

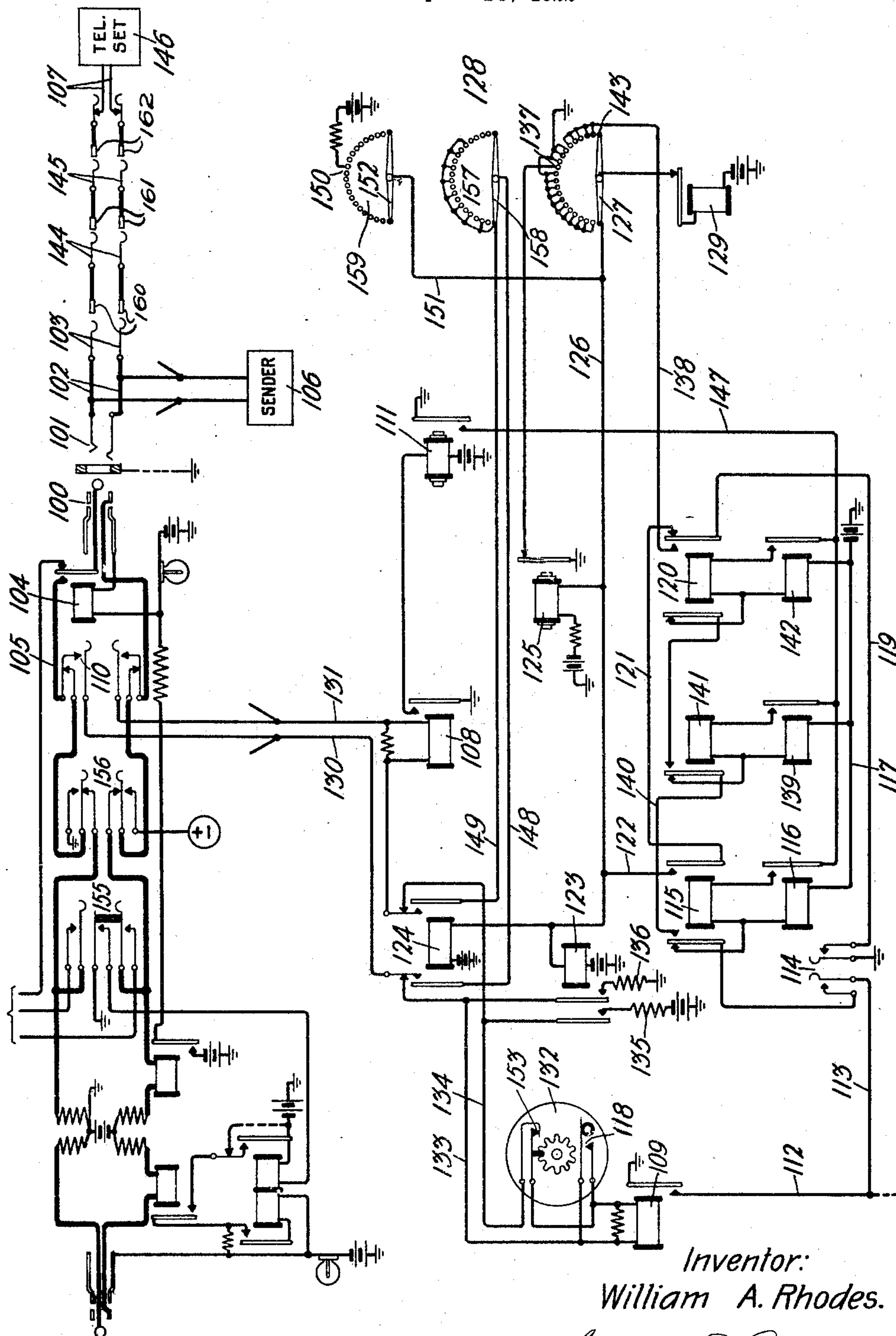
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MACHINE SWITCHING TELEPHONE EXCHANGE SYSTEM

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Inventor:

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UNITED STATES PATENT OFFICE.

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MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM.

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To all whom it may concern:

Be it known that I, WILLIAM A. RHODES, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain Improvements in Machine-Switching Telephone-Exchange Systems, of which the following is a specification.

This invention relates to machine switching telephone exchange systems.

Its object is to provide a circuit arrangement for use in training operators accurately to manipulate the impulse sender used in setting the automatic switches.

The invention contemplates locating the operator's position under observation and the instructor's position in the same operating room of a given office of the exchange and to handle calls completely within that room, while retaining the feature of having the operator operate the impulse sender in accordance with the designation of any office in the system and at the same time utilize only the machine switching equipment in the office where these operators are located.

