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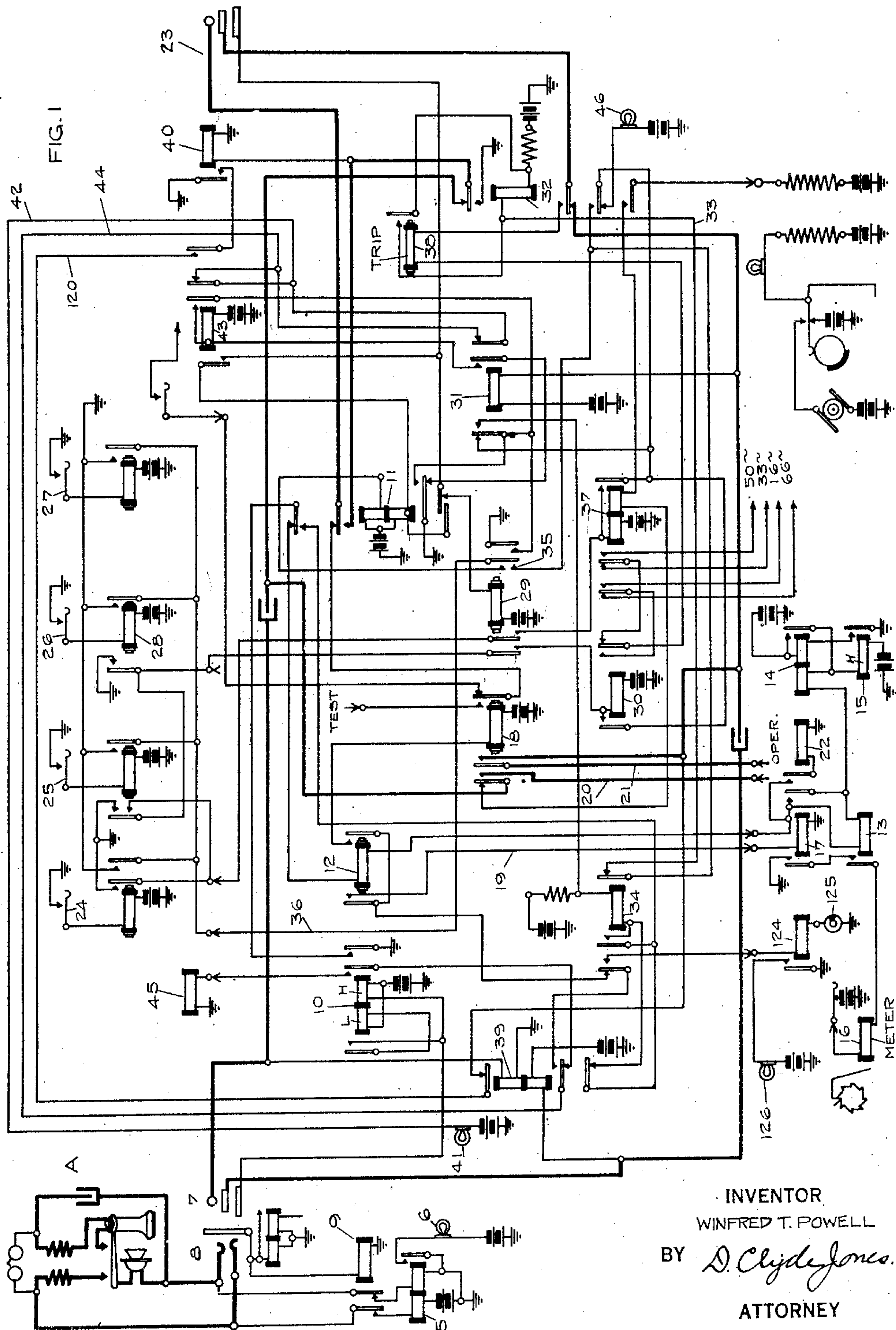
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W. T. POWELL

TELEPHONE SYSTEM

Filed May 8, 1924

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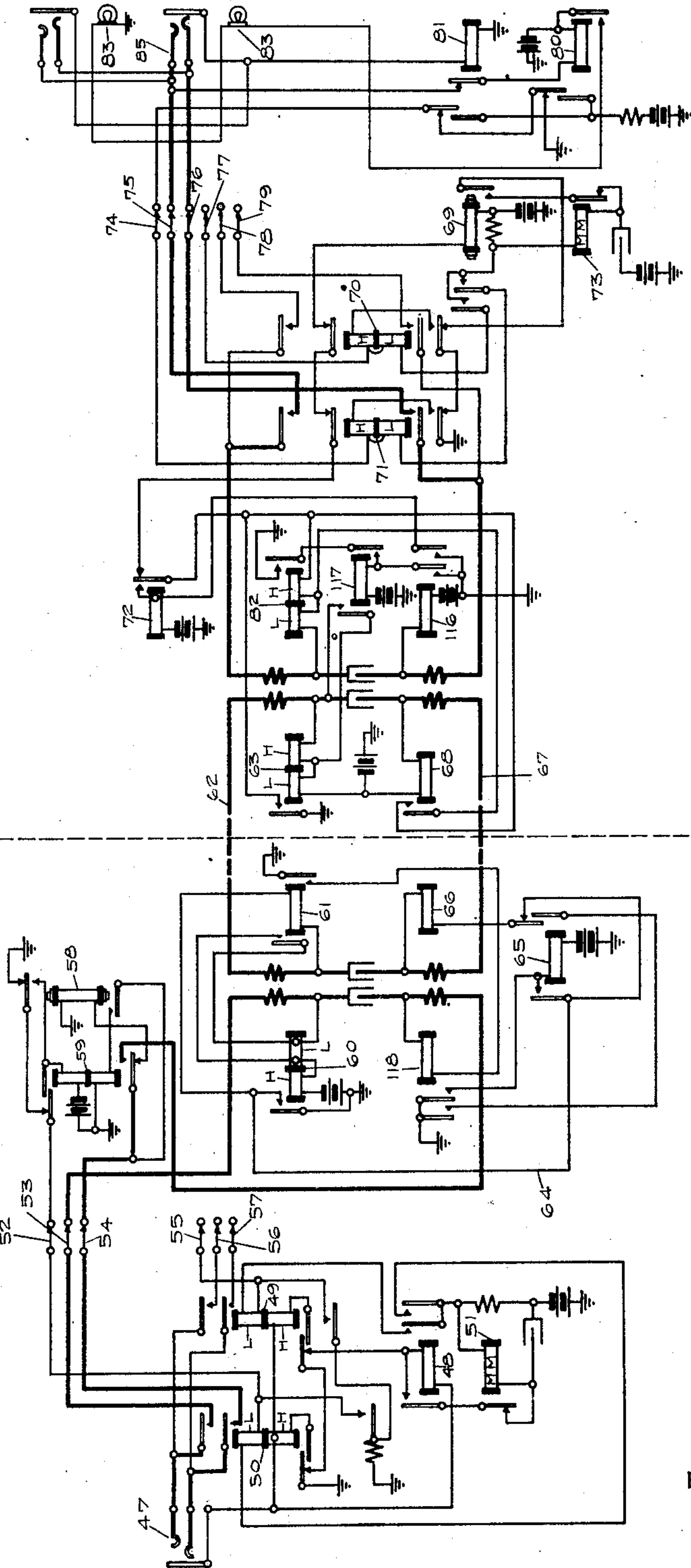
TELEPHONE SYSTEM

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FIG. 2 SECONDARY TRUNK SELECTOR

