May 15, 1945. S. W. BEYLAND 2,376,225

TELEGRAPH TRANSMISSION MEASURING SYSTEM

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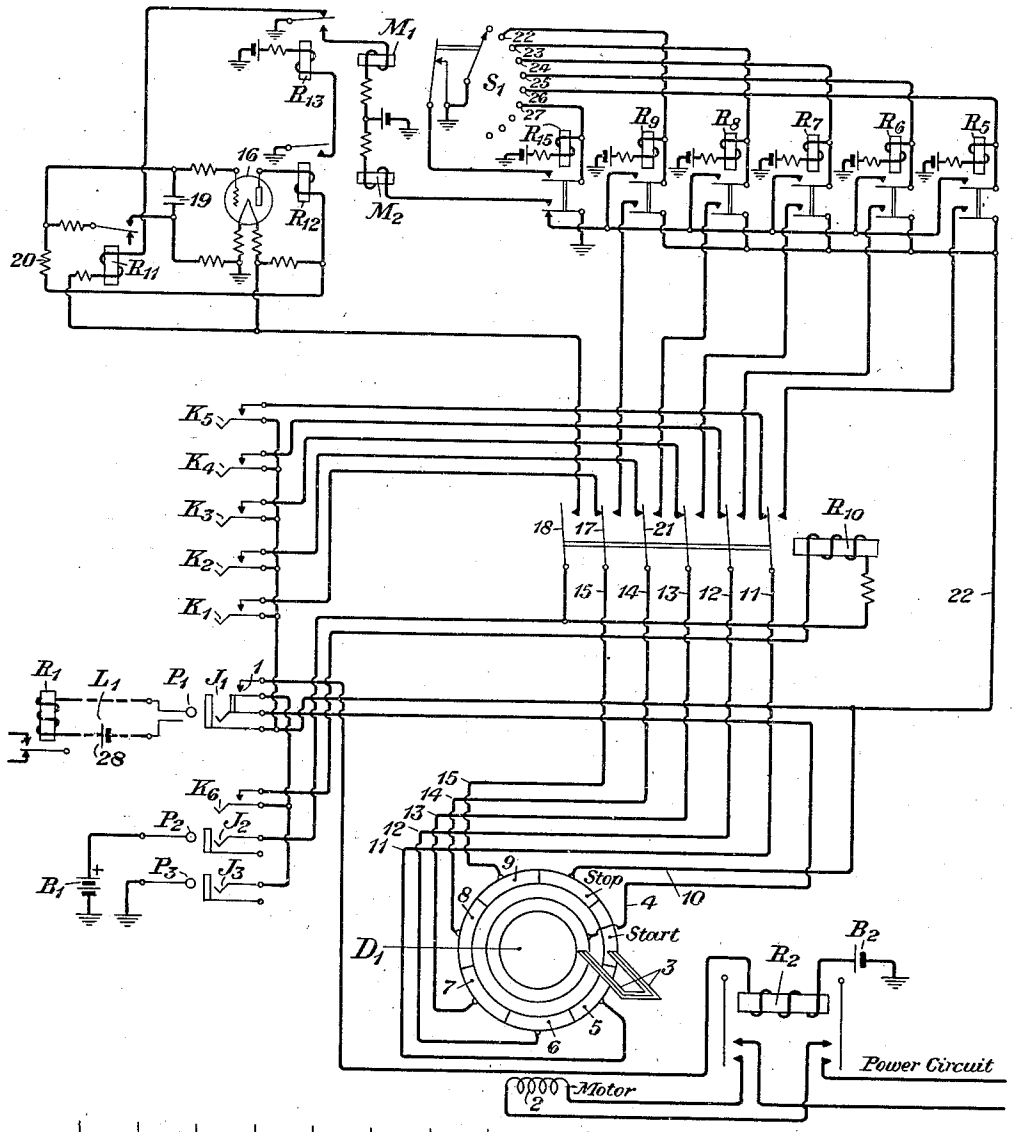


Fig. 1

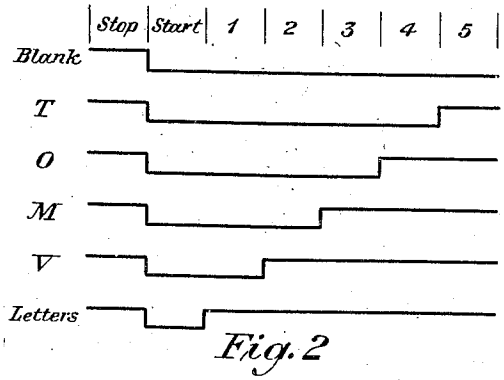


Fig. 2

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TELEGRAPH TRANSMISSION MEASURING SYSTEM

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8 Claims. (Cl. 178—69)

This invention relates to a teletypewriter testing system and particularly to one in which preselected teletypewriter characters may be automatically applied to a teletypewriter circuit in a given sequence for the testing of that circuit.

