

Aug. 6, 1946.

M. P. WILLIS

2,405,339

EQUIPMENT FOR OBSERVING DIAL TONE SPEED

Filed June 6, 1944

2 Sheets-Sheet 1

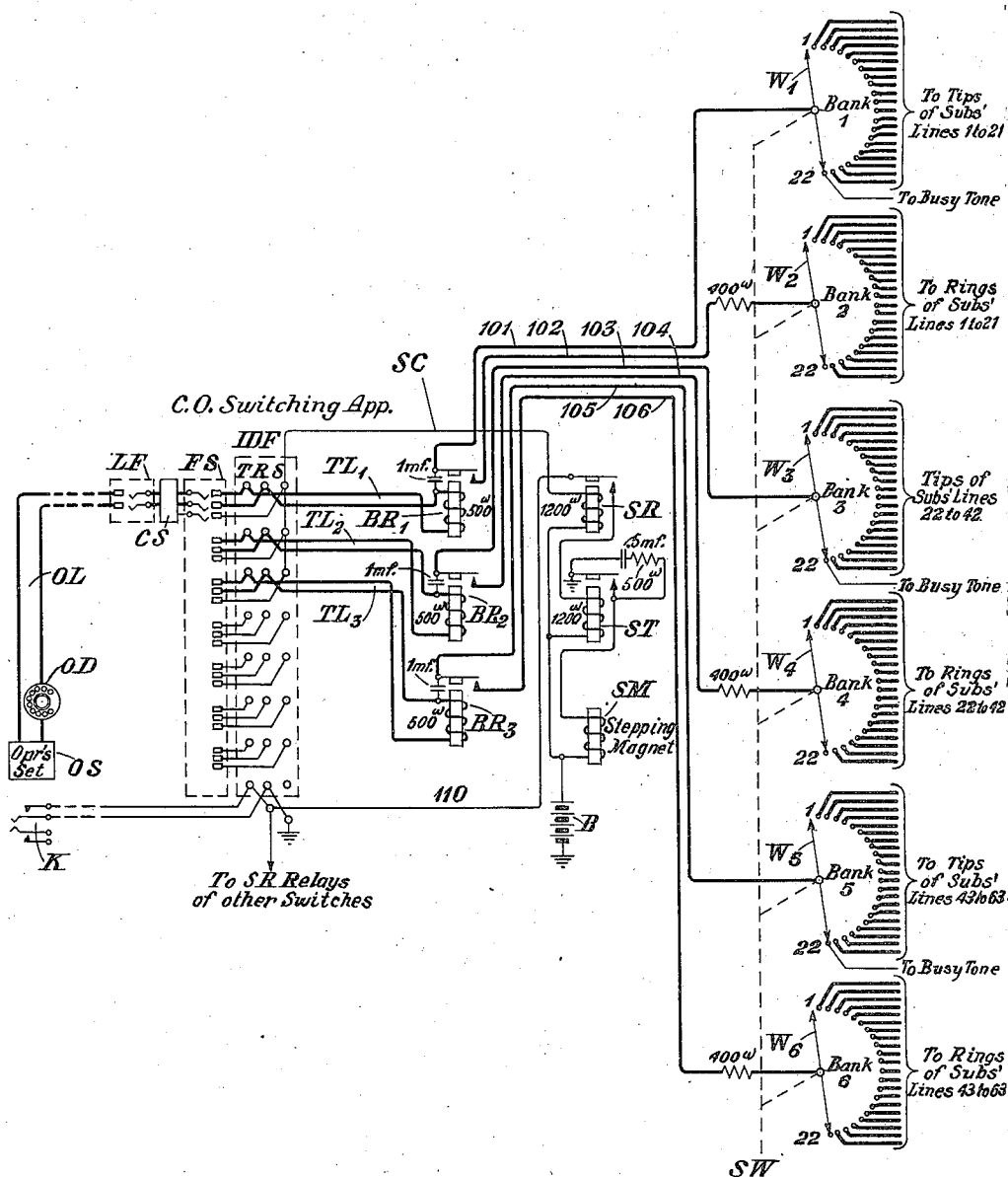


Fig. 1

BY

INVENTOR
M. P. Willis
Claude B. Rose
ATTORNEY

Aug. 6, 1946.