The invention comprises therefore a circuit arrangement wherein the impulse sending equipment, although variably operated, invariably transmits to the machine switching office a predetermined office code of impulses to cause the switches to select a given office and to thereafter transmit sets of impulses for setting the machine switching equipment corresponding to the remaining digits of the number used in operating the impulse sender.

In the present embodiment of the invention, the impulse sender at the operator's position is shown as a dial which is rotated once for each digit of the desired number. When the dial is moved off normal for the first digit the leads to the office selector are transferred from the the dial to an impulse sender in the form of a step by step switch which is automatically advanced due to the rotation of the dial to transmit a predetermined office code consisting of two sets of impulses which set the office switch to pick out a trunk leading to an incoming selector. In the meantime the operator rotates the dial for the second digit, but since the trunk leads are still connected to the step by step impulse sender this rotation of the dial has no effect upon the automatic switches but serves to prepare a circuit for restoring the trunk leads to the dial which circuit is closed as the dial

is moved off normal for the third digit of the wanted number. Upon the return of the dial after being rotated for the third and subsequent digits it transmits a number of series of impulses for controlling the setting of the incoming selector and the final selector for establishing a connection with the line to which the instructor's telephone is connected. If the exchange system is equipped with switches of the step by step type the impulses transmitted by the automatic step by step sender and by the operator's dial directly control the setting of the switches in the well known manner. If however switches of the power driven type operating upon a reverive impulse control basis are employed, as illustrated herein, the impulses transmitted by the automatic step by step sender and by the dial, are registered upon a register sender and thereby control the setting of the switches.

Referring to the drawing which illustrates only so much of a telephone system as is necessary for a comprehension of the invention, it is thought the invention will be most readily understood from a detailed description of the operations involved in building up a connection.

In initiating a call, the operator under instruction actuates locking key 114 and inserts the plug 100 of a cord circuit at her position into the jack 101 of a trunk 102 terminating in an office selector 103. Relay 104 thereupon operates in a circuit including the sleeves of the plug and jack and completes the continuity of the tip conductor 105 of the cord. The insertion of the plug into the jack causes a register sender 106 to be associated with the trunk 102 as shown and described in detail in the patent to F. A. Stearn, No. 1,505,171, issued August 19, 1924. This register sender is set in accordance with the character of the desired number and thereafter controls the setting of the office selector 103, and the incoming and final selectors 144 and 145 to select the desired telephone line 107, in this instance, terminating in the telephone set 146 of the instructor. The insertion of the plug into the jack and the actuation of the dialing key 110 result in the closure of the following circuit including the line relay (not shown) of the register sender and relays 108 and 109, which may be traced from the sender 106, over the tip conductor of trunk 102, the tip contacts

of jack 101 and plug 100 the armature and front contact of relay 104, the upper alternate contacts of key 110, conductors 130, 133, relay 109, impulse contacts 153 of dial 132, conductor 134, normal right contact of relay 124, relay 108, conductor 131, lower alternate contacts of key 110, ring contacts of plug 100 and jack 101, ring conductor of trunk 102 to the sender. Relay 108, in operating, energizes a slow to release relay 111 which, in attracting its armature, places a ground on conductor 147 leading to locking contacts of a series of counting relays. Relay 109, in operating, closes a circuit including conductors 112, 113, left contact of locking key 114, left normal contact of the upper counting relay 115 of the first pair of counting relays, lower counting relay 116, conductor 117 to battery, operating relay 116. Relay 116, in attracting its armature, closes a locking circuit for itself through the upper counting relay 115 its own armature contact and to ground on conductor 147. Relay 115 does not energize in this circuit being shunted by ground connected to conductor 113 at the contact of relay 109. When the operator starts to dial the first office code digit, relay 109 is short-circuited at the off-normal contact 118 of the dial 132 and relay 109 releases removing the shunt from around the upper counting relay 115 and this relay operates in series with relay 116. Relay 115, in addition to extending conductor 113 to the second pair of counting relays, extends a connection from ground at the right contact of the locking key 114, over conductor 119, right normal contact of upper counting relay 120 of the third pair of counting relays, conductor 121, right alternate contact of the upper counting relay 115, conductor 122 thence in parallel to relays 123, 124 and slow to release relay 125, and also over conductor 126 and brush 127, position 1 of the lower arc of the step by step impulse sending switch 128, stepping magnet 129 of said switch to battery, this circuit including the armature and normal contact of the stepping magnet 129. Relay 124 disconnects the impulse leads 130 and 131 from the dial 132 and transfers them to the second arc 157 of the step by step switch 128 over the leads 143, 149. Relay 123 connects the leads 133 and 134 extending from the dial to battery and ground through two resistances 135 and 136 to hold relay 109 operated after relay 124 operates. Relay 125 disconnects the ground from contact 137 on the third arc for a purpose which will later appear. The step by step switch 128 under the influence of magnet 129 leaves its normal position and then proceeds to automatically step its brushes over its arcs until brush 127 reaches contact 137 controlled by relay 125. At this point it stops since ground was removed from this contact by relay 125. During the advance of the switch

