

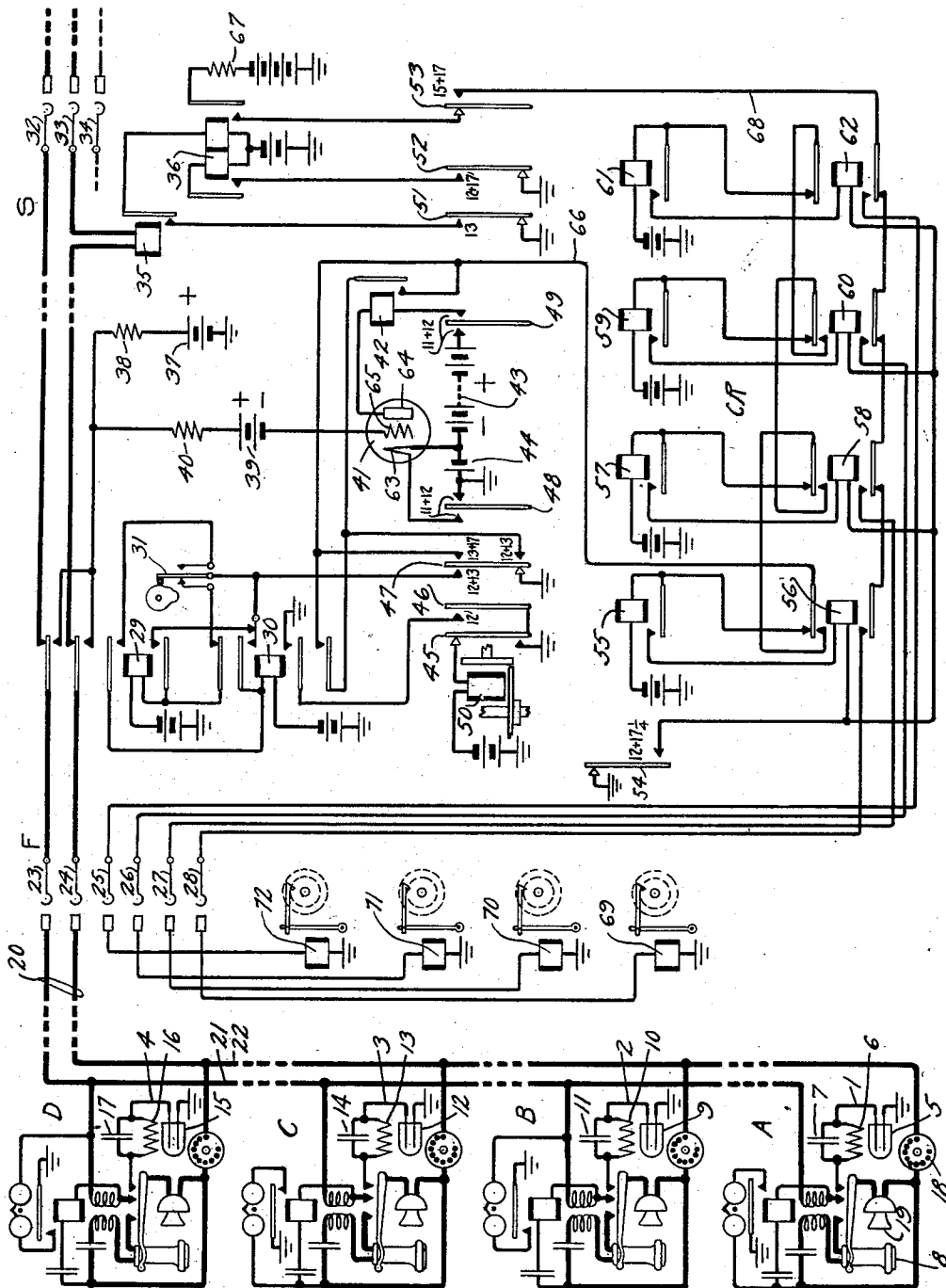
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H. E. BRAGG

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TELEPHONE SYSTEM

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INVENTOR
H. E. BRAGG
BY *M. P. McFadden*
ATTORNEY

UNITED STATES PATENT OFFICE

HERBERT E. BRAGG, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to the identification of calling stations on a party line.

The objects are to secure a positive and reliable test of a party line to identify the calling station, to enable the performance of such a test without the use of connections which interfere with signaling or conversation, to simplify the equipment used at the substation, and to otherwise improve systems of this character.