M. P. WILLIS

2,405,339

EQUIPMENT FOR OBSERVING DIAL TONE SPEED

Filed June 6, 1944

2 Sheets-Sheet 2

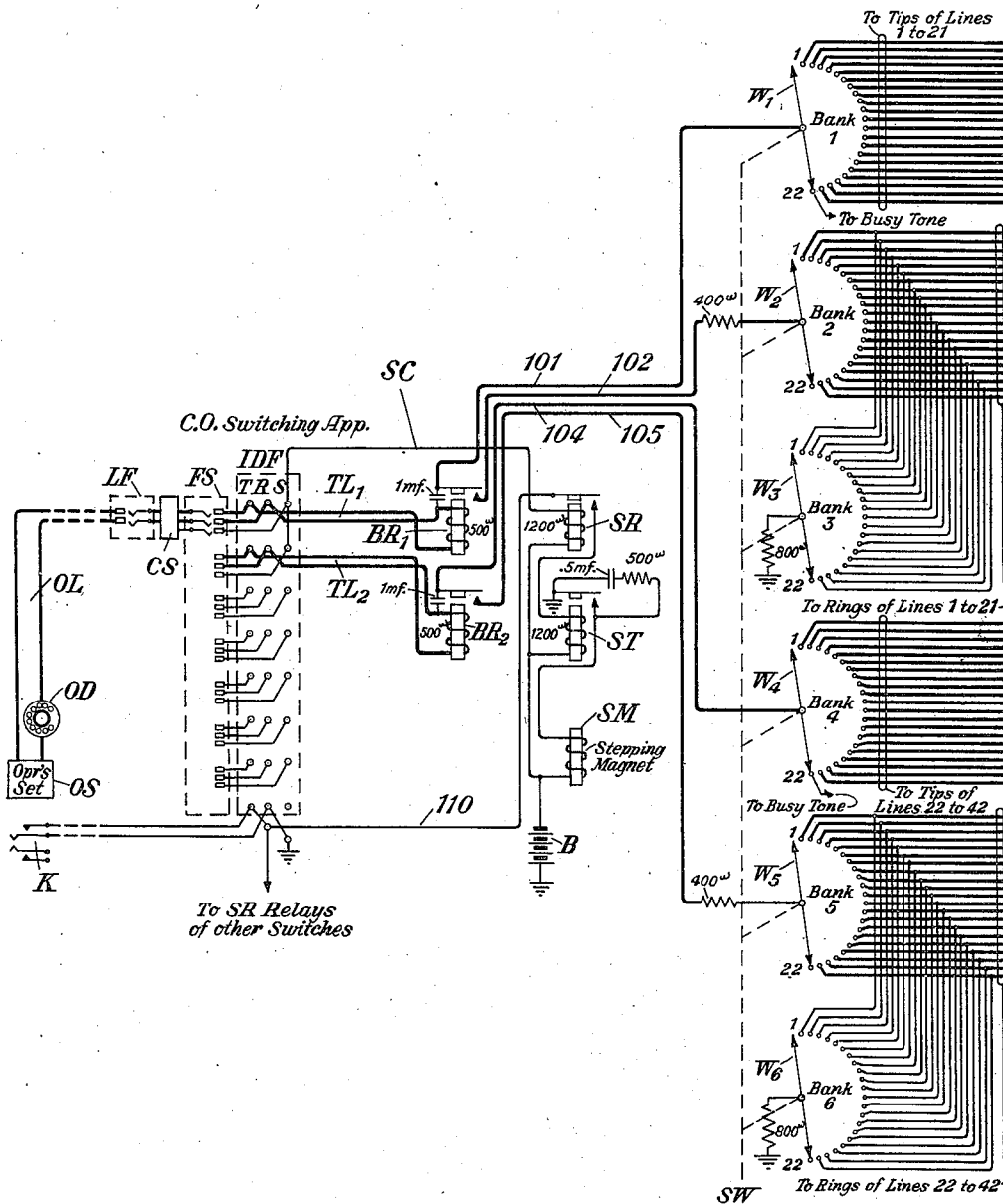


Fig. 2

BY

INVENTOR
M.P. Willis
Leland E. Rose
ATTORNEY

UNITED STATES PATENT OFFICE

2,405,339

EQUIPMENT FOR OBSERVING DIAL TONE
SPEEDMilton Powell Willis, Dallas, Tex., assignor to
American Telephone and Telegraph Company,
a corporation of New York

Application June 6, 1944, Serial No. 539,019

12 Claims. (Cl. 179—175.2)

1

This invention relates to equipment for making observations of certain operations of machine switching systems, and it particularly relates to making observations of the time required for a dial tone to appear after a call has been initiated upon a line.