One of the great disadvantages of the method heretofore employed for equalizing metallic telegraph facilities and for testing for characteristic distortion was that the transmitter required constant attention on the part of an attendant and, furthermore, continuous communication had to be maintained with the receiving office. One of the objects of the present invention is to enable such testing signals to be applied automatically to the line to be tested, thereby eliminating the need for an attendant at the transmitting office to perform that function and, also, the need for continuous communication with the receiving office. That and other objects of this invention will be apparent from the following description when read in connection with the attached drawing of which Figure 1 shows schematically one form of embodiment of the invention, and Fig. 2 is a graph of the teletypewriter characters that may be transmitted by the circuit of Fig. 1, in order to accomplish the objects of this invention.

In Fig. 1 the line L_1 represents a teletypewriter circuit having at its distant end a teletypewriter receiver of the conventional type which is indicated symbolically by the relay R_1. That line terminates at the testing point in the plug P_1 which, when inserted in the jack J_1, connects the line to the testing circuit. A battery B_1 and a ground connection are adapted to be connected to the testing circuit by inserting the plugs P_2 and P_3 in the jacks J_2 and J_3, respectively. The keys K_1 to K_5, inclusive, provide manually operated means for the transmission of particular teletypewriter characters. The position of key K_6, that is, whether open or closed, determines whether the testing is to be done manually or automatically. Throughout manual operation K_6 is open, and for automatic testing it is closed. Thus with the key K_6 open, as shown in the drawing, and no other keys operated there would be transmitted over the line during one complete revolution of the distributor D_1 a series of impulses representing a blank in the teletypewriter code, as indicated in Fig. 2, that character consisting of a closed stop impulse, and open start impulse, and five open character impulses. With the key K_1 closed there would be transmitted the letter T which, as shown in Fig. 2 consists of the closed stop impulse, the open start impulse and four open and one closed impulses. With keys K_1 and K_2 both closed the letter O would be transmitted comprising three open and two closed character impulses; with those two keys closed and also key K_3 the letter M would be transmitted consisting of two open and three closed character impulses; and with the additional key K_4 closed the letter V consisting of one open and four closed character impulses would be transmitted; with those four keys, and in addition key K_5 closed the word "letters" would be transmitted consisting of five closed character impulses. While the manner in which such transmission is accomplished will be clearly described hereinafter, it is desired at this point merely to point out that by the operation of the keys K_1 to K_5 in sequence the teletypewriter symbols may be sent manually in sequence, but by permitting the keys to remain closed a given character may be sent repetitively throughout the period of closure.

The terms "open impulse" and "closed impulse" mean that the line circuit will be open or closed during the transmission of such impulses, thereby effecting the transmission of spaces and marks, respectively.

The insertion of plug P_1 in the jack J_1 closes the contact 1 which establishes a circuit from the battery B_2 through the relay R_2, contact 1 to ground at the plug P_3 thereby causing the operation of relay R_2, which applies power to the motor 2 that causes the brushes associated with the distributor D_1 to sweep over the inner ring and the outer segments of that distributor. Those brushes are connected so as to provide a conductive path between the outer and the inner ring of the distributor. Since such distributors are well known in the art, further description of how that is accomplished is felt to be unnecessary since it forms no part of this invention. The inner ring of the distributor is connected by conductor 4 to the tip of the jack J_1 and thereby to one side of the line L_1. The outer ring of the distributor is divided into seven segments, designated "Stop," "Start," and 5 to 9, inclusive. The stop segment is connected by conductor 10 to the sleeve of the jack J_1 through which it is in turn connected to the other side of the line L_1. The conductor 10 is also connected to the lower armatures of relays R_5 to R_9, inclusive, which form part of the equipment for the automatic transmission of the teletypewriter signals of Fig. 2 in sequence. Since the start impulse of a teletypewriter signal is always an open impulse, the start segment is not connected to any apparatus of the system. Segments 5 to 9, inclusive, are