According to this invention the stations of a party line are provided with devices for producing oscillations in the line, the frequency of which differs according to which station is calling. These oscillators are rendered effective by the application of a source of potential to the line. By maintaining the connection of this source to the line for a definite measured interval of time, the number of oscillations in the line may be counted by detecting mechanism at the central office, thus positively identifying the calling station on the party line.

A feature of the invention is a detecting mechanism for counting the number of oscillations produced by a calling station which comprises a thermionic-discharge device and a plurality of register relays.

An advantage secured by this invention is that the identification of the calling party is made possible without the use of complicated and expensive equipment at the substations and without the necessity of connections that interfere with the quality of transmission during conversation.

This invention is illustrated in the accompanying drawing, which shows a party line terminating in a line finder switch together with means at the central office for performing an identification test and for selectively operating message registers.

The subscriber's line 20 is provided with four substations A, B, C, and D. These stations are equipped, respectively, with oscillating circuits 1, 2, 3, and 4. Each of these circuits comprises a space-discharge device, a resistance element, and a condenser. At substation A, for instance, the oscillating circuit 1 is made up of the discharge device 5

connected in circuit with a resistance 6 and a condenser 7. The oscillating circuits 2, 3, and 4 at the remaining stations are similarly constituted. These circuits are connected between ground and normally open contacts on the respective switchhooks. These discharge devices are so designed that they will not permit current to flow from one electrode to the other until subjected to a sufficiently high value of potential. By selecting the breakdown potential for the discharge tubes at a value substantially greater than the potential of the battery which supplies talking current to the line, it is possible to effectively insulate the line from the ground connections at the substations, thus avoiding interference during conversation.

When potential of sufficient value is applied at the central office to the subscriber's line 20 and when the receiver 8 is off the switchhook at substation A, the oscillating circuit 1 becomes effective to set up in the line oscillations of a frequency dependent upon the characteristics of the elements comprising the circuit 1, such as the value of the resistance 6 and the capacity of the condenser 7. By properly selecting the values of the resistances 10, 13, and 16 and the capacities of the condensers 11, 14, and 17 at the remaining three stations, it is possible to obtain oscillations of four distinctly different frequencies in the subscriber's line 20 according to which of the substations A, B, C, and D is initiating the call.

The subscriber's line 20 at the central office appears in the terminals of a line finder switch F which is diagrammatically represented by the brushes 23 to 28, inclusive. The finder extends the line to a selector switch S, which is also diagrammatically illustrated by the brushes 32, 33 and 34.

At the central office, the oscillations produced in line 20 are impressed upon the control electrode of a thermionic-discharge device 41, which in conjunction with a set of counting relays CR serves to count the number of oscillations produced in a definite interval of time to identify the calling station. The counting relay set CR consists of four pairs of relays 55 to 62, inclusive. When the

time arrives for making the identification tests, a source of potential 37 is connected to the line 20 for a definite measured interval of time and then is disconnected therefrom.

5 The source of potential 37 energizes the oscillating circuit at the calling substation and causes it to produce oscillations in the line of a characteristic frequency. The thermionic-discharge device 41 controls a relay 42
10 in response to each oscillation, and the relay 42 serves to energize the counting relays in succession. The testing interval is so chosen with respect to the frequencies of the oscillations produced at the substations that when
15 the substation which generates the lowest frequency is calling only one pair of counting relays are operated during the interval. When the substation generating the next higher frequency is calling, two pairs of
20 counting relays are operated, and similarly the third substation causes the operation of three sets of relays, and the fourth substation causes the operation of all four sets of the counting relays during the testing interval.
25 According to how many counting relays have been energized, the message registers are selected and operated to charge the call against the calling substation.

The finders and selectors disclosed in this
30 system may be of the panel type similar to the one described in the patent to Craft et al. No. 1,123,696, granted January 5, 1915. The control and operating circuits for a selector switch of this character are shown and described in detail in the patent to Kopp No.
35 1,589,402, granted June 22, 1926 and also in the patent to Stearn et al. No. 1,395,977, granted November 1 1921. The thermionic-discharge device 41 may be of any well-known construction, such as the three-electrode current discharge tube comprising a
40 heated filament 63, a plate electrode 64, and a control or grid element 65 enclosed within a glass container. The current-discharge devices 5, 9, 12, and 15 shown at substations A, B, C, and D may be of any suitable type such as the well-known discharge tube comprising
45 a glass container with a pair of enclosed electrodes and filled with any suitable gas. A tube of this general nature is shown in the patent to F. Gray, No. 1,784,869, granted Dec.
50 16, 1930. Another is shown in the patent to Schroter No. 1,605,001, granted Nov. 2, 1926.