In one type of machine switching systems, when a call is initiated by taking the receiver off the switchhook, certain automatic equipment is set into operation to connect the line to an idle first selector. As soon as such first selector has been seized, a dial tone is sent out over the line to indicate to the subscriber that he may proceed to dial.

The time required for the dial tone to appear varies as between different lines in the same exchange and it also varies from time to time for any given line. In the case of a given line, the time required for the dial tone to appear will depend upon a number of factors. For example, if the group in which the line is located is operating under overload conditions a longer time will be required before a line finder or trunk selector will become available to extend the line to a first selector. Another factor that may affect the dial tone time is the number of lines in each group served by a given amount of appropriate switching equipment. Likewise any change in the amount of switching equipment available to all the lines of such a group will affect the time for the dial tone to appear.

As between lines in different groups the time required for the dial tone to appear will on the average be affected by (a) the number of lines in each group, (b) the amount of equipment available to serve a particular group, and (c) the load on the lines of each group. Any one or all of the foregoing factors may, of course, vary from group to group.

Due to these and other conditions it is desirable to have means available to make observations of the time required for the dial tone to appear on each of a number of lines selected as samples for observation. In accordance with the present invention the lines selected for sampling purposes are connected to contacts of a rotary switch, which may be used by the service observing operator to connect her equipment to the lines one at a time, under conditions simulating the conditions of a call. As connections are thus successively established to the lines the service observer may note the time required before the dial tone appears for each line. If desired, the lines taken for sampling may be more or less uniformly chosen from groups which are subject to differ-

2

ent service conditions, so that the difference in dial tone time between lines of different groups may be noted.

In the system as herein disclosed, the switch which is used for service observing purposes is of a type having six brushes and twenty-two point banks for each brush. It will be understood, however, that other types of switches may equally well be used.

The invention may now be more fully understood from the following description, when read in connection with the accompanying drawings, in which Figure 1 illustrates the invention as applied to a system in which the lines to be observed are operated on either a flat rate or message rate basis; while Fig. 2 shows the system as applied to observed lines which are provided with coin box equipment at the subscribers' stations.

Referring to Fig. 1, a switch SW is shown having six wipers W₁ to W₆, inclusive, each arranged to operate over a bank having twenty-two points. The brushes of the switch may be rotated step by step to establish connections to the different points of the switch. When the switch is operated step by step, under the control of the service observing operator as will be described later, the operator's service-observing equipment may be connected to successive lines to be tested, under conditions approximating the initiation of a call over each line. For this purpose the first twenty-one points of bank 1 are connected to the tip conductors of 21 lines and the corresponding points in bank 2 are connected to the ring conductors of said lines. A busy tone is connected to the twenty-second point of bank 1. This informs the operator that the switch is in its stand-by position ready to test all of the lines connected to banks 1 and 2.

In a similar manner the tip conductors of another group of twenty-one lines (herein numbered 22 to 42, inclusive) are connected to the first twenty-one points of bank 3, the corresponding tip conductors being connected to the first twenty-one points of bank 4. Likewise the tip and ring conductors, respectively, of lines numbered 43 to 63 are connected to the first twenty-one points of banks 5 and 6, respectively. Busy tones are applied to points 22 of banks 3 and 5 to indicate to the operator that the switch is in its waiting position ready to test the lines connected to those banks. After all of the lines connected to a pair of banks have been tested, the busy will be heard on the next step to indicate that the switch is again in its stand-by position.

The conductors 101 and 102, leading to wipers

3

W₁ and W₂ of the switch SW, are connected over trunk TL₁ and through tip and ring terminals of an intermediate frame IDF to tip and ring contacts of a final selector FS. The final selector FS is normally employed in the exchange for establishing connections from line to line, but certain of its terminal points are for purposes of the present invention assigned to trunks such as TL₁. Other terminal points are similarly assigned to other testing trunks such as TL₂ and TL₃.

