

April 18, 1933.

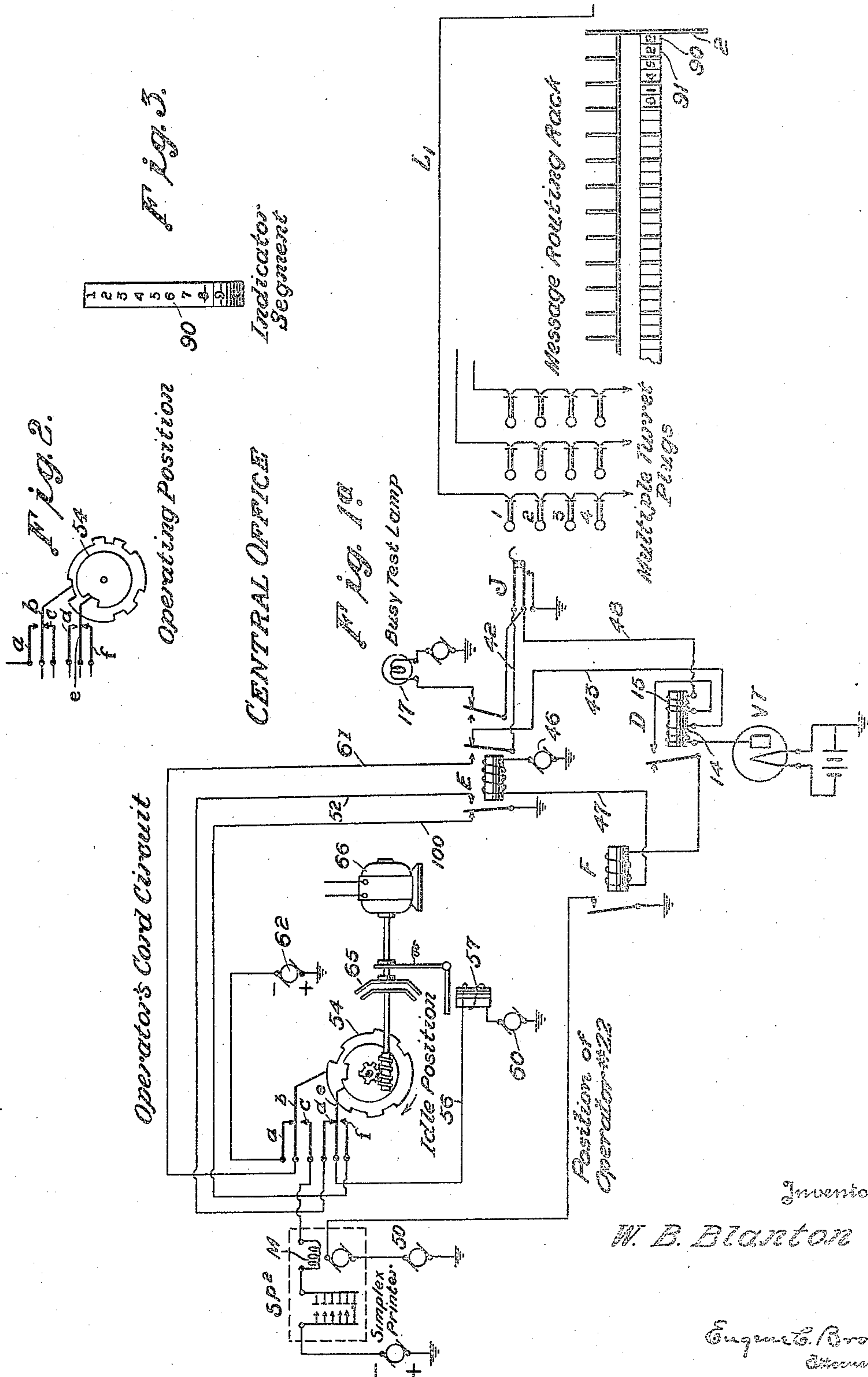
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Filed Sept. 30, 1931