A detailed description will now be given,
55 and it will be assumed for this purpose that the subscriber of substation A initiates a call. In response to the initiation of a call, the line finder F operates to seize the calling line 20. Thereupon, the subscriber manipulates his
60 impulse transmitter 18 to set up the called designation in a register sender (not shown) at the central office. The register sender proceeds to control the selector switch S and succeeding switches to extend the connection
65 to the called subscriber's line as is fully de-

scribed in the above-mentioned patents to Kopp and to Stearn et al.

During the process of establishing the connection, the controlling sequence switch 50 associated with the line finder F and selector
70 S reaches some position, such as position 12. In position 12 of the sequence switch 50, a test is made of the calling line to determine which party has initiated the call. With the sequence switch in position 12 and as soon
75 thereafter as the interrupter 31 closes its left contacts, a circuit is completed from battery through the winding of relay 29, upper contact of relay 30, left contacts of interrupter
80 31, left contacts of sequence switch spring 47 to ground. Relay 29 operates and locks through its front contact, normal contact of relay 30 to ground at sequence switch spring
85 47 independently of interrupter 31. Relay 29 connects the source of potential 37 to the tip and ring conductors of the line 20, and the testing interval commences and will continue until the interrupter 31 (which is constantly driven) closes its right-hand
90 contacts. The source of potential 37 energizes the oscillating device 1, and the circuit therefor may be traced from said source through the resistance 38, thence through the two uppermost front contacts of relay 29, brushes
95 23 and 24 to the conductors of line 20. The circuit over the tip conductor 21 may be continued through the right winding of the induction coil at substation A, switchhook contacts to the oscillating circuit 1. The circuit
100 over the ring conductor 22 may be traced through the impulse transmitter 18, talking transmitter 19, switchhook contacts to the oscillating circuit 1. It will be assumed that the oscillating circuit 1 produces oscillations
105 in the line 20 of a lower frequency than those produced by either of the circuits 2, 3, or 4.

When sequence switch 50 reaches position 11, the discharge device 41 is prepared for service before being connected to the line to make the test. In position 11 and also in
110 position 12, a circuit is completed from the free pole of battery 44, through the filament 63, thence through contacts of spring 48 to the grounded pole of battery 44. Another circuit is completed from the negative pole
115 of battery 43 to the filament 63, thence to the plate 64, through the winding of relay 42, contacts of sequence switch spring 49 to the positive pole of battery 43. Current flows in this latter circuit of sufficient intensity to energize the relay 42. With relay 42 energized
120 and the sequence switch in position 12, a circuit is closed from ground through the lower contacts of sequence switch spring 47, contact of relay 42, conductor 66, upper back
125 contact of relay 56, winding of relay 55 to battery. Relay 55 operates and closes a circuit from battery, through its winding and contacts, winding of relay 56 to ground at sequence switch spring 54. Relay 56, however,
130

being shunted by the ground potential on conductor 66 does not operate at this time.

Since the substation A produces oscillations of the lowest frequency, only one oscillation will be received during the interval that the battery 37 is connected to the subscriber's line. The potential of the control element 65 of the thermionic-discharge device 41, which is also connected to the line over a circuit traceable through the resistance 40 and the grid battery 39, is changed by this oscillation in such a way as to reduce the current flowing through the plate circuit of the tube 41, thereby permitting relay 42 to release momentarily. When relay 42 releases it removes ground potential from conductor 66, and relay 56 thereupon operates and locks in the circuit above traced. As soon as the oscillation has passed, relay 42 again energizes and the grounded conductor 66 is now extended through the upper armature and front contact of relay 56, upper armature and back contact of relay 58, winding of relay 57 to battery. Relay 57 operates and prepares a circuit for relay 58, but relay 58 being shunted by the ground potential on conductor 66 does not operate at this time. Before the occurrence of the next oscillation in the line, the interrupter 31 closes its right contacts, and a circuit is completed from battery, through the winding of relay 30, inner upper contact of relay 29, right contacts of the interrupter 31 to ground at the left contacts of spring 47. Relay 30 immediately releases relay 29, and the latter relay deenergizes to disconnect the source 37 and the tube 41 from the line, thus terminating the testing interval. Relay 30 locks through its inner upper armature and front contact to ground through the spring 47. Relay 30 closes an obvious circuit for driving the sequence switch into position 13, and relay 42 thereupon releases. Since the relay 42 releases, it becomes necessary to maintain ground potential on conductor 66 to prevent the operation of relay 58, since the substation A is identified by the operation of a single pair of counting relays 55 and 56. Conductor 66 is maintained grounded over a circuit extending through the lower front contact of relay 30 and the lower contacts of sequence switch spring 47. With the sequence switch in position 13, conductor 66 is held grounded through the upper right contact of spring 47.