connected by conductors 11 to 15, inclusive, respectively, to the armatures of relay R_{10}. That relay, when unoperated, connects the conductors 11 to 15, inclusive, to the contacts of keys K_1 to K_5, inclusive. When relay R_{10} is operated, its armatures connect the said conductors to the lower contact points of relays R_5 to R_9, inclusive, for the automatic transmission of the testing signals. The extreme left-hand armature 18 of relay R_{10} serves to connect the battery B_1 to the filament and plate of the vacuum tube 16, and likewise to the winding of relay R_{11}, which is associated with the circuit of the said vacuum tube. The plate circuit of that tube includes relay R_{12} which, when operated, in turn operates relay R_{13}. The operation of the latter relay in turn causes the operation of the magnet M_1, which causes the arm of the selector switch S_1 to rotate. The magnet M_2 causes the arm to be returned to its initial starting position after it has been stepped over a predetermined number of its contacts and thereby effected the operation of relays R_5 to R_9 and also relay R_{15}.

The manner in which the circuit is operated for the making of tests is as follows: Let it be assumed that the line L_1 is connected to the testing circuit by the insertion of the plug P_1 in the jack J_1, and that by the closing of contact 1 of that jack the motor 2 has caused the brushes 3 to move over the rings of the distributor D_1. It is perhaps necessary to point out that the brush arm does not stop and start as in so-called stop-start systems, but rotates continuously and uniformly as long as the contact 1 remains closed. Let it further be assumed that it is intended to transmit the letter T repetitively. Accordingly the key K_1 is closed and as the brushes 3 sweep over the inner ring of the stop segment the distributor D_1, a closed circuit will be established from that stop segment over conductor 10, the sleeve contact of the jack J_1 and the plug P_1, the lower conductor of L_1, battery 26, the winding of relay R_1 and the upper conductor L_1, thence over the tip contact of P_1 and J_1 and conductor 4 to the inner ring of the distributor D_1, thence through the brushes 3 to the stop segment thus forming a closed circuit. As the brush sweeps over the start segment, which has no external connection, the line circuit L_1 will accordingly be opened, and it will remain open as the brush sweeps over segment 5, because the circuit that connects that segment to the line is opened at the contact of key K_5. In like manner the circuits that connect segments 6, 7 and 8 are likewise open at contacts of keys K_4, K_3 and K_2, respectively. Accordingly four open or spacing impulses will be sent over the line as indicated by 1 to 4 of Fig. 2. The circuit that connects segment 9 to the line circuit is, however, closed at this instant as may be seen by tracing the connection of that segment through conductor 15, left-hand contact of armature 17, contact of key K_1 and the sleeve of jack J_1. Accordingly during the interval in which the brushes sweep over segment 9 the circuit of the line L_1 will be closed, as indicated by 5 of the graph of the letter T in Fig. 2. Therefore, as long as key K_1 remains closed and the distributor D_1 continues to operate, there will be sent over the line L_1 the impulses that represent the teletypewriter character T. If the key K_2 is also closed, and kept closed during several cycles of rotation of the distributor the teletypewriter character O will be transmitted repetitively over the line. In like manner the closing of keys K_3, K_4 and K_5 in succession will cause the transmission of M, V and "letters."

If we want to transmit those characters automatically and in sequence, all that is required is to close the key K_6. That serves to connect battery and ground to the winding of the relay R_{10} which, becoming energized, moves its armatures so as to close the right-hand contacts, thereby connecting the conductors 11 to 15, inclusive, to the relays R_5 to R_9, inclusive. As mentioned before, the operation of relay R_{10} serves also to connect battery B_1 to the filament of the vacuum tube 16 and also to the winding of relay R_{11}. Relay R_{11} operates and disconnects the negative biasing source from the grid of the tube 16. When the condenser 19 has lost its negative charge, the grid of the tube will gradually acquire a positive charge through the resistance 20 which is connected to the positive source of potential. As soon as the grid becomes sufficiently positive, current will flow from the plate to the filament and that, in turn, will operate relay R_{12} which will close the circuit of the winding of relay R_{13}. That opens the circuit of relay R_{11} and closes the circuit of the magnet M_1. The armature of relay R_{11} will be released, and the negative voltage will again be applied to the grid of tube 16, which will stop the flow of current through relay R_{12}. The operation of magnet M_1 causes the arm of the selector switch S_1 to move to its contact 22. That causes the operation of relay R_9 which locks through its upper contact and the lower contact of relay R_{15}.