2 Sheets-Sheet 1



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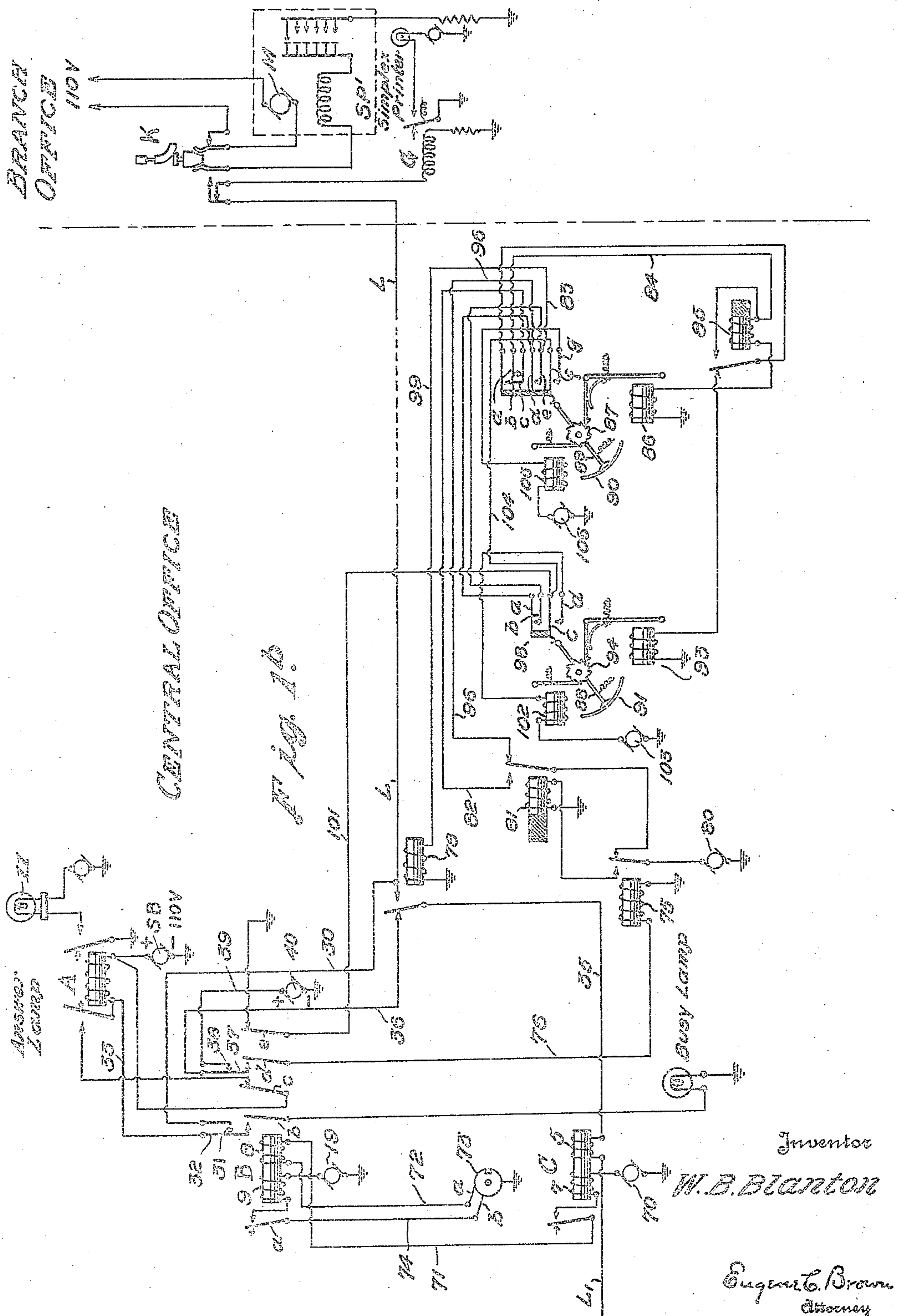
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UNITED STATES PATENT OFFICE

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AUTOMATIC OPERATOR INDICATOR FOR BUSY LINES AT CENTRAL OFFICES

Application filed September 30, 1931. Serial No. 566,096.