During the further progress of establishing the connection to the called subscriber's line, the sequence switch 50 may remain in position 13 which may be assumed to be the talking position. As soon as the called subscriber answers, the supervisory relay 35 operates in the well-known manner and completes a circuit from battery to the right winding of relay 36, contact of relay 35 to ground through sequence switch spring 51.

Relay 36 operates and locks through its left winding and contact to ground at sequence switch spring 52.

When conversation has been completed and the subscribers have replaced their receivers, the sequence switch 50 advances from the talking position through positions 15 to 17 where metering takes place. The metering circuit may be traced from battery through resistance 67 and the contacts of relay 36, contacts of sequence switch spring 53, conductor 68, lower back contacts of relays 62, 60, and 58, lower front contact of relay 56, brush 28 to the winding of message register 69 to ground. Register 69 operates and charges the call to the substation A.

As the sequence switch 50 moves out of position 13, relay 30 releases, and as it moves from position 17 into its normal position, the remaining energized relays of the circuit are restored to normal.

Assume next that the call is originated at substation B. The source of potential 37 is connected to the line as above described and the oscillator 2 becomes effective to set up oscillations in the line of a frequency higher than that caused by the oscillator at substation A. The frequency of the oscillations produced by the oscillator 2 is such that two of these oscillations occur during the interval the source 37 and the vacuum tube 41 are connected to the line. When relay 42 releases upon the occurrence of the first oscillation, relay 56 operates as above described. Following the first oscillation relay 42 operates and closes an operating circuit as traced for relay 57. When the next and second oscillation occurs, the potential of the control element 65 is so altered that relay 42 again releases and in so doing removes the shunting potential from relay 58, and this relay operates in series with relay 57 to the sequence switch spring 54. When the potential of the element 65 again changes following the second oscillation, relay 42 operates, and a circuit is traceable over the conductor 66, through the upper front contacts of relays 56 and 58, upper back contact of relay 60, winding of relay 59 to battery. Relay 59 operates and prepares a circuit for itself and relay 60 in series to ground at spring 54. Relay 60, however, being shunted does not operate. Relay 30 operates at the end of the measured interval as above described to release relay 29 and disconnect the source 37 from the subscriber's line. Subsequently when the sequence switch is passing through positions 15 to 17, the metering circuit is closed over conductor 68, lower back contacts of relays 62 and 60, lower front contact of relay 58, brush 27, through the winding of message register 70 to ground. The register 70 operates and charges the call against substation B.

If a call is originated at substation C, the

apparatus functions in a similar manner, except that the oscillator 3 produces a frequency sufficiently high to permit three oscillations to be impressed upon the tube 41 during the counting interval. This results in the operation of counting relays 55, 56, 57, 58, 59, 60, and 61. In this case the metering circuit is traceable over conductor 68, through the lower back contact of relay 62, lower front contact of relay 60, brush 26, through the winding of message register 71 to ground. The register 71 operates and assesses the call to the substation C.

Lastly, the initiation of a call at substation D renders the oscillator 4 effective to produce oscillations of a frequency such that four successive oscillations are impressed on the tube 41 during the time interval. This results in the operation of all of the counting relays CR. The metering circuit in this case is traceable over conductor 68 through the lower front contact of relay 62, brush 25, and the winding of message register 72, thus charging the call against substation D.

The substations on the party line are shown to be equipped with individual signal bells and relays. These relays are operated by alternating current from the ringing sources to effect selective ringing of the stations in the manner well-known in the art. By properly selecting the characteristics of the oscillators 1, 2, 3, and 4, the frequencies which they produce may be so chosen as not to interfere with the substation bells.