PRIMARY TRUNK SELECTOR



DISTANT OFFICE

ORIGINATING OFFICE

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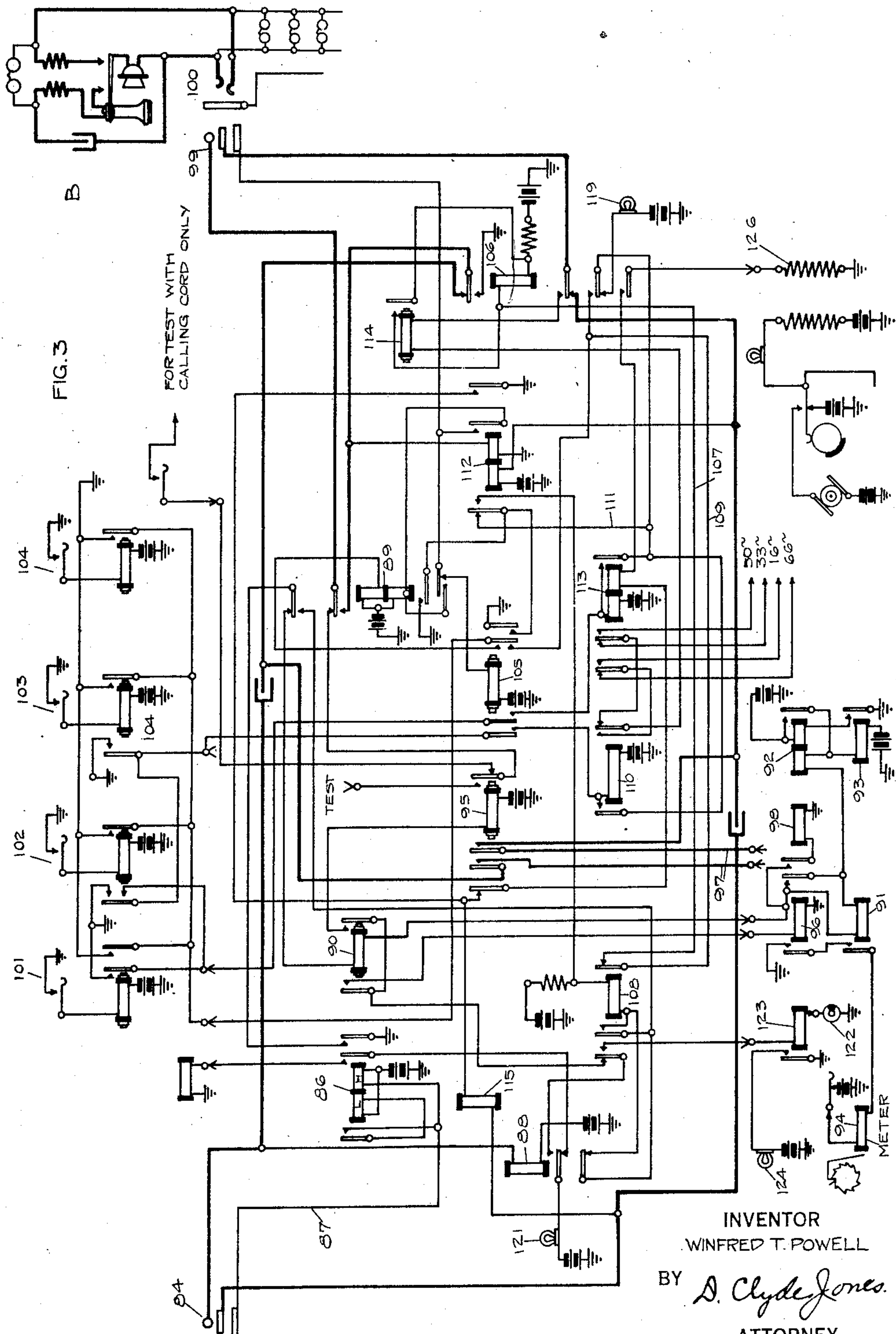
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TELEPHONE SYSTEM

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6 Sheets-Sheet 3



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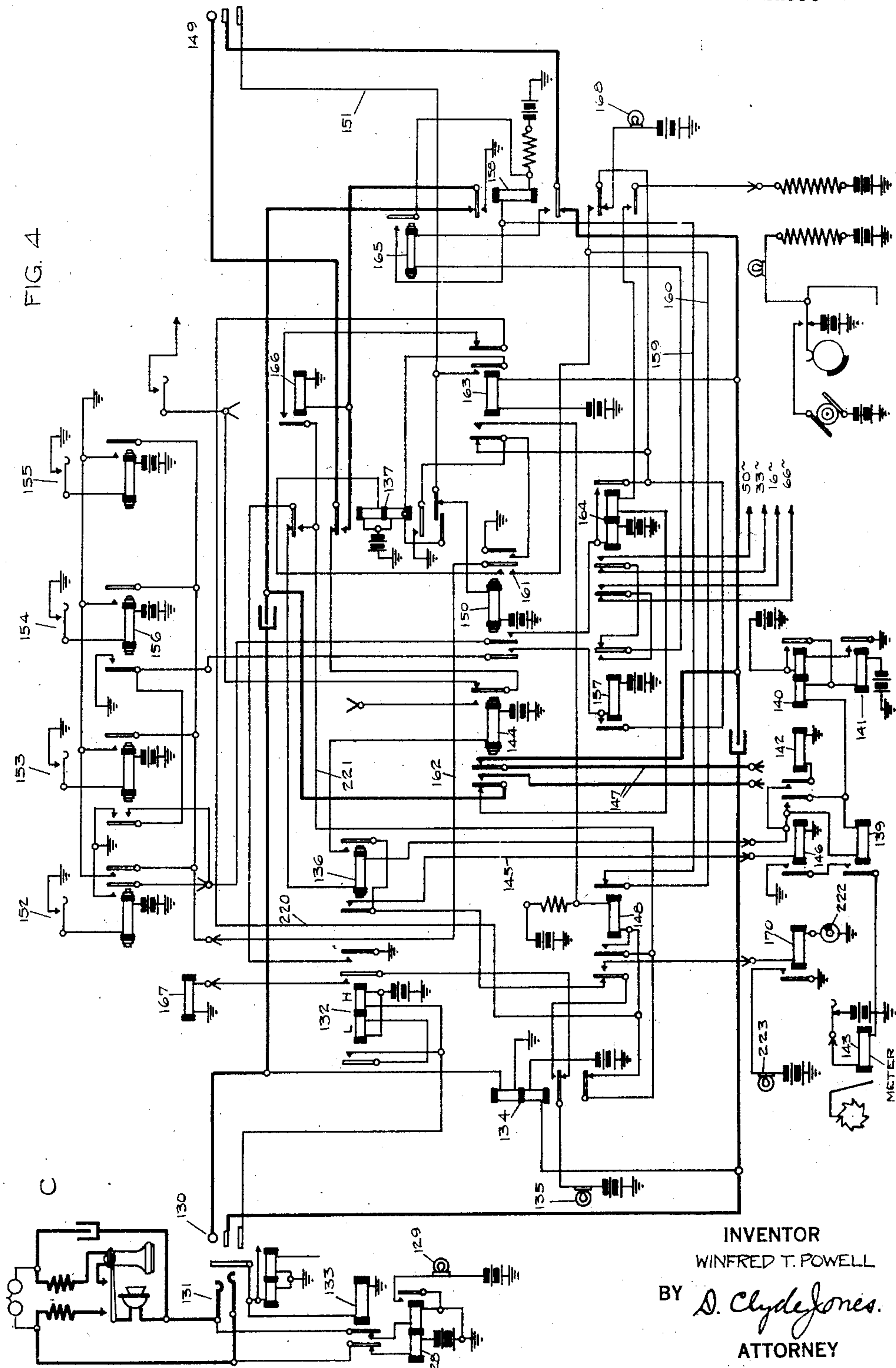
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TELEPHONE SYSTEM