This invention relates to the handling of traffic at a central office or concentration unit where a large number of subscriber's lines are terminated before a small number of operators. Messages which are received at the central office for transmission or retransmission over the various lines to the different branch offices are received at a distributing center from which they are taken to the operators by delivery girls or messengers. At the distributing center there is located a rack for the reception of the messages, a compartment of the rack being designated for each branch office connected to the central office. In order that the messages may be transmitted with the least delay, it is desirable to have them taken from the distributing center directly to the operator who is at that moment working the line connected to the branch station to which the message is directed.

The object of the present invention is to provide means for automatically indicating at the distributing center the operator who is working the line connected to any desired branch office so that the message or messages intended for that office may be taken directly to that operator by the messenger.

As one means for accomplishing this purpose I provide a rack at the distributing center having a compartment for each branch circuit terminating at the central office or concentrator unit. Under each of these compartments is located an indicator positioned behind a window in the frame of the rack. The indicator is provided with numerals on its face which register combinations corresponding to the different locations of the operators. Thus when operator 24 plugs in on a line circuit, the units and tens elements of the corresponding indicator would register the number 24 at its window, thereby indicating to the delivery girls that operator No. 24 was then working the line with which the compartment over the window is associated.

The invention will be understood from the following description in connection with the accompanying drawings in which—

Figures 1^a and 1^b represent apparatus and circuits employed in one embodiment of my invention.

Figure 2 is a detail view of the code wheel in operating position.

Figure 3 is a front elevation of an indicator dial plate.

I have illustrated one concentrator circuit at the central office and only one branch office but it will be understood that each concentrator may be provided with a plurality of circuits connected to a plurality of branch offices. The equipment at each branch station comprises a simplex printer SP', a key switch K, and a signal relay G. The branch station is connected by a line L to the central station. With the key K in the position illustrated, the line L is grounded through the signal relay G and in the other position of the key, the relay G is disconnected, the line is grounded through the simplex printer and the energizing circuit of the printer operating motor M is completed.

At the central station, the line L is connected through conductor 30, contact 31, spring contact arm 32, conductor 33, winding of relay A to the signaling generator or battery SB. The terminal plugs for each line are connected in multiple and are located at the respective operators' positions or turrets. When the line is idle these plugs are connected through line L₁, coil 5 of relay C, conductor 35, armature and back contact of relay 78, conductor 36, spring contact arm 37, contact 38, conductor 39 to the plus pole of generator 40.

Assume that operator 22 desires to answer or to initiate a call on the particular line shown on the drawings. When she attaches her cord jack J to plug No. 1, positive potential from generator 40 is applied over the circuit above traced, tip contact of jack J,

conductor 42, inner right hand armature and back contact of relay E, conductor 43, coil 14 of relay D, vacuum tube VT to ground. The plate current drawn by the vacuum tube VT is not of sufficient value to operate relay C; however, this current is of sufficient value to cause the operation of relay D which closes a circuit from generator 46 through the coil of relay E, conductor 47, coil of relay F, armature, front contact and coil 15 of relay D, conductor 48, intermediate and lower contacts of jack J to ground. This circuit locks up relays D, E and F.

Operation of relay F closes a circuit from generator 50 through the printer motor M of simplex printer SP². Operation of relay E closes a circuit through its left hand armature and front contact over conductor 52, contacts *d* and *e* of code wheel 54, conductor 56, relay 57 of generator 60. The inner right hand armature of relay E in moving from its back contact opens the circuit through the vacuum tube VT and closes a circuit from the tip contact of the jack J through conductor 61, contacts *b* and *a* of the code wheel to generator 62. Thus a circuit is established from the negative polarity battery 62 through winding 5 of relay C to positive polarity battery 40, thereby operating relay C. The operation of the outer right hand armature of relay E opened the circuit through the busy test lamp 17 which was momentarily closed when the operator connected her jack J to the plug. The operation of the relay 57 causes the members of the clutch 65 to engage so that the continuously running motor 66 begins to rotate the code wheel 54.