When the service observing operator wishes to connect her set OS to any of the lines 1 to 21, inclusive, for testing purposes, the receiver is removed from the hook of the set and this causes a line finder LF or other suitable mechanism (herein indicated symbolically) to establish connection between the operator's set and the first selector of the central office switching apparatus CS. The operator then dials by means of the office dial OD the special number assigned trunk TL₁, thus completing a connection through the central office switching apparatus CS and the final selector FS to the tip and ring terminals of the trunk TL₁.

If access to trunk TL₂ is desired the operator may, by dialing a different code, connect her set to the tip and ring terminals in the final selector FS which are connected to the trunk TL₂. As this trunk is associated with conductors 103 and 104 leading to wipers W₃ and W₄, access is thus given to lines 22 to 42 for testing purposes. By dialing a still different code the trunk TL₃ may be reached and this trunk is associated through conductors 105 and 106 with the banks 5 and 6 through which subscribers' lines 43 to 63, inclusive, are reached.

The trunks TL₁, TL₂ and TL₃ have associated with them relays BR₁, BR₂ and BR₃, respectively. The armature of relay BR₁ closes a connection between conductors 101 and 102 through a 400-ohm resistance to the wipers W₁ and W₂. Consequently, when these wipers rest upon the points associated with one of the lines to be tested, the circuit of that line is closed in a manner similar to that occurring when a subscriber takes the receiver off the switchhook. In a similar manner relay BR₂ closes the circuit of conductors 103 and 104 and the relay BR₃ closes the circuits of conductors 105 and 106 through 400-ohm resistances.

The sleeve terminals of the intermediate distributing frame IDF, which are associated with the trunks TL₁, TL₂ and TL₃, are strapped together so that when the final selector FS establishes a connection to any one of these trunks, a circuit is completed over a common sleeve conductor SC to operate a relay SR which controls the circuit of a relay ST. The operator is also provided with a key K which, if closed when the relay SR is operated, will complete a circuit through the relay ST, which in turn controls the operation of a stepping magnet SM for the switch SW.

Further details of the apparatus will be clear from a description of the operation. Let us assume that the switch SW is in such position that each of its six wipers is resting upon the twenty-second point in the corresponding bank of the switch. The operator through her set closes the operator's line OL, thus causing the line finder, or other switching apparatus, to connect the line OL to the first selector of the central office switching apparatus CS. As soon as the connection to the first selector is established the operator will hear a dial tone indicating that the circuit is in

4

condition to be dialed. The operator then uses her dial OD to dial the code of the trunk TL₁.

In response to this dialing operation the final selector FS connects the operator's line OL to the terminals of the trunk TL₁, thus operating the relay BR₁. As soon as the final selector FS makes connection with the trunk TL₁ a busy tone is transmitted over point 22 of bank 1 of the switch SW, over conductor 101, through a condenser and over the tip conductor of the trunk TL₁ and the operator's line OL to the operator's set OS. This informs the operator that each of the wipers of the switch SW is resting upon the twenty-second point of the corresponding switch bank. At the same time the connection above described was established over the trunk TL₁ a connection is completed from the sleeve circuit of the central office switching equipment CS, over the common sleeve conductor SC, and through the winding of the relay SR to battery B, thus energizing the relay SR.

The operator, upon hearing the busy tone above described, closes the key K momentarily, thus establishing a circuit from ground, over the upper contacts of said key, over conductor 110, over the now closed contact of relay SR, and through the winding of relay ST to battery B. Relay ST upon being energized closes a circuit from ground over its contact to energize the stepping magnet SM. As soon as the key K is restored, relay ST is released, thus opening the circuit of the stepping magnet SM which advances the six wipers of the switch SW to the first point in each of the switch banks.