It will be seen that segments 5 to 9, inclusive, are connected by conductors 11 to 15, inclusive, to the lower armatures of relays R_5 to R_9, inclusive. The operation of relay R_9 closes a circuit that may be traced from segment 9, conductor 15, armature 17 of relay R_{10}, lower contact and armature of relay R_9, conductor 22 to the sleeve side of the line, thence over the tip side of the line and conductor 4 to the inner ring of the distributor, which is connected by the brushes 3 to the segmental outer ring. Since the other relays R_5 to R_8, inclusive, are not operated at this time, the impulses transmitted by the sweep of the brush over segments 5 to 8, inclusive, will be open. There will accordingly be transmitted over the line a teletypewriter character representing the letter T.

Relay R_{11}, associated with the vacuum tube circuit, is of the slow-release type, in order to provide adequate time for the operation of the magnets M_1 and M_2 associated with the selector S_1. As soon as relay R_{13} is released, relay R_{11} will again operate and apply positive potential to the grid of tube 16, thereby causing that tube and its associated relay R_{12} again to operate. The time interval between such operations is determined by the values of the resistance 20 and the condenser 19, and that may be varied up to approximately two minutes.

Upon the subsequent operation of relay R_{12} relay R_{13} will be operated and the magnet M_1 will cause the arm of the selector to move on to its contact 23. That causes the operation of relay R_8 which also locks up through the ground connection upon the lower armature of relay R_{15}. The operation of relay R_8 also closes the circuit between segment 8 of the distributor D_1 and the line L_1, which circuit may be traced from that segment over conductor 14, armature 21 of relay R_{10}, lower contact and armature of relay R_8, conductor 22 and the sleeve contact of jack J_1 to the line L_1, thence over the tip contact to the inner

ring of the distributor. As soon as relay R_{13} operates, relay R_{11} will again be released and the negative potential will again be applied to the grid of the vacuum tube 16. The circuit of the said vacuum tube will again go through the same cycle of operations as has previously been described. The distributor D_1, the brush-arm of which is continuously rotating, will thereupon cause the transmission of the teletypewriter character O consisting of the closed stop impulse, the open start impulse, then three open and two closed character impulses, the latter corresponding to the unoperated condition of relays R_5, R_6 and R_7 and the operated condition of relays R_8 and R_9.

The arm of the switch S_1 will continue to step to the contacts **24**, **25** and **26** of the switch and will operate relays R_7, R_6 and R_5. The operation of those relays will effect the transmission of the characters represented by M, V and "letters," as the distributor continues to function. As soon as all of those characters have been transmitted, relays R_5 to R_9, inclusive, will be released in the following manner. Upon the stepping of the arm of the switch S_1 to its contact **27** relay R_{15} will be energized. That will remove the ground connection from relays R_5 to R_9, inclusive, and will permit those relays to return to their unoperated condition. The ground, however, will be applied to the release magnet M_2 which will continue to operate and will step the arm of the selector S_1 around until it is restored to its initial position, as shown in Fig. 1. The circuit is then in condition to repeat the teletypewriter signals starting with blank and proceeding through the characters T, O, M, V and "letters" as shown in Fig. 2.

Leaving out of consideration the stop impulse and the start impulse, which are always closed and open, respectively, it will be seen that the remaining impulses, herein designated as character impulses, as shown in Fig. 2, are such as to act as a satisfactory criterion of transmission for all characters in the teletypewriter code. The blank character consists of five open character impulses, the letter T consists of four open and one closed impulse in sequence; the letter O consists of three open and two closed impulses, and the letter M of two open and three closed impulses. The letter V consists of a single open impulse and four closed impulses, and the character "letters" consists of five closed impulses. By the transmission of the group of teletypewriter characters shown in Fig. 2, it is possible to test the condition of the line for the transmission of any teletypewriter character in that code. Furthermore, by means of the arrangement shown in Fig. 1 those characters may be transmitted automatically in sequence over the line, or a single character may be transmitted repetitively by the manual operation of one of the keys K_1 to K_5, inclusive.