The operation of relay C when the operator connected her jack to the plug 1, closed a locking circuit from generator 70 through coil 7 and armature of relay C, conductor 71, coil 8 of relay B, conductor 72, brush *a* and disk of interrupter 73 to ground. Operation of relay B closed a locking circuit for itself from generator 19 through coil 9 and left hand armature of the relay, conductor 74, brush *b* and disk of interrupter 73 to ground. These two locking circuits and the interrupter 73 are for the purpose of maintaining relay B continuously in the operated position while the concentrator operator has her jack J connected to the line plug. Assume that interrupter 73 takes $1\frac{1}{4}$ second to make a complete revolution and that the time required to rotate the notch on the interrupter from contact *a* to contact *b* in a clockwise direction takes one second. Now when the locking circuit through winding 8 of relay B and winding 7 of relay C is open due to the notch of the interrupter passing under contact *a*, relay C will be deenergized if at that moment no current is passing through winding 5. Relay B, however, will remain energized due to the locking circuit

through its winding 9. If, before the notch on interrupter 73 passes under contact *b*, a line signal passes through winding 5 of relay C, the locking circuit connected to contact *a* of the interrupter will be restored. Therefore, relay B will continue in the energized position when the locking circuit connected to interrupter contact *b* is open. When the operator disconnects her jack J from the line plug, all battery is removed from this line and relay B will be released when interrupter 73 opens the locking circuit connected to its contact *a* and the locking circuit connected to its contact circuit *b*, in the sequence named. Thus, it will be seen that relay B is maintained continuously operated as long as relay C receives a current impulse at least once every second through its winding 5. The operation of the armature *b* of relay B disconnects relay A and signaling generator SB from the line and a circuit is established from this signaling battery through relay A and the busy lamp to ground. The operation of armature *c* opens the short circuit which is established around the winding of relay A when this relay responds to a momentary open circuit at the branch office in order to receive an incoming call.

The armature *d* of relay B opens the circuit from the generator 40 to the terminal plug 1 and closes a circuit from ground through the coil of relay 75, conductor 76, armature *d*, spring contact arm 37, conductor 36, armature and back contact of relay 78, coil 5 of relay C and line L₁ to the plug. Current, therefore, flows over this circuit from the generator 62 and operates relay 75.

The operation of relay 75 closes a circuit from generator 80 through armature and front contact of relay 75 and coil of relay 81 to ground, causing relay 81 to operate. Now the rotation of code wheel 54 will cause a series of breaks or openings in this circuit by the opening of the springs *a* and *b*. Relay 75 will follow these openings, permitting its armature to fall back each time to its deenergized position, thus completing a circuit from generator 80, through armature and back contact of relay 75, armature and front contact of slow-to-release relay 81, conductor 82, springs *c* and *b* of switch 83, conductor 84, coil of relay 85 and coil of stepping magnet 86 to ground. Magnet 86 will be energized each time the code wheel opens the circuit, thus actuating the ratchet 87 and swinging the arm 89 to step the indicator segment 90 upwardly so that the figures on its face will appear successively in front of the window at the message routing rack.

I have shown the indicator as comprising a units segment 90 and a tens segment 91 which would be sufficient for ninety-nine operators. It is obvious that by adding a third indicator with the corresponding circuit equipment, the

indicator would provide for nine hundred ninety-nine operators.

Relays 81 and 85 are indicated as slow-to-release relays and because of this feature, they will remain operated during the series of breaks or open circuit impulses. When the stepping magnet 86 operates the indicator 90 to its first step or position the right hand end of the arm 89 releases the off-normal spring of the switch 83, permitting them to move downward into engagement with the other springs, thus establishing another circuit from the front contact of relay 81 through the winding of relay 85. This circuit passes from the front contact of relay 81, through springs *c* and *a* of switch 83, armature, front contact and winding of relay 85 and stepping magnet 86 to ground. The engagement of the other springs *d* and *e* prepares a circuit to relay 78 to connect the main line L to the operators set and the engagement of springs *f* and *g* prepares a circuit for restoring the indicator to starting position.