128 the impulse leads 130 and 131 incoming from the cord have been opened six times by brush 158 at arc 157. A corresponding point 150 on the first arc 159 is wired to short-circuit relay 125 at this time over conductors 126, 151 and brush 152. Relay 125 thereupon releases, and since it is slow in releasing sufficient time is provided to allow the register sender 106 to set its circuit for the reception of the second digit. In other words, the switch 128, which is automatically sending out impulses, stops at this time for a short period of time. Upon the release of relay 125, contact 137 is again grounded and the step by step selector steps over four more contacts and at brush 158 and arc 157 transmits two more impulses to the register sender. Switch 128 thereupon stops awaiting the application of ground to the conductor 138 which is wired to the last series of contacts on the third arc. This ground will be furnished by the operation of the relay 120 of the third pair of counting relays to restore the step by step switch 128 to normal position.

During the time this step by step switch or automatic dial is operating, the operator proceeds with her dialing of the first two digits on her regular dial 132. When the dial restores to normal after the first code digit, relay 109 again operates operating the lower counting relay 139 of the second pair, this circuit including the left contact of the locking key 114, left alternate contact of relay 115, conductor 140, left normal contact of upper relay 141 of the second pair of counting relays, relay 139 to battery. The dial in being moved off normal for the second digit causes the release of relay 109 and the operation of the upper relay 141 of the second pair of counting relays in the well-known manner. The dial again returns to normal after the second digit is dialed, removing the short circuit from relay 109 which reoperates, closing a circuit to operate lower counting relay 142. When the dial is moved off normal in accordance with the third digit, relay 109 again releases thus removing the short circuit from the winding of upper counting relay 120 which now operates and locks in series with relay 142 to ground at the armature of relay 111. Relay 120 in operating opens at its right hand armature the holding circuit for relays 123, 124 and 125 releasing these relays. Relay 124 in releasing transfers leads 130 and 131 from leads 148 and 149 to leads 133 and 134 which are connected to the impulse springs 153 of the dial 132. The impulses produced by the dial 132 in accordance with the third digit are transmitted over leads 133, 134, 130 and 131 to the register sender 106. The attraction of the right armature of the upper relay 120 of the last pair of counting relays connects ground to the last series of

contacts on the third driving arc over conductor 138 and the step by step switch proceeds to advance until brush 127 reaches contact 143 which is open, thus restoring the switch 128 to normal position.

The counting relays are locked in their operated positions due to the operated condition of relay 111 which being slow-to-release is held operated at the armature and front contact of the relay 108 in series with the impulse leads 130, 131.

The operator now rotates the dial for the remaining digits and impulses corresponding thereto are transmitted to the register sender 106 by the operation of the impulse contacts 153 of the dial 132.

The register sender 106 has now received, stored up, and translated where necessary the impulses transmitted by the switch 128 and the dial 132. The impulses transmitted by the switch 128 in accordance with the first two digits or office code are so translated by the register sender 106 as to set the brushes 103 of the office selector on the terminals 160. The impulses corresponding to the third and fourth digits dialled are so translated by the register sender 106 as to set brushes 144 of the associated selector on the terminals 161. The impulses corresponding to the fifth and sixth digits dialled set brushes 145 of the final selector by two distinct movements to the terminals 162 of the line 107 connected to the instructor's telephone set 146.

The operator's telephone set 146 is located at the instructor's position which is preferably in close proximity to the student operator's position. The instructor is thereby in position effectively to supervise the work of the operator. The cord circuit shown in the drawing will not be described in detail since it is a standard cord circuit and is only an incidental part of this invention. The cord is provided with the usual ringing key 156 for applying ringing current to the selected line to operate the bell thereof, and with a key 155 which bridges the operator's telephone set (not shown) across the cord.

The counting relays are restored to normal when the dialing key 110 is restored. The restoration of this key disconnects the dialing equipment from the cord, resulting in the permanent deenergization of relay 108 and the consequent release of slow relay 111 which opens the locking circuit of the counting relays. The locking key 114 may be released when the operator finishes dialing.

In the foregoing description it has been assumed that it was necessary to automatically transmit the code 62 in order to route the connection entirely within the office in which the operator's and instructor's positions are located. It is obvious that should it be desirable to trans-

mit any other office code such for example as 28 this may be done by shifting the resting contacts 150 and 137 of the first and third arcs of the switch 128 and changing the strapping on the second and third arcs.