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6 Sheets-Sheet 4

FIG. 4



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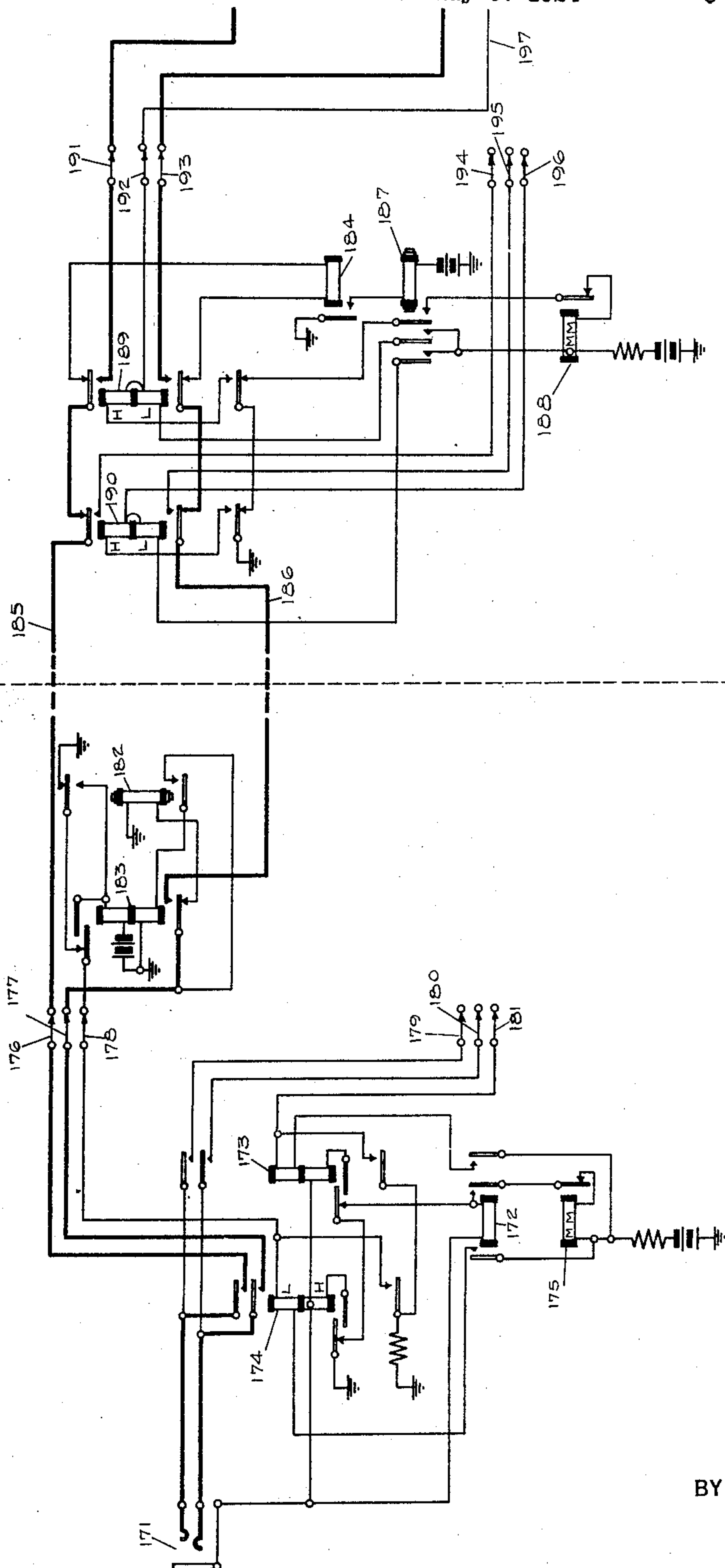
TELEPHONE SYSTEM

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FIG. 5 SECONDARY TRUNK SELECTOR

PRIMARY TRUNK SELECTOR



ORIGINATING OFFICE

DISTANT OFFICE

INVENTOR

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Feb. 7, 1928.

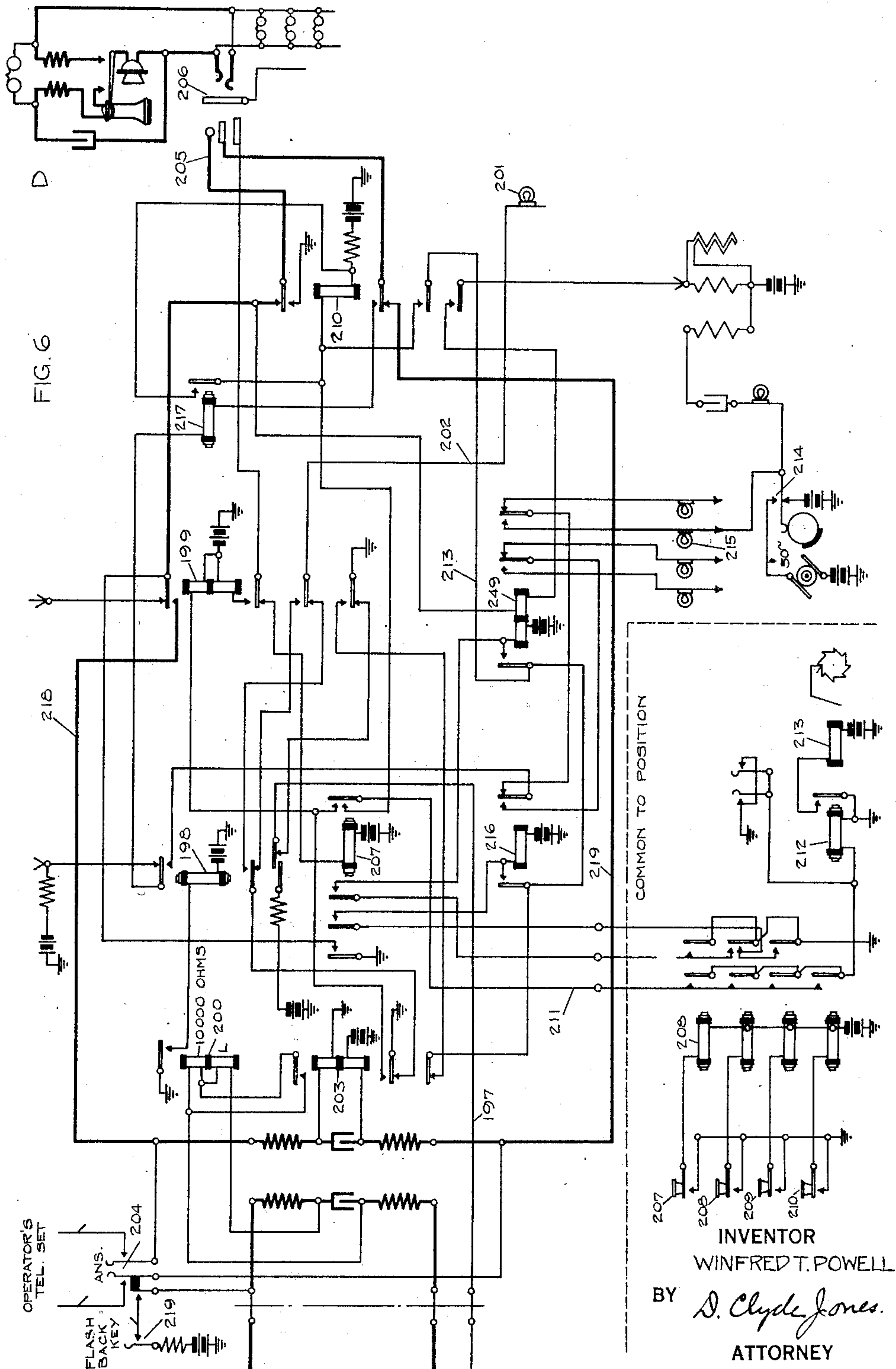
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TELEPHONE SYSTEM

Filed May 8, 1924

6 Sheets-Sheet 6



UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

Application filed May 8, 1924. Serial No. 711,751.

This invention relates to telephone systems and more particularly to telephone systems having one or more offices. In such telephone systems it has been customary to provide so-called order wires connecting the various offices over which an operator at an originating office transmits the wanted number to a B operator at a distant office and this last named operator in turn assigns a trunk over which the A operator may extend a call. Such order wire operation has proved to be especially inefficient during busy periods and has resulted in numerous wrong connections.

It is the purpose of the present invention to provide an improved arrangement whereby the order wires may be dispensed with to the end that the operation of the system may be greatly facilitated and the number of incorrect connections reduced to a minimum.

One of the features of the present invention resides in the provision of automatic trunking means, whereby an operator at an originating office, by connecting the calling line to said trunking means operates mechanism to extend the calling line to a B operator's position at the distant office at which office each B operator's position is provided with a plurality of manual link circuits with but one common ringing key for each of the sources of ringing current of the characteristic provided for selectively signaling the several stations on a party line.

Another feature of the invention consists in the arrangement for automatically extending a calling line at an originating office by means of automatic switching devices, to trunk circuits each of which terminates in multiple jacks provided with associated trunk lamps at several operator's positions.