At the completion of the first series of circuit openings from the code wheel 54, it will be noted that the circuit is closed for a long period before the second series of circuit openings occurs for stepping up the "tens" indicator. During this long closed circuit period, relay 75 will be held in an energized position, thus holding relay 81 also in energized position. Hence the circuit through relay 85 and stepping magnet 86 will be open for this length of time at the back contact of relay 75. This allows the slow-to-release relay 85 to be deenergized so that the circuit from the front contact of relay 81 will now be directed to the "tens" indicator through the armature and back contact of relay 85. Tracing this circuit from the front contact of relay 81, it passes over conductor 82, off-normal springs *c* and *a* of switch 83, armature and back contact of relay 85 and winding of stepping magnet 93 to ground.

The continued movement of the code wheel 54 now produces the second series of open circuit conditions which will be followed by the relay 75. The circuit through the stepping magnet 93 will be closed each time the armature of relay 75 moves to its back contact, thereby stepping the ratchet 94 and swinging the indicator 91 upwardly one step each time relay 75 is deenergized. During this series of open circuit conditions, slow-to-release relay 81 will remain in the operated condition. The last open circuit conditions of the "tens" series is a long one so that the armature of relay 75 will rest on its back contact a sufficient length of time to permit the relay 81 to deenergize. When this occurs, a circuit is closed from generator 80 through the armature and back contact of relay 75, armature and back contact of relay 81, conductor 96, off-normal springs *d* and *e* of

switch 83, and off-normal springs *a* and *b* of switch 98 in parallel and thence through conductor 99 and the winding of relay 78 to ground, thereby connecting the line L through the armature and front contact of relay 78 to the conductor 35 and the operator's cord circuit. At the same time, the circuit to relay 75 is opened at the back contact of relay 29.

The tens and units segments 91 and 90 of the indicator now show the figure 22 at the window under compartment No. 1 of the message routing rack which indicates to the messenger girl that operator 22 is working on this line so that any messages destined to that branch office may be taken directly to this operator.

Code wheel 54 will continue to rotate until it reaches the position shown in Fig. 2. At this point, the spring *e* riding on the periphery of the smaller code wheel, falls into a depression therein thereby opening the contacts *d* and *e* and breaking the circuit of the clutch magnet 57, thus disengaging the clutch members. The spring *b* which rides on the larger code wheel, falls into the deep depression, thus closing the contacts *b* and *c* and connecting the line to the simplex printer SP². The circuit is now in readiness for the exchange of business from the central office to the branch office. At the completion of the exchange of business with the branch office connected to line L, operator 22 removes her jack J from the line plug 1. Relay E is thus deenergized and completes a circuit through its left hand armature and back contact from ground through conductor 100, contacts *f* and *e* of the code wheel 54 to the clutch magnet 57. The engagement of the clutch members 65 causes the code wheel to rotate until the circuit to the clutch magnet 57 is broken at the springs *e* and *f*, thus placing the code sending mechanism in the printer cord circuit in readiness to function when the operator connects her jack to the plug of another line.

When operator 22 removed her jack J from the line plug 1, all line battery was disconnected from this line and consequently relay B will be deenergized as soon as the contact springs *a* and *b* of the constantly rotating interrupter 73 fall into the notch in the periphery of the disc in the order named. As the armatures of the relay B move to their back contacts, the indicators 90 and 91 are restored to their initial position in the following manner: A release circuit is established from ground through armature *e* and back contact of relay B, through conductor 101, off-normal springs *c* and *d* of switch 98, winding of release magnet 102, and generator 103 to ground; and also from said spring *c* through conductor 104, off-normal springs *f* and *g* of switch 83, winding of release magnet 105 and generator 106 to ground. The

energizing of these two release magnets disengages the locking pawls from the respective ratchet wheels 87 and 94, thus allowing the indicators to be restored to starting position by their biasing springs. It will be noted that when the indicators move to their initial position, the arms 88 and 89 engage the off-normal springs and lift them to their normal position indicated in the drawings.