While the invention has been shown in connection with a telephone system employing a certain type of switches, it is to be understood that it may be equally applicable to other kinds of systems. Also other kinds of oscillating means may be used as well as other types of detecting devices for identifying the stations.

What is claimed is:

1. In combination a line having two stations thereon, a device at one of said stations for causing in said line oscillations of a given character, a device at the other station for causing in said line oscillations of a different character, means responsive to said oscillations, and means controllable by said oscillation responsive means for distinguishing said stations.

2. In a telephone system, a line having two stations thereon, a device at one of said stations for causing in said line oscillations of a given frequency, a device at the other station for causing in the line oscillations of a different frequency, means responsive to said oscillations, and means controllable by said oscillation responsive means for identifying one of said stations when calling.

3. In a telephone system, a line having a plurality of stations, oscillatory devices for causing oscillations of different frequencies in said line, each of said stations being pro-

vided with one of said devices, means responsive to said oscillations, and means controllable by said oscillation responsive means for identifying said stations.

4. The combination in a telephone system of a line having two stations thereon, a device at one of said stations for causing in the line oscillations of a given frequency, a device at the other station for causing in the line oscillations of a different frequency, and a counting mechanism for counting the oscillations in said line to identify said stations.

5. The combination in a telephone system of a line having a number of stations thereon, an oscillatory device at one of said stations for setting up in the line oscillations of a given frequency, an oscillatory device at another of said stations for setting up in the line oscillations of a different frequency, a thermionic-discharge device responsive to said oscillations, and a counting device responsive to said thermionic-discharge device for identifying the stations.

6. In a telephone system, a line having a number of stations thereon, a source of current, means for connecting said source to the line, a device at one of said stations responsive to current from said source for setting up in the line oscillations of a given frequency, a device at another of said stations responsive to current from said source for setting up in the line oscillations of a different frequency, and means responsive to said oscillations for identifying said stations.

7. In a telephone system, a line having two stations thereon, a central station in which said line terminates, a source of current at the central station, means for connecting said source to the line, an oscillator at one of said stations responsive to flow of current from said source for setting up in the line oscillations of a given frequency, an oscillator at the other station responsive to the flow of current from said source for setting up in the line oscillations of a different frequency, and means responsive to said oscillations for identifying said stations.

8. In a telephone system, a line having a number of stations thereon, a central station in which said line terminates, a source of current at the central station, means for connecting said source to the line for a definite interval, an oscillatory device at one of said stations responsive to current from said source for causing oscillations of a given frequency, an oscillatory device at another of said stations responsive to current from said source for causing oscillations of a different frequency, and means for measuring the number of oscillations during the interval said source is connected to the line.

9. In a telephone system, a line having a number of stations thereon, individual oscillators for said stations normally disconnected from the line, said oscillators arranged to

set up oscillations of different frequencies in the line, means at a calling station for connecting the corresponding oscillator to the line, means responsive to said oscillations in the line, and means controllable by said oscillation responsive means for identifying a calling station.

10. The combination in a telephone system of a line having a plurality of stations thereon, said stations being equipped with individual oscillators each including a space-discharge device, said oscillators arranged to set up oscillations of different frequency in said line, means responsive to the oscillations in said line, and means controllable by said oscillation responsive means for identifying said stations.

11. In a telephone system, a line having a number of stations thereon, an oscillator at one of said stations comprising a space-discharge device and impedance elements, means effective when said station is calling for connecting said oscillator to the line, said oscillator arranged to set up in line oscillations of a given frequency, and means for counting the oscillations set up in said line to identify said station.

12. In combination, a line having two stations thereon, a device at one of said stations for causing in said line oscillations of a given character, a device at the other station for causing in said line oscillations of a different character, circuit paths for distinguishing said stations, and means responsive to said oscillations for selecting said circuit paths to distinguish said stations.

13. In combination, a line having two stations thereon, a device at one of said stations for causing in said line oscillations of a given character, a device at the other station for causing in said line oscillations of a different character, circuit paths for identifying said stations, relays operative to select said circuit paths, and means responsive to said oscillations for actuating said relays to select circuit paths to identify a station when calling.

In witness whereof, I hereunto subscribe my name this 14th day of April, 1930.

HERBERT E. BRAGG.