Another feature of the invention includes the arrangement whereby a subscriber at an originating office on initiating a recall causes a signal at the B operator's position to be actuated in a distinctive manner and whereby said B operator controls means to actuate in a distinctive manner a corresponding signal at the A operator's position.

In the drawings Figures 1, 2 and 3 when arranged in the order named, diagrammati-

cally represent one form of the invention. In the upper left hand corner of Fig. 1 there is represented a calling line and although it is indicated as provided with only one substation it may be provided with a plurality of substations for party line operation. The remainder of Fig. 1 diagrammatically represents an A operator's cord circuit together with certain portions of the equipment, which are common to a plurality of cord circuits at an A operator's position.

At the left of the dotted line in Fig. 2 there is represented a trunk selector switch which is located in the same office as the equipment of Fig. 1. At the right of the dotted line in Fig. 2 there is represented a second trunk selector switch which is located in a distant office. Fig. 3 diagrammatically represents a cord circuit at a B operator's position in the distant office, which is the same office as that represented at the right of Fig. 2. At the upper right hand corner of Fig. 3 a party line is represented.

Figures 4, 5 and 6 when arranged in the order named diagrammatically represent a modified form of the invention. In the upper left hand corner of Fig. 4 there is indicated a telephone line and substation, but it will be understood that this line may be provided with a plurality of substations for party line operation, without departing from the present invention. The remainder of Fig. 4 diagrammatically represents an A operator's cord circuit and certain of the equipment which is common to a plurality of cord circuits at this operator's position. At the left hand side of the dotted line of Fig. 5, there is represented a trunk selector switch located in the same office as the equipment of Fig. 4. At the right of Fig. 5, there is represented a secondary trunk selector switch, which is located at a distant office. A two conductor trunk connects these offices. In Fig. 6, there is indicated the equipment of a B operator's plug-ended link circuit and certain of the equipment at this position, which is common to a plurality of such link circuits. In the upper right hand corner of Fig. 6, there is represented a multi-station telephone line.

The selector switches referred to in this

disclosure may be substantially similar to that disclosed in the patent to Clement No. 1,107,153 patented August 11, 1924, when modified by being provided with two sets of brushes for simultaneously engaging two sets of trunk terminals and for seizing an idle one of these sets of terminals.

It is believed that the invention will best be understood by describing the method of extending a telephone call from a subscriber's substation indicated at A. It will first be assumed that the subscriber at A desires a connection to a second subscriber, whose line is not shown, but which is understood to terminate in the same exchange as the A subscriber's line. It will then be assumed that the A subscriber desires to establish a telephone connection to a subscriber's line, whose substation such as that indicated at B in Fig. 3, terminates in a distant office.

Local call.

When the subscriber at A removes his receiver from its switchhook, the line relay 5 is energized in the well known manner, over the two sides of the calling line in series and thereby lights the line lamp 6. The operator whose cord circuit is shown in Fig. 1 then inserts the answering plug 7 of this cord circuit into the jack 8 of the calling line. This operation is effective to energize the cut-off relay 9 and the operator's bar relay 10 in a circuit extending from grounded battery through the right hand high resistance winding of relay 10 through the sleeve contacts of the plug 7 and jack 8, winding of the cut-off relay 9 to ground. As soon as the cut-off relay 9 is actuated it opens the energizing circuit of the line relay 5, which relay deenergizes and opens the circuit of the lamp 6 to extinguish it. The operator's bar relay 10 when operated, closes a locking circuit for itself through its low resistance left hand winding and through its left hand armature and front contact over the remainder of the circuit previously described. As is well known, the high resistance and low resistance windings of the relay 10 are provided to prevent a second operator's telephone set from being connected to a calling subscriber's line at the same time, in the event that two operators should simultaneously connect the answering ends of their cord circuits to the same calling line.

When the relay 10 is operated it closes a circuit from ground, its outer right hand armature and front contact, uppermost armature and back contact of relay 11, winding of the slow releasing relay 12, winding of the relay 13, left hand winding of the relay 14, winding of the high resistance relay 15, to grounded battery. The resistance of the relay 15 is such that it is operated in this cir-

cuit, but the other mentioned relays in series therewith are not operated at this time. With the relay 15 operated, an energizing circuit is closed from grounded battery, right hand winding of the relay 14, front contact and armature of relay 15, to ground. When the relay 14 is thus energized, it extends a circuit from grounded battery, its front contact, armature and left hand winding, and thence through the windings of relays 13 and 12, over the remainder of the circuit previously described as extending to ground at the right hand front contact and armature of relay 10. Relays 12 and 13 are energized in this last circuit. Relay 13 closes a break-point in the operating circuit of the meter 16 and with the relay 12 energized the operator's cut-in relay 18 is energized from grounded battery, front contacts and armatures of relay 12, conductor 19, winding of relay 17, to ground. The relay 18 is thereby energized and at its left hand armatures and front contacts, extends the operator's telephone set through the conductors 20 and 21 over the answering end of the cord circuit in use, to the calling subscriber's line. The relay 17 is energized in series with the relay 18 and closes the remaining break-point in the circuit of the meter 16, causing the same to energize once and once only to record that this operator has answered a call.

The relays 13, 14, 15 and the impedance coil 22, are common to an operator's position and are provided to permit the operator to extend a second call through a second cord circuit while she is completing the connection on a first cord circuit such as that shown in Fig. 1. This arrangement permits the operator to "plug up" a second call while she is pressing the ringing key to apply ringing current over a first cord circuit. The arrangement of relays is such that only two calls may be in the process of completion by one operator at the same time. If the operator "plugs up" more than two calls before any one connection is completed, then all of the calls will fail. Such an arrangement has proved to be especially satisfactory in handling a large number of calls.

As soon as the operator's telephone set is connected to the calling telephone line, the operator inquires for the number of the wanted telephone line and when she ascertains that the call is a local call, that is, one terminating in the same office as the calling subscriber, she inserts the calling plug 23 into the multiple jack of the wanted line (not shown) and then depresses some one of the ringing keys, such as 24, 25, 26 and 27.

Let it be assumed that the ringing key 26 is depressed to operate the relay 28, which in turn controls the selection of the proper ringing current to signal the wanted station.

As soon as the calling plug 23 is inserted in a multiple jack of the called line, the sleeve relay 29 is operated from grounded battery, winding of this relay, back contact and armature of relay 11, sleeve contacts of the plug 23 and thence to ground through the jack and the cut-off relay of the wanted line (not shown). With the relays 28 and 29 actuated, an operating circuit is extended from ground, left hand front contact and armature of relay 28, left hand armature and front contact of relay 29, winding of the relay 30, to grounded battery. Relay 30 when thus operated, closes a ringing circuit, which will be described later, and closes a locking circuit for itself through its left hand front contact and armature, left hand back contact and armature of relay 31, right hand front contact and armature of relay 29 to ground. Also when the relay 28 is operated, a circuit for the ringing relay 32 is completed from grounded battery, resistance, winding of the relay 32, conductor 33, right hand back contact and armature of relay 34, contact 35 and armature of relay 29, conductor 36, right hand armature and front contact of relay 28, to ground.

Relay 11 is also energized at this time in a circuit traceable from grounded battery, its upper winding, inner front contact and armature of relay 29, and thence over conductor 36, to ground at the armature and front contact of relay 28. Relay 11 is actuated in this circuit and locks itself operated from grounded battery, its lower winding, lowermost armature and front contact and thence through the sleeve contacts of the plug 23, jack and cut-off relay of the wanted line (not shown). It will be noted that the relay 11 opens the circuit of the slow releasing relay 29 and this relay when it deenergizes removes ground from the holding conductors of the cord circuit, but this ground is immediately applied to the holding conductors through the inner lower armature and front contact of relay 11. The relay 29 on deenergization also restores the ringing keys 24 to 27 inclusive, and the relays individual thereto, for common use. At the inner upper armature and front contact of relay 11, a break-point is closed in the tip conductor of the calling end of the cord circuit. With the relay 30 and ringing relay 32 operated, 66 cycle ringing current is applied to the called line through the left hand back contact and armature of relay 37, right hand front contact and armature of relay 30, winding of the trip relay 38, innermost, lower front contact and armature of relay 32, ring contacts of the plug 23 over the lower side of the wanted line and through the bell (not shown) at the wanted substation, over the upper side of the wanted line (not shown), tip contact 23 of the calling plug, inner-upper armature and front

contact of relay 11, upper armature and front contact of relay 32 to ground. Ringing current is applied over this circuit until the called party answers, at which time the trip relay 38 is actuated, and at its armature and front contact closes a shunt circuit about the winding of the relay 32, which relay deenergizes to close a break-point in the talking conductors.