A connection is now established for the first line to be tested from the tip conductor of said line 1, over wiper W₁, conductor 101, over the closed contact of relay BR₁, over conductor 102, through a 400-ohm resistance, and thence over wiper W₂ to the ring conductor of line 1. This completes the circuit of line 1, thus causing the line finder or other switching equipment (not shown) of the central office to establish a connection from the line 1 to a first selector. When the connection to the first selector is established, the usual dial tone is transmitted over the tip conductor of line 1 and thence to the operator's set OS over the circuit previously traced for the busy tone from point 22 of switch bank 1. The operator notes the time elapsing from the moment the key K is released to the moment when the busy tone is heard, and thereby knows the time required for a subscriber initiating a call on that line to hear the dial tone.

In a similar manner the operator, by again depressing the key, will operate the stepping magnet SM to advance each wiper of the switch SW to the second point of each bank. Thereupon the time elapsing before the dial tone is heard may be noted for line No. 2. As soon as the operator notes down the elapsed time for line No. 2, the operator in a similar manner advances the wipers of the switch SW over successive points of the banks until all of the lines 1 to 21, inclusive, have been tested. After line 21 has been tested the next operation of the key K advances the wipers of the switch to the twenty-second point of each bank, and the operator again hears the busy tone coming in over point 22 of bank 1. This apprises the operator that the first set of twenty-one lines has been tested.

The operator now releases the connection to trunk TL₁ and dials the code number by which the trunk TL₂ may be reached. Relay BR₁ is released as soon as the brushes of the final selector

5

FS leave the terminals of the trunk TL₁. When said brushes of a final selector in response to the dialed code establish contact with the terminals of the trunk TL₂ the relay BR₂ is energized, and relay SR₁ is operated over the sleeve terminal of the trunk TL₂ at the final selector FS. The operator now hears a busy tone over the twenty-second point of bank 3, over conductor 103, through the condenser associated with the relay BR₂, over the tip conductor of the trunk TL₂, and thence over the circuit previously traced to the operator's set OS.

The operator again actuates the key K, stepping the wipers of the switch SW to the second point of each of the banks. A circuit is thus completed over the operating contact of the relay BR₂ through a 400-ohm resistance, and thence over the wipers W₃ and W₄ to the tip and ring conductors of line 22. After the operator notes the dial tone coming in over line 22, the key K is again actuated to advance the switch to the next line, and so on, until the dial tone time of each of the lines 22 to 42 has been determined.

The next operation of the key K advances the wipers of the switch again to the twenty-second point so that the operator once more hears the busy tone. The operator now releases and then dials the code for trunk TL₃, thus establishing connection to wipers W₅ and W₆ of the switch SW. Upon hearing the busy tone from the twenty-second point of bank 5, the operator then actuates the key K to step the switch SW step by step until all of the lines 43 to 63 have been tested.

The foregoing operations may be repeated from time to time to test the dial tone times of the various lines at different times of day and under different conditions of load. From the observations thus made information may be tabulated to inform those concerned of the operating conditions in the exchange so far as the waiting time for dial tones is concerned. As already stated, the lines chosen for test purposes and connected to the various points of the switch SW may be representative of different groups, if desired, so that information may be had as to the dial tone time for representative lines under different service conditions. Also comparisons may be made between individual lines of the same group, or between lines of any group and those of any other group.

The arrangement of Fig. 1 is that preferably employed when the lines to be tested are either flat rate lines or message rate lines. Where, however, coin box lines are to be tested, a somewhat different arrangement, such as that illustrated in Fig. 2, is employed.

Since circuits over coin box lines cannot be completed until a coin has been dropped in a coin box to operate the coin box trunk relay equipment, arrangements must be provided for simulating the conditions resulting from the dropping of the coin. Therefore, in the arrangement of Fig. 2, while the points 1 to 21, inclusive, of banks 1 and 2 are connected to the tip and ring conductors of the lines as before, the points of bank 3 are arranged to establish a connection through an 800-ohm resistance over the wiper W₃ to the ring conductors of each of the lines, to operate the coin box trunk relay equipment. Since three banks are therefore used for each service observing trunk, only two trunks, TL₁ and TL₂ with their associated relays BR₁ and BR₂, are provided. The tip and ring conductors of lines 22 to 42, inclusive, are in this instance connected to the points

6

of banks 4 and 5, while the points of bank 6 are used to connect ground through the 800-ohm resistance to the ring conductors of these lines to operate the coin box trunk relay equipment. Otherwise, the apparatus is similar to that of Fig. 1.