As hereinbefore stated the invention may be applied to a system employing step by step switches in which event the register sender 106 would not be used. The first two digits would represent the office code as before. The first series of impulses transmitted by the switch 128 would set the brushes 103 on the terminals 160, the second series of impulses would set brushes 144 on the terminals 161, the third series would set the brushes 145 on the terminals of a selector switch (not shown), whose brushes would be set under control of the fourth series on the terminals of another selector switch also not shown. The brushes of the last mentioned switch would be set under control of the fifth and sixth series of impulses by two movements on the terminals 162 of the line 107 connected to the instructor's telephone set 146.

What is claimed is.

1. In a telephone system, telephone lines, means including automatic switching apparatus for interconnecting the same, a dial, means for associating said dial with said switching apparatus, impulse sending means automatically actuated by the variable operation of said dial and a part of the digits of the desired number for invariably transmitting the same code of impulses to said automatic switching apparatus, and means for transferring the control of said automatic switching apparatus from said impulse sending means to the impulse contacts of the dial for transmitting sets of impulses to said automatic switching apparatus corresponding to the remaining digits dialled.

2. In a telephone system, telephone lines divided into groups, means including automatic switching apparatus for selecting any line in any group, an impulse sender adapted to be operated in accordance with the digits of the desired number, means for associating said sender with said switching apparatus, and means controlled by the sender in being operated in accordance with any number to control said automatic switching apparatus invariably to select the same group of lines irrespective of the character of certain of the digits, said sender controlling said automatic switching apparatus in accordance with the character of the remaining digits to select a given line in said group.

3. In a telephone system, telephone lines, trunks and automatic numerical switches, a manual sender adapted to be associated with the trunk terminating in the first switch to be set, an automatic sender, means auto-

manually operated upon the actuation of the manual sender for disconnecting said manual sender from said trunk and substituting said automatic sender to control the partial extension of said connection over said switches, and means for reconnecting said manual sender to said trunk to control the setting of the remaining switches to connect with one of said lines.

4. In a telephone system, telephone lines, an automatic office wherein said lines terminate, an office selector therein, other automatic switches, an operator's position, a manual sender thereat, an automatic sender, means for associating said sender with said office selector, means automatically operated upon the actuation of said manual sender to cause said automatic sender to transmit impulses to control said office selector invariably to select the same office, and means for thereupon transferring the control of the remaining switches to said manual sender to set said switches to select the line corresponding to the remaining digits of the wanted number.

5. In a telephone system, a plurality of offices, telephone lines terminating therein, an office selector, other automatic switches, an operator's position, a dial and an automatic sender thereat, means for associating said dial and sender with said office selector, means automatically operated by the actuation of said dial for causing said automatic sender to set said office selector invariably to select the same office, and means thereupon automatically operated for transferring the control of the setting of the remaining switches to said dial.

6. In a telephone system, telephone lines, offices wherein said lines terminate, an instructor's telephone line terminating in one of said offices, automatic switching apparatus adapted to select said line, an operator's position in said office, a manual sender and an automatic sender, means for associating said senders with the first of said switches, means automatically operated by the actuation of the manual sender to cause said automatic sender invariably to set a part of said automatic switching apparatus to select said office, and means thereupon automatically

operated for transferring the control of said automatic switching apparatus to said manual sender to select said instructor's telephone line.

7. A telephone system, telephone lines, trunks and automatic numerical switches, a dial adapted to be associated with the trunk terminating in the first switch to be set, a step by step automatic sender, means automatically actuated upon the rotation of the dial for the first digit for causing said automatic sender to control the setting of said first switch, and means automatically operated upon the completion of the operation of said automatic sender for disconnecting said automatic sender from said trunk and for transferring the control of the remaining switches to said dial.

8. In a telephone system, telephone lines, automatic offices wherein said lines terminate, an office selector switch, other automatic switches in said offices, a register sender, an operator's position, a manual sender and an automatic sender at said operator's position, means for associating said senders with said office selector, means automatically operated upon the actuation of said manual sender to cause said automatic sender invariably to set said register sender to control said office selector to select the same office, means for thereupon transferring the control of the setting of said register sender for the remaining digits to said manual sender, and means including said office selector for associating said register sender with said automatic switches to set the same in accordance with its set position.

9. A telephone system, telephone lines, trunks and automatic numerical switches, a manual sender adapted to be associated with the trunk terminating in the first numerical switch to be set, an automatic sender, and means automatically actuated upon the initial operation of the manual sender for causing said automatic sender to control the setting of said first numerical switch.

In testimony whereof, I have signed my name to this specification this tenth day of April, 1922.

WILLIAM A. RHODES.