Also when the calling party responds the supervisory relay 31 is energized and at its left hand armature and back contact opens the locking circuits of the frequency selecting relays such as 30 or 37, and the ringing relay 32, so that these operated relays now return to normal condition.

Talking current is supplied to the calling party through the two windings in series of the answering supervisory relay 39, while talking battery is supplied to the called party through the windings of relays 40 and 31 in series.

At the close of the conversation when the subscriber at A replaces his receiver on its switchhook, the energizing circuit of the answering supervisory relay 39 is opened so that the answering supervisory lamp 41 is lighted in a circuit traceable from grounded battery, lamp 41, conductor 42, middle armature and back contact of relay 43, conductor 44, inner armature and back contact of relay 39, inner armature and front contact of relay 10, winding of the impedance coil 45, to ground. Similarly, when the called party terminates the connection relay 31 deenergizes and the calling supervisory lamp 46 is lighted in a circuit from grounded battery, lamp 46, middle back contact and armature of relay 32, back contact and armature of relay 31, inner front contact and armature of relay 11, to ground.

The operator on noting that one or both of these lamps are lighted, removes the answering plug 7 and the calling plug 23 from the jacks with which they have been in engagement.

Inter-office call.

Now let it be assumed that the subscriber at A, instead of desiring a connection with a subscriber whose line terminates at the local exchange, wishes a connection to a subscriber's line such as B, terminating at a distant office. Under this assumption the subscriber at A originates a call in the manner previously described, by removing his receiver from its switchhook which operation causes the lighting of the line lamp 6. The operator on noting that this lamp is lighted, inserts the answering plug 7 of her cord circuit into the jack 8 of the calling line. The relays of the cord circuit function in the manner already described to connect the operator's telephone set to the calling line, at which time the operator inquires

the number of the wanted station and when she learns that the wanted line terminates at a distant office, inserts the calling plug 23 of her cord circuit into a jack 47 of a trunk through which the wanted office may be reached. The various operations in extending the call to the distant office up to this time, are the same as those described in the case previously assumed of extending a call to the local subscriber.

As a result of the insertion of the calling plug 23 into the trunk jack 47, the sleeve relay 29, shown near the center of Fig. 1 is now operated from grounded battery, winding of relay 29, back contact and armature of relay 11, sleeve contacts of the plug 23 and the jack 47, winding of the relay 48, back contact and continuity spring of relay 49, back contact and continuity spring of relay 50, to ground. The relays 29 and 48 are thereby energized and the relay 43 when energized, closes an operating circuit for the motor magnet 51 of the primary trunk selector switch whose brushes are designated 52 to 57 inclusive. The operating circuit of the magnet 51 is closed from grounded battery, resistance, winding of this magnet, its back contact and armature, left hand armature and front contact of relay 48 and thence to ground through the back contacts and continuity springs of relays 49 and 50. Under the control of this circuit the motor magnet 51 advances the brushes of the line switch, until the test brush 52 or the test brush 55 encounter the test terminals of an idle trunk.

Let it be assumed that test brush 52 locates an idle trunk, such as that shown in Fig. 2, at which time a circuit is extended from ground, back contact and armature of relay 58, back contact and continuity spring of relay 59, test terminal of this trunk, test brush 52, the low resistance winding of relay 50, outer front contact and armature of relay 48, resistance, to grounded battery. The relay 50 is thereby energized and at its upper armatures and front contacts extends the connection to the line switch brushes 53 and 54. The relay 50 when energized also opens the operating circuit of the motor magnet 51 and at its continuity spring and lower armature closes a locking circuit for itself through its lower winding and through the sleeve contacts of the jack and plug to grounded battery, through the windings of the sleeve relay 29 of Fig. 1.

With relay 50 operated as above described a circuit is closed for operating relay 31 extending from grounded battery, winding of relay 31, inner back contact and armature of relay 32, ring contacts of the plug and jack, inner front contact and armature of relay 50, brush 54, back contact and armature of relay 59, and winding of relay 58 to ground. As soon as relay 31 is operated

it closes an operating circuit for relay 43 extending from the grounded battery, winding of relay 43, inner front contact and armature of relay 31 and lower inner back contact and armature of relay 11 to ground. Relay 43 is locked operated for a short interval to ground at the outer right hand armature and front contact of relay 29 and after the release of relay 29, relay 43 is locked operated to ground at the lower, inner front contact and armature of relay 11. As soon as relay 43 is operated it closes an operating circuit for relay 11, from grounded battery, lower winding of this relay, left hand armature and front contact of relay 43, and thence to ground over the sleeve conductor and the sleeve contacts of the plug and jack. The operation of relay 11 opens the energizing circuit of the slow releasing relay 29, which shortly afterwards deenergizes and the relay 11 also closes a locking circuit for itself through its lower winding, lowermost front contact and armature and thence to ground through the sleeve conductor, which locking circuit is independent of the armature and contact of the relay 43. From the foregoing it will be seen that on a local connection when a ringing key is operated to cause the energization of the relay 11, relay 43 is not operated because relay 11 is operated before relay 31. On a local connection the relay 31 operates to give the regular supervision and the relay 40 is energized, but this is ineffective because the circuit through its contacts is open at a front contact of relay 43. With the relay 50 operated, the slow releasing relay 58 is actuated in a circuit closed from ground, winding of this relay, lower back contact and armature of relay 59, inner, upper front contact and armature of relay 50, ring contacts of the jack 47 and the plug 23, inner armature and back contact of relay 32, winding of relay 31, to grounded battery. As soon as the relay 58 attracts its armatures, the make-busy relay 59 is energized from ground through the lower winding of this relay, lower front contact and armature of relay 58 and thence over the remainder of the circuit just described, through the winding of relay 31. Relay 59 when operated closes a locking circuit for itself from grounded battery, its upper winding, armature and continuity spring, brush 52, and thence through the lowermost front contact and armature of relay 50, resistance, to ground. Also as soon as relay 50 is operated, the relay 60 has a circuit completed from grounded battery through its high and low resistance windings in series, through the upper left hand winding of the repeating coil, line switch brush 53, uppermost front contact and armature of relay 50, tip contacts of the jack 47 and plug 23, upper, inner armature and front contact of relay 11,

winding of relay 40, to ground. The relay 60 is energized in this circuit, but the relay 40 will not operate in series with the high resistance winding of relay 60. The operation of relay 60 extends a circuit from ground at its armature and front contact, winding of the relay 61, upper right hand winding of the repeating coil, over the upper side of the trunk 62 to the distant office, upper left hand winding of the repeating coil at the distant office, through the high and low resistance windings in series of the relay 63, to grounded battery. Also when the relay 60 is operated, it closes a second circuit from ground through its armature and front contact, conductor 64, back contact and continuity spring of relay 65, winding of the relay 66, lower right hand winding of the repeating coil, over the lower side of the trunk to the distant office, lower left hand winding of the repeating coil, winding of the relay 68 to grounded battery. The relays 63 and 68 are both actuated in these circuits and the relay 63 closes an energizing circuit for the slow releasing relay 69 from grounded battery, winding of this relay, inner back contacts and armatures of relays 70 and 71, back contact and armature of relay 72, front contact and armature of relay 63 to ground.