It will be noted that when one operator has her jack J connected to a line, there will be negative battery connected to this line. Therefore, if a second operator attaches her jack J to this same line, this negative battery will be applied to the plate of the vacuum tube in the second operator's cord circuit. No plate current will flow and consequently relay D in the second operator's cord circuit will not be energized. Consequently, relays E and F and magnet 57 receive no current and therefore the code wheel 54 does not rotate. Thus it will be seen that it is necessary for an operator to plug up to an idle line in order to cause the code signal device in her cord circuit to function.

For the purpose of illustrating my invention, I have shown it as applied to the concentrator circuit for simplex printers disclosed in U. S. Patent 1,804,327 dated May 5, 1931 but it should be understood that my invention can be applied to other concentration circuits. It will also be obvious to engineers that various changes and modifications in the circuit arrangement may be made without in any manner departing from my invention.

I claim:

1. In an intercommunication system embodying a central office and a plurality of branch offices, a line from each branch office terminating at said central office, multiplied jacks or plugs for each line located at a number of turrets or operators' positions, a message routing or distributing center, indicating devices at said center corresponding to each line, and means operating automatically in response to the seizure of a line to cause the corresponding indicator to display a signal designating the particular operator seizing the line.

2. In an intercommunication system embodying a central office and a plurality of branch offices having lines terminating at the central office, multiplied jacks or plugs for each line located at a number of turrets or operators' positions, a message distributing center at the central office, an indicator at said center for each line, a code signaling device operatively connected to each operator's cord circuit and means automatically actuated when an operator connects a cord circuit to one of said jacks or plugs for causing said signaling device to transmit a code signal to the corresponding line indicator designating the particular operator making connection to this line.

3. In an intercommunication system embodying a central office and a plurality of branch offices having lines terminating at the central office, multiplied jacks or plugs for each line located at a number of turrets or operators' positions, a message distributing center at the central office, an indicator at said center for each line, a receiving device at each operator's position, a code signaling and switching mechanism connected to each operator's cord circuit, and means automatically actuated when an operator connects her cord circuit to one of said jacks or plugs to cause said mechanism to first transmit a code signal to the corresponding line indicator designating said calling operator and then connect said receiving device to the cord circuit.

4. An intercommunication system as set forth in claim 3, and means for causing said mechanism to disconnect said receiving device and return to normal idle position when the operator disconnects her cord circuit from the line jack or plug.

5. In an intercommunication system embodying a central office and a plurality of branch offices having lines terminating at the central office, multiplied jacks or plugs for each line located at a number of turrets or operators' positions, a message routing center at the central office provided with operator indicators for each operator's position, a code signaling mechanism connected to each operator's cord circuit, means automatically actuated when an operator connects her cord circuit to a jack or plug to cause said mechanism to transmit a code signal designating said calling operator, and switching mechanism associated with each indicator responsive to the code signal operating to first actuate the indicator and then connect the branch office line to the operator's cord circuit.

6. In an intercommunication system embodying a central office and a plurality of branch offices having lines terminating at the central office, multiplied jacks or plugs for each line located at a number of turrets or operators' positions, a message routing center at the central office provided with operator indicators for each operator's position, a simplex printer at each operator's position, a code signaling and switching mechanism connected to each operator's cord circuit, means automatically actuated when an operator connects her cord circuit to a jack or plug to cause said mechanism to first transmit a code signal designating said calling operator and then connect the simplex printer to the cord circuit, and switching mechanism associated with each indicator responsive to the code signal operating to first actuate the indicator and then connect the branch office line to the operator's cord circuit.

7. In an intercommunicating system embodying a central office and a plurality of branch offices, a line from each branch office terminating in a concentration unit having
5 a number of operators' positions, said concentration unit having circuit arrangements which permit any one of the lines to be worked from any one of the operators' positions, and means at a message routing center
10 operating in response to the seizure of a line for automatically indicating the particular operator working each busy line.

In testimony whereof, I affix my signature.

15 WILLIAM B. BLANTON.

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