arrangement with the usual duplex line relays, means for indicating a break or a ground in the line, comprising a pair of relays having one of their terminals connected respectively to opposite poles of a current source and their opposite terminals connected to the armature of the line relay, the latter connecting alternately to opposite poles of a battery, and a signal device controlled by the armatures of said pair of relays.

In testimony whereof I affix my signature.

WALTER A. HOUGHTALING.