The energization of relay 69 starts the secondary trunk selector switch in operation by the closure of a circuit from grounded battery, resistance, winding of the motor magnet 73, its back contact and armature, right hand front contact and armature of relay 69, lower back contacts and armatures of relays 70 and 71 to ground. Under the control of this circuit the motor magnet advances the brushes 74, 75, 76, 77, 78 and 79 in a step-by-step movement over the terminals of the trunks leading to the B operator's position. When an idle trunk is reached, a condition indicated by the presence of ground on its test terminal, the trunk selector switch is stopped by a circuit traceable from ground, back contact and continuity spring of relay 80, back contact and continuity spring of relay 81, test brush 74, the low resistance winding of relay 71, inner armature and front contact of relay 69, resistance, to grounded battery. This last described circuit is effective to shunt the motor magnet 73 and to operate the relay 71. When the relay 71 is operated, it closes a circuit from grounded battery, winding of the relay 80, inner armature and back contact of relay 81, brush 75, upper front contact and armature of relay 71, upper right hand winding of the repeating coil, through the low resistance winding of relay 82, armature and front contact of relay 68, front contact and armature of relay 63 to ground. This operates the relay 80 which in turn lights the incoming signal lamp 83. The B operator

then inserts the plug 84 of the cord circuit shown in Fig. 3, into the multiple trunk jack 85. There is one such jack and lamp 83 at each of several B operator's positions. The relay 81 is then actuated in series with the relay 86 of Fig. 3, over a circuit from grounded battery, through the high resistance winding of relay 86, conductor 87, through the sleeve contacts of the plug 84 and jack 85, winding of relay 81, to ground. The relay 86 is a barring relay similar to relay 10 of Fig. 1 and when operated closes a locking circuit for itself through its low resistance winding, in order to bar another operator's telephone set from the same connection. The operation of relay 81 effects the deenergization of the relay 80 and also completes a holding circuit for the trunk selector switch from grounded battery, resistance, armature and continuity spring of relay 81, test brush 74, high resistance winding of relay 71, lowermost front contact and armature of this relay, to ground. With the relay 71 operated, a circuit is closed for the answering supervisory relay 88 of the B operator's cord circuit from grounded battery, winding of this relay, tip contacts of the plug 84 and jack 85, brush 75, upper front contact and armature of relay 71, upper right hand winding of the repeating coil through the low resistance winding of relay 82, armature and front contact of relay 68, front contact and armature of relay 63, to ground. Relay 86 of Fig. 3, on operation completes a circuit from ground, its outer armature and front contact, upper armature and back contact of relay 89, winding of slow releasing relay 90, windings of relays 91, 92 and 93 to grounded battery. Relay 93 is of especially high resistance so that the relays 90, 91 and 92 will not energize in series therewith. Relay 93 however, is energized and at its armature and front contact closes a circuit for the right hand winding of the relay 92, which causes this relay to energize and extend the previously described series circuit through the windings of relays 90, 91 and 92, to grounded battery, independently of the relay 93. The relays 90 and 91 operate in this circuit and relay 91 closes a break-point in the operating circuit of the meter magnet 94. The relay 90 completes an actuating circuit for the operator's cut-in relay 95, which may be traced from grounded battery, winding of this relay, front contacts and armatures of the relay 90, winding of the relay 96, to ground. The relays 95 and 96 are energized in this circuit. Relay 96 completes the circuit of the meter magnet 94 and the relay 95 extends the conductors 97 connected to the operator's telephone set to the answering end of the B operator's cord circuit.

As was described in connection with the cord circuit of Fig. 1, the relays 91, 92, 93 and impedance coil 98 permit the operator to

connect the answering plug of a second cord circuit and only one to the jack of a calling line, in addition to the connection which she is extending on a first cord circuit. As soon as the operator's telephone set is connected to the answering end of the B cord circuit, the B operator inquires the designation of the wanted connection.

Let it be assumed that this wanted line is that represented at B at the upper right hand corner of Fig. 3. The operator then inserts the calling plug 99 into the multiple jack 100 of this line. It is also assumed that the wanted line is a party line and in order to operate the signal at substation B, it is necessary to apply ringing current of the proper frequency. The operator then depresses someone of the ringing keys, 101, 102, 103, or 104. Let it be assumed that the operator depresses key 103, which in turn actuates the slow releasing relay 104. As soon as the plug 99 is inserted into the jack 100, the sleeve relay 105 is actuated from grounded battery, its winding, back contact and armature of relay 89, sleeve contacts of the plug 99 and jack 100, through the resistance of the cut-off relay (not shown) of the called line, to ground. With the relays 104 and 105 actuated, the ringing relay 106 is energized from grounded battery, its winding, conductor 107, back contact and armature of relay 108, conductor 109, inner front contact and armature of relay 105 right hand front contact and armature of relay 104, to ground. As soon as the relay 104 is operated, a circuit is also closed from ground, its front contact and left hand armature, outer armature and front contact of relay 105, winding of relay 110, to grounded battery. This last named relay on operation closes a locking circuit for itself through its contact and left hand armature, conductor 111, back contact and armature of relay 112, front contact and armature of relay 105, to ground.

The relay 89 is energized simultaneously with ringing relay 106 and its operating circuit is traceable from grounded battery, upper winding of relay 89, inner front contact and armature of relay 105, right hand armature and front contact of relay 104, to ground. As soon as relay 89 is energized it closes a locking circuit for itself through its lower winding, lowermost armature and front contact, through the sleeve conductor and sleeve contacts of the plug 99 and jack 100, to ground through the winding of the cut-off relay (not shown) of the wanted line. The relay 89 on energization also opens the circuit of the slow releasing relay 105, which shortly afterwards deenergizes to restore the ringing keys to common use. The locking circuits for the ringing relay 106 and for the frequency selecting relays such as 110 and 113 are now completed through the inner lower armature and contact of relay 89, in-

stead of at the outer right hand front contact and armature of relay 105, to ground.

With relays 106 and 110 actuated, 66 cycle ringing current is applied through the outer back contact and armature of relay 113, front contact and armature of relay 110, winding of the trip relay 114, innermost front contact and armature of the ringing relay 106, ring contact of the jack 100 over the lower side of the called line and through the ringer at substation B, over the upper side of the called line through the tip contacts of the jack 100 and plug 99, inner armature and front contact of the relay 89, armature and front contact of relay 106, to ground. Ringing current is supplied over this circuit until the subscriber at substation B responds by moving its receiver from its switchhook, at which time the relay 114 is actuated and at its front contact and armature places a short circuit about the relay 106. Relay 106 thereupon deenergizes and at its armatures and back contacts closes a break-point in the talking connection. During the time that relay 106 is actuated a circuit is closed through the winding of the induction coil of the ringing tone devices, lowermost armature and front contact of relay 106, right hand winding of relay 113, armature and back contact of relay 95, winding of the relay 115, ring contacts of the plug 84 and jack 85, brush 76, inner front contact and armature of relay 71, lower right hand winding of the repeating coil, winding of relay 116, to grounded battery. Relay 116 is operated and at its inner armature and front contact closes a circuit for actuating the relay 117, which in turn closes a locking circuit for itself through its front contact and armature, armature and front contact of relay 82, to ground. Relay 116 on operation also causes relay 72 to be actuated from grounded battery, its winding, right hand armature and front contact of relay 116, to ground. Relay 72 when energized closes a locking circuit for itself, its front contact and armature, front contact and armature of relay 63, to ground. The relay 72 is locked energized as long as the A operator has the calling plug 23 in the trunk jack 47, so that when the secondary trunk selector at the right of Fig. 2, is released by the B operator disconnecting her cord circuit from the jack 85, this last mentioned trunk selector will not seize a trunk. The operation of the relay 117 short-circuits the high resistance winding, which may be 10,000 ohms, of the relay 63, to permit the relay 61 at the originating office to operate. This relay when operated closes a circuit from ground through the winding of relay 118, lower left hand winding of the repeating coil, front contact and armature of relay 59, brush 54, inner front contact and armature of relay 50, ring contacts of the jack 47 and the plug 23, innermost armature and back contact of

relay 32, winding of relay 31, to grounded battery. The relay 31 on operation extinguishes the calling supervisory lamp in the same manner as if this cord circuit had been
 5 used on a local call and the local subscriber had answered. The operation of the relay 118 closes a circuit to operate the relay 65 and this relay at its continuity spring and armature completes a substitute circuit from
 10 ground at the front contact and armature of relay 118, through the winding of relay 66 to trunk conductor 67, for holding operated the relay 68 of the distant office.