While this invention has been disclosed as embodied in a particular form and arrangement of parts, it is not so limited, since it may be embodied in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A teletypewriter testing circuit including, in combination, a plurality of relays, means to operate said relays in sequence, the said means including a vacuum tube timing circuit to effect the periodic operation of the said means, a plurality of circuits each adapted to be closed upon the operation of the relay individual to that circuit, the sequence of operation of said relays being such that the closed or open condition of the said circuits corresponds to the impulses of a predetermined teletype character, and a distributor to connect said circuits to a teletypewriter line circuit in such sequence as to transmit the said teletypewriter character.

2. A teletypewriter testing circuit including, in combination, a plurality of relays, switching means connected to the said plurality of relays to operate each in sequence, a vacuum tube timing circuit to operate the said switching means at prefixed intervals of time, a plurality of circuits each adapted to be closed upon the operation of one of said relays associated therewith, and a distributor adapted to connect the said circuits in sequence to a teletypewriter line circuit.

3. In a teletypewriter testing system, the combination with a teletypewriter line circuit of a device for applying to the said line predetermined teletypewriter characters, the said device comprising a segmental distributor, a plurality of relays each individual to and connected with a segment of said distributor, a selector switch to operate the said relays in a predetermined sequence and a vacuum tube timing circuit adapted to operate the said selector switch at prefixed intervals of time whereby marking and spacing impulses of a teletypewriter character will be applied to the said line circuit.

4. In a teletypewriter testing system, the combination with a line circuit having teletypewriter apparatus associated therewith, of a segmental distributor having an inner and an outer ring, one of which is connected to the said line circuit, and the segments of the other ring are severally connected to contacts of a group of relays, the said relays being arranged to be operated in a given sequence, a selector switch connected to the said relays, and a vacuum tube timing circuit to operate the said selector switch upon each operation of the said timing circuit, which circuit is adjusted to effect the operation of the next relay in sequence upon each operation of the timing circuit.

5. In a teletypewriter testing system the combination with a line of a rotary distributor having a plurality of rings, one of which is segmental for the transmission of a stop impulse, a start impulse and five character impulses, and rotating brushes adapted to sweep over the said rings to connect each segment in turn to the said other ring of the distributor, means to connect the said other ring to one side of the said line, means to connect the other side of the said line to one of the said segments and to the armature of a plurality of relays, means to connect to the contacts of the said relays each of the segments for the transmission of the character impulses, an electric timing circuit having a vacuum tube therein through which current will flow from the plate to the filament at prefixed intervals, a relay adapted to be operated by the said current, a second relay operable by the said first relay, a selector switch having an operating and a releasing magnet connected therewith, the said operating magnet being energized upon the operation of the said second relay to step the arm of the selector switch upon each energization of the operating magnet to close the circuit through the winding of one of the said plurality of relays whereby the said line circuit may be connected to the said distributor.

6. A teletypewriter testing circuit including,

in combination, a relay, switching means to operate said relay, means to operate said switching means at prefixed intervals of time, including a vacuum tube timing circuit having a condenser and a resistance associated therewith so proportioned as to permit the occurrence of a discharge in the said vacuum tube at the prefixed intervals to effect the operation of said switching means, a circuit connected to the armature and contact of said relay, and a distributor to connect said circuit to the line to be tested.

7. A teletypewriter testing circuit including, in combination, a plurality of relays, switching means to operate each of said relays in sequence without releasing each previously operated relay, means to operate said switching means at prefixed intervals of time, including a vacuum tube timing circuit having a condenser and a resistance associated therewith proportioned to permit the occurrence of a discharge in the vacuum tube at the said intervals to effect the operation of the said switching means, a plurality of circuits each connected to the armature and the contact of one of said relays, and a distributor to connect each of said circuits in sequence to a line to be tested.

8. In a teletypewriter testing system the combination with a line circuit having a teletypewriter receiver connected thereto, of a testing device for applying to the said line a sequence of impulses representing predetermined teletypewriter characters, the said device comprising a segmental distributor, a plurality of relays each individual to and connected with a segment of said distributor, switching means to operate the said relays in a predetermined sequence without releasing previously operated relays, and a vacuum tube timing circuit adapted to operate the said switching means at prefixed intervals of time whereby marking and spacing impulses of teletypewriter characters will be applied in succession to the said line circuit.

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