In testing the lines the operator proceeds as in the case of Fig. 1, first dialing to establish a connection to trunk TL₁, thus operating the relay BR₁ and the relay SR. Upon hearing the busy tone from the twenty-second point of bank 1, the operator momentarily closes the key K to operate the relay ST, which in turn operates the stepping magnet to advance the switch to the first point in each bank. As before, a line circuit closing connection is established from the tip of line 1, over the wiper W₁, conductor 101, operating contact of relay BR₁, conductor 102, through the 400-ohm resistance, and over wiper W₂ to the ring conductor of line 1.

However, this operation alone does not complete the line circuit, for the coin box trunk relay equipment must also be operated before the line can be extended to any switching equipment. This is done by means of the third bank of the switch, a ground connection being established through the 800-ohm resistance, over wiper W₃ and the first point of bank 3 of the ring conductor of line 1. The closing of this circuit and the simultaneous closing of the circuit over the first points of banks 1 and 2 simulate the conditions under which a call is initiated on a coin controlled line. As soon as the first selector has been reached, the operator will hear the dial tone from the line 1 as described in connection with Fig. 1. The operator then successively tests the other lines by stepping the switch point by point by means of the operator's key K, as described in connection with Fig. 1.

The operator having tested lines 1 to 21, inclusive, will release the connection previously dialed and then dial the trunk TL₂. After connection to the trunk has been established, the operator proceeds in a similar manner to test lines 22 to 42.

While this invention has been disclosed in certain specific arrangements which are deemed desirable, it will be obvious that the general principles herein set forth may be embodied in many other organizations, widely different from those illustrated, without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch to the contacts of which lines to be tested are connected, a trunk leading to said switch, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby said trunk when selected is conditioned to simulate the initiation of a call, and means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to successively initiate simulated calls over said lines without changing the setting of any final selector, whereby the time requirement for the dial tone to appear may be observed for each line connected to said step-by-step switch.

2. A system for observing the time between

7

the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch to the contacts of which lines to be tested are connected, a trunk leading to said switch, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby said trunk when selected is conditioned to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to successively initiate simulated calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, and means to transmit a special signal to the operator when a group of the lines connected to the switch have been tested.

3. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch to the contacts of which lines to be tested are connected, a trunk leading to said switch, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby said trunk when selected is conditioned to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to successively initiate simulated calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, and means associated with said switch acting when the line is selected for observation to produce a condition to operate the coin box trunk relay equipment associated with the line.

4. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch to the contacts of which lines to be tested are connected, a trunk leading to said switch, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting the operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby said trunk when selected is conditioned to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to successively initiate simulated calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, means associated with said switch acting when the line is selected for observation to produce a condition to operate the coin box trunk relay equipment associated with the line, and means to transmit a special signal to the operator when a group of the lines connected to the switch have been tested.

8

5. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of banks of contacts, tip conductors of lines to be tested connected to the contacts of one bank of said switch and the ring conductors of said lines being connected to the corresponding contacts of another bank, a trunk having tip and ring conductors leading to the respective wipers associated with bank having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when said trunk is selected its tip and ring conductors are connected through a resistance to simulate the initiation of a call, and means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to cause said trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch.

6. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of banks of contacts, tip conductors of lines to be tested connected to the contacts of one bank of said switch and the ring conductors of said lines being connected to the corresponding contacts of another bank, a trunk having tip and ring conductors leading to the respective wipers associated with banks having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when said trunk is selected its tip and ring conductors are connected through a resistance to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to cause said trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, and means to transmit a special signal to the operator when a group of the lines connected to the switch have been tested.

7. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of banks of contacts, tip conductors of lines to be tested connected to the contacts of one bank of said switch and the ring conductors of said lines being connected to the corresponding contacts of another bank, a trunk having tip and ring conductors leading to the respective wipers associated with banks having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing

set thereto in response to a dialed number assigned to said trunk, means whereby when said trunk is selected its tip and ring conductors are connected through a resistance to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to cause said trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, and means associated with said switch acting when the line is selected for observation to produce a condition to operate the coin box trunk relay equipment associated with the line.

8. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of banks of contacts, tip conductors of lines to be tested connected to the contacts of one bank of said switch and the ring conductors of said lines being connected to the corresponding contacts of another bank, a trunk having tip and ring conductors leading to the respective wipers associated with banks having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting said trunk and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when said trunk is selected its tip and ring conductors are connected through a resistance to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line to cause said trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, means associated with said switch acting when the line is selected for observation to produce a condition to operate the coin box trunk relay equipment associated with each line, and means to transmit a special signal to the operator when a group of the lines connected to the switch have been tested.

9. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of contacts, a plurality of lines to be tested, the tip conductors of certain of said lines being connected to the contacts of one bank of said switch and the corresponding ring conductors of said lines being similarly connected to the contacts of another bank, the tip and ring conductors of other of the lines to be tested being similarly connected to other banks of said switch, trunks having tip and ring conductors leading to the respective wipers associated with pairs of banks having tip and ring conductors connected thereto, there being a trunk for each pair of banks having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting any one of said trunks and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when a trunk is selected its tip and ring conductors are connected through a re-

sistance to simulate the initiation of a call, and means controlled by the operator to send a single pulse over said trunk to step said switch from line to line of the pair of banks corresponding to the selected trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch.

10. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of contacts, a plurality of lines to be tested, the tip conductors of certain of said lines being connected to the contacts of one bank of said switch and the corresponding ring conductors of said lines being similarly connected to the contacts of another bank, the tip and ring conductors of other of the lines to be tested being similarly connected to other banks of said switch, trunks having tip and ring conductors leading to the respective wipers associated with pairs of banks having tip and ring conductors connected thereto, there being a trunk for each pair of banks having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting any one of said trunks and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when a trunk is selected its tip and ring conductors are connected through a resistance to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line of the pair of banks corresponding to the selected trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, and means to transmit a special signal to the operator when a group of lines connected to a pair of banks of the switch have been tested, whereupon the operator may select another trunk to similarly test a group of lines connected to another pair of banks of said step-by-step switch.

11. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of contacts, a plurality of lines to be tested, the tip conductors of certain of said lines being connected to the contacts of one bank of said switch and the corresponding ring conductors of said lines being similarly connected to the contacts of another bank, the tip and ring conductors of other of the lines to be tested being similarly connected to other banks of said switch, trunks having tip and ring conductors leading to the respective wipers associated with pairs of banks having tip and ring conductors connected thereto, there being a trunk for each pair of banks having tip and ring conductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting any one of said trunks and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when a trunk is selected its tip and ring conductors are connected through a resistance to

11

simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line of the pair of banks corresponding to the selected trunk to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, and means associated with said switch acting when the line is selected for observation to produce a condition to operate the coin box trunk relay equipment associated with each line.

12. A system for observing the time between the initiation of a call over a telephone line and the appearance of a dial tone, said system including a step by step switch having a plurality of contacts, a plurality of lines to be tested, the tip conductors of certain of said lines being connected to the contacts of one bank of said switch and the corresponding ring conductors of said lines being similarly connected to the contacts of another bank, the tip and ring conductors of other of the lines to be tested being similarly connected to other banks of said switch, trunks having tip and ring conductors leading to the respective wipers associated with pairs of banks having tip and ring conductors connected thereto, there being a trunk for each pair of banks having tip and ring con-

12

ductors of lines connected thereto, means including final selectors for selecting for communication purposes any desired line in response to the dialed number assigned to said line and for selecting any one of said trunks and connecting an operator's observing set thereto in response to a dialed number assigned to said trunk, means whereby when a trunk is selected its tip and ring conductors are connected through a resistance to simulate the initiation of a call, means controlled by the operator to send a single pulse over said trunk to step said switch from line to line of the pair of banks corresponding to the selected trunks to successively simulate the initiation of calls over said lines without changing the setting of any final selector, whereby the time required for the dial tone to appear may be observed for each line connected to said step-by-step switch, means associated with said switch acting when the line is selected for observation to produce a condition to operate the coin box trunk relay equipment associated with each line, and means to transmit a special signal to the operator when a group of lines connected to a pair of banks of the switch have been tested, whereupon the operator may select another trunk to similarly test a group of lines connected to another pair of banks of said step-by-step switch.

MILTON POWELL WILLIS.