When the called party at B terminates the
 15 call by replacing his receiver on its switchhook, the relay 112 deenergizes and the calling supervisory lamp 119 is lighted from grounded battery, back contact and armature of relay 106, left hand back contact and
 20 armature of relay 112, inner lower front contact and armature of relay 89, to ground. The deenergization of the relay 112 removes ground at its outer right hand armature and front contact from the ring side of the
 25 answering cord circuit to allow the relay 116 to deenergize. The relays 117 and 72, however, are locked at this time so that the release of the relay 116 is ineffective.

When the subscriber at A replaces his
 30 receiver on its switchhook the relay 39 deenergizes, but the answering supervisory lamp 41 is not lighted. The deenergization of relay 39 establishes a circuit from ground, armature and front contact of relay 40, arma-
 35 ture and front contact of relay 43, conductor 120, armature and back contact of relay 39, over the ring conductor of the calling cord of Fig. 1, winding of relay 31, to grounded battery. This last described cir-
 40 cuit maintains relay 31 energized, but short-circuits and thereby releases relay 118 of Fig. 2. The release of relay 118 removes ground through the relay 66 and the con-
 45 ductor 67 of the trunk leading to the distant office which causes the relay 68 to deenergize. This connects the 10,000 ohm winding of the relay 82 in series with the tip side of the trunk conductor leading to the jack 85.
 50 The high resistance causes the relay 88 of Fig. 3 to deenergize and thereby light the answering supervisory lamp 121. Relay 82 does not deenergize at this time, so that the relay 117 is maintained operated to short-
 55 circuit the high resistance winding of relay 63. The B operator on noting that the lamp 121 is lighted, disconnects the plug 84 from the jack 85 and removes the plug 99 from the jack 100, which causes the relays 82 and 117 to deenergize. The release of the
 60 relay 117 connects the 10,000 ohm winding of relay 63 in series with the trunk conductors 62, which causes the relay 61 to release. Relay 63 does not deenergize at this time, so that the relay 72 is locked operated to prevent the operation of the secondary trunk

selector. The deenergization of the relay 61 opens the circuit of relay 118 and relay 31 of the A operator's cord circuit allowing these two relays to deenergize. Relay 61
 70 also connects the 10,000 ohm winding of the relay 60, in the tip side of the calling cord, which causes the relay 40 to deenergize. Since the relay 31 is deenergized at this time, and since the calling party has replaced
 75 his receiver on its switchhook, the supervisory lamp 41 is now lighted in a circuit completed from grounded battery, lamp 41, conductor 42, middle armature and back contact of relay 43, conductor 44, inner, lower
 80 armature and back contact of relay 39, inner armature and front contact of relay 10, impedance coil 45, to ground

The A operator on noting the lighting of this lamp removes the answering plug 7 and the calling plug 23 from the jacks with
 85 which they were in engagement. This operation permits the relays 50, 59 and 60 to release and the release of relay 60 removes ground from the tip side of 62 of the trunk to permit the relays 63 and 72 to deenergize.
 90 The circuits of the system are now in normal condition.

Recall operation.

In the event that the calling subscriber
 95 initiates a recall before the B operator removes the answering plug 84 from the trunk jack 85, relays 88 and 108 of the cord circuit of Fig. 3, are operated to flash the super-
 100 visory lamp 121, under the control of the interrupter devices 122. This is effected as follows: The temporary deenergization of relay 88 is effected by replacing the calling receiver on its switchhook and subsequently
 105 removing it again. Relay 118 is short-circuited and released when relay 39 is deenergized by the calling subscriber replacing his switchhook. When the calling subscriber again removes the receiver from its
 110 switchhook, the relay 118 again operates and connects ground to the ring conductor 67 of the inter-office trunk, which again operates relay 68. Relay 68 short-circuits the high resistance of relay 82, which allows relay 88
 115 to be energized again. Relay 108 is operated, during the interval when the relay 88 deenergizes, in a circuit closed from grounded battery, resistance, winding of relay 108, lowermost back contact and armature of
 120 relay 88, uppermost front contact and armature of relay 89, outer right hand front contact and armature of relay 86, to ground. Relay 108 when thus operated closes a locking circuit through its inner front contact
 125 and armature, and over the remainder of the circuit just described, but independently of the back contact and armature of relay 88. With the relays 88 and 108 now operated the answering supervisory lamp 121 of Fig. 3, is
 130 intermittently flashed in a circuit from

grounded battery, lamp 121, armature and front contact of relay 88, outer armature and front contact of relay 108, winding of relay 123, interrupter 122, to ground. Relay 123 also intermittently lights the pilot lamp 124.

If the calling subscriber desires another subscriber at the distant office, the B operator completes this connection in the manner already described. If, however, the calling subscriber desires a subscriber in the originating office, the B operator removes the plug 84 from the trunk jack 85, which permits the relays 82 and 117 to release. The release of relay 117 includes the 10,000 ohm winding of the relay 63 in the trunk conductors 62, which causes the relay 61 to deenergize and this in turn opens the circuit of the relays 118 and 31. With relay 31 in its normal condition and with the relay 39 energized, since the recall relay 34 is now operated owing to the temporary release of relay 39, the supervisory lamp 41 is intermittently flashed in a circuit completed from grounded battery, lamp 41, conductor 42, middle armature and back contact of relay 43, conductor 44, lower armature and front contact of relay 39, left hand armature and front contact of relay 34, winding of relay 124, interrupter 125, to ground. Relay 124 is also intermittently operated in this circuit and in turn intermittently lights the pilot lamp 126. The intermittent lighting of the supervisory lamp 41, is a signal to the A operator that the calling subscriber desires to initiate a recall.

Local call.

In the modified form of the invention shown in Figures 4, 5 and 6, when the subscriber at C desires to originate a call to another subscriber whose line terminates at the same exchange. The subscriber at C removes his receiver from its switchhook. This completes a circuit for the line relay 128, over the two sides of the calling line in series and through the calling substation network. When the line relay is thus energized, it closes a circuit to light the line lamp 129, which is a signal to the operator that a call is waiting attention.

The operator then inserts the answering plug 130 of one of the cord circuits at her position into a jack 131 of the calling line. As the result of this operation the operator's barring relay 132, which functions for the same purpose as the corresponding relay in Fig. 1, is energized from grounded battery through its high resistance winding, through the sleeve contacts of the plug 130 and the jack 131, winding of the cut-off relay 133 to ground. The relay 132 and cut-off relay 133 are both actuated in this circuit and the cut-off relay at its armatures and back contacts opens the circuit of line relay 128,

which deenergizes to extinguish the line lamp 129. The relay 132 when operated closes a locking circuit through its low resistance left hand winding, left hand armature and front contact and thence to ground in series with the cut-off relay 133, as previously described. Also when the operator inserts the plug 130 into the jack 131, the answering supervisory relay 134 is energized in the well known manner, but the answering supervisory lamp 135 is not lighted at this time, since its circuit is open at the armature and front contact of relay 136. With the relay 132 operated, a circuit is closed from ground at its right hand armature and front contact, upper armature and back contact of relay 137, winding of relay 136, winding of relay 139, left hand winding of relay 140 and winding of the high resistance relay 141, to grounded battery. The resistance of winding 141 is so great that the other relays in series therewith are not operated. The relay 141 is, however, operated in this circuit and at its armature and front contact, closes a circuit from ground through the right hand winding of relay 140, to grounded battery. This last circuit energizes the relay 140 and thereby extends a circuit from grounded battery, front contact and armature of relay 140 and thence through the windings of relays 140, 139 and 136, to ground as previously described, but the circuit no longer includes the high resistance winding of 141.

The arrangement of the relays as just described together with impedance coil 142, permits the operator to connect the answering end of a second cord circuit to a calling line for extending a second connection before all the operations in connection with a previous call have been completed. But this arrangement is such that if more than two calls are simultaneously in the process of connection, all of the calls will fail. The operator is therefore instructed not to attempt the completion of more than two calls at the same time. Since the high resistance winding has been eliminated from the series circuit in the manner just described, relays 139 and 136 are operated. Relay 139 serves to close a break-point in the operating circuit of the meter magnet 143, while the operation of the relay 136 closes a circuit for the operator's cut-in relay 144. This circuit is closed from grounded battery, winding of relay 144, right hand front contact and armature of relay 136, left hand armature and front contact of this relay, conductor 145, winding of relay 146, to ground. The relays 146 and 144 are thus actuated and the relay 146 completes the circuit of the meter magnet 143, which operates to record the number of calls answered by this operator.

The relay 144 connects the operator's telephone set (not shown) over the conduc-

tors 147 and the answering end of the cord circuit, to the calling subscriber's line. It should be pointed out at this time that the answering supervisory lamp 135 is dimly
 5 lighted to indicate to the operator to which cord circuit her telephone set is connected. The lighting circuit for lamp 135 is traceable from grounded battery, through this lamp 135, inner armature and front contact
 10 of relay 134, left hand armature and back contact of relay 148, left hand armature and front contact of relay 136, conductor 145, to ground through the resistance of the winding of relay 146, which is of such value
 15 that the lamp 135 is only dimly lighted.

The operator now inquires the number of the wanted line and as soon as she learns that the wanted line is a local line, inserts the calling plug 149 of the cord circuit into
 20 a multiple jack of the called line (not shown), but which is similar to that shown at the left hand side of Fig. 4. When this connection is completed to the called line, the sleeve relay 150, is actuated from
 25 grounded battery, its winding, back contact and continuity spring of relay 137, conductor 151, through the sleeve contacts of the plug 149, to ground through the winding of the cut-off relay of the called line (not
 30 shown). It is assumed that the wanted line is a party line, and it is necessary for the operator to depress some one of the common ringing keys 152, 153, 154 or 155 to select ringing current of the proper frequency to signal the wanted station. It is
 35 assumed that the operator depresses ringing key 154, to actuate slow releasing relay 156, this is effective to extend a circuit from ground, left hand front contact and armature of relay 156, outer left hand armature and front contact of relay 150, winding of relay 157, to grounded battery. At this
 40 same time the ringing relay 158 and the relay 137 are operated in multiple. A circuit for the relay 158 is traceable from grounded battery, resistance, winding of the relay 158, conductor 159, right hand armature and back contact of relay 148, conductor 160, contact 161 and inner right hand
 45 armature of relay 150, conductor 162, right hand armature and front contact of relay 156, to ground. The circuit for relay 137 is closed from grounded battery, upper winding of this relay, inner, right hand front contact and armature of relay 150, to
 50 ground over conductor 162. The relay 137 when thus operated closes a locking circuit for itself through its lower winding, its lowermost armature and continuity spring, conductor 151 and thence to ground through the sleeve contacts of the plug and jack and winding of the cut-off relay of the called
 55 line, (not shown). The ringing relay 158 is locked operated at this time from grounded battery, resistance, its winding,

conductor 159, back contact and armature of relay 148, conductor 160, middle front contact and armature of relay 158, back contact and armature of relay 163, and to
 70 ground either at the outer front contact and armature of relay 150 or through the inner, lower armature and front contact of relay 137. It should be noted that the actuation of relay 137 opens the circuit of the sleeve relay 150, but the holding circuits controlled by this last named relay are maintained by the relay 137. 75

With the ringing relay 158 and the relays 137 and 157 operated, 66 cycle frequency ringing current is applied to the called line
 80 through the outer armature and back contact of relay 164, armature and front contact of relay 157, winding of the trip relay 165, innermost front contact and armature of relay 158, through the ring contacts of the plug 149, over the lower side of the called line and the ringer at the wanted substation, over the upper side of the called line (not shown), tip contact of the plug 149, inner, upper armature and front contact of
 90 relay 137, upper armature and front contact of relay 158, to ground. Ringing current is supplied over this circuit until the called party responds, at which time the trip relay 165 is energized and at its front contact and armature short-circuits the ringing relay 158 which immediately deenergizes. The response of the called party also actuates the relays 163 and 166 through which talking battery is supplied to the
 100 called party. When the relay 163 attracts its armatures, it opens the holding circuit for the relay 157, which deenergizes.

At the close of the conversation when the subscriber at C replaces his receiver on its
 105 switchhook, the answering supervisory relay 134 deenergizes and lights the answering supervisory lamp 135 in a circuit closed from grounded battery, lamp 135, lower armature and back contact of relay 134, inner armature and front contact of relay 132, winding of impedance coil 167, to ground. Also when the called party replaces his receiver on its switchhook, relays 163 and 166 deenergize and the calling
 110 supervisory lamp 168 is lighted in a circuit completed from grounded battery, lamp 168, middle back contact and armature of relay 158, back contact and armature of relay 163, inner, lower armature and front contact of relay 137, to ground. The lighting of lamps 135 and 168 is a disconnect
 115 signal for the operator, who thereupon removes the plugs 130 and 149 from the jacks with which they were in engagement. 125

Recall operation on local call.

In the event that the calling subscriber desires to initiate a recall, the relays 148 and 170 function in the same manner as pre- 130

viously described in the case of corresponding relays of Fig. 1.

Inter-office call.

Let it be assumed that the calling subscriber at C desires to call a subscriber such as D, whose line terminates at the distant office. The subscriber at C initiates a call by removing his receiver to light the line lamp 129 in the manner already described. The operator then inserts plug 130 into the answering jack 131, as a result of which the circuits function in the same manner as in the case of a local call to connect the operator's telephone set over the conductors 147, to the calling line. The operator then inquires the number of the wanted line and inserts the calling plug 149 into a trunk jack such as 171 through which the distant office is reached. In this system the subscriber may be instructed to pause between giving the office designation and the remainder of the wanted number, so that the operator at the originating office can connect the cord circuit to the trunk leading to the distant office and an idle B operator's position selected, before the calling subscriber gives the line designation to the operator of the distant office. In this way it will not be necessary for the A operator to repeat the number and it will likewise be unnecessary for the subscriber to give the line designation more than once. In the case of an inter-office call, it is unnecessary for the operator to depress any of the ringing keys such as 152 to 155 inclusive, but when the plug 149 is inserted in the trunk jack 171, a circuit is closed from grounded battery, winding of the slow releasing relay 150, back contact and continuity spring of relay 137 conductor 151, sleeve contacts of the plug 149 and jack 171, winding of relay 172, back contact and continuity springs of relays 173 and 174, to ground. The relay 172 is energized in this circuit and closes an operating circuit for the motor magnet 175, which circuit extends from grounded battery, resistance, winding of the magnet 175, its back contact and armature, inner armature and front contact of relay 172, back contacts and continuity springs of relays 173, and 174, to ground. Under the control of this circuit the motor magnet 175 advances the brushes 176, 177, 178, 179, 180 and 181 over the various pairs of trunks until a test brush such as 178 encounters the test terminal of an idle trunk leading to the distant office. This idle condition is indicated by the presence of ground potential on this test terminal. When the idle trunk is reached, the motor magnet 175 is shunted and the relay 174 is actuated in a circuit completed from ground, upper back contact and armature of relay 182, back contact and continuity spring of relay 183, test brush 178, low resistance

winding of relay 174, left hand front contact and armature of relay 172, resistance, to grounded battery. This circuit is effective to stop the operation of motor magnet 175 and causes the actuation of relay 174, which closes a locking circuit for itself from ground, continuity spring and inner armature, its lower winding and thence to ground through the sleeve contacts of the jack 171 and the plug 149, and the winding of relay 150. With the relay 174 operated, the calling supervisory relay 163 is actuated, from grounded battery, its winding over the lower side of the cord circuit, inner back contact and armature of ringing relay 158, ring contacts of plug 149 and the jack 171, inner, upper armature and front contact of relay 174, brush 177, lower armature and back contact of relay 182, winding of the slow releasing relay 182, to ground. Relay 182 attracts its armatures, whereupon the relay 183 is operated from ground, its lower windings, lower armature and front contact of relay 182 and thence to grounded battery through the winding of relay 163 of Fig. 4, as previously described. Relay 183 on operation closes a locking circuit for itself from grounded battery, its upper winding, upper armature and continuity spring, test brush 178, lowermost front contact and armature of relay 174, resistance, to ground. As soon as the relay 163 of Fig. 4 is actuated the relay 137 is energized from grounded battery, its lower winding, inner armature and front contact of relay 163, conductor 151, sleeve contacts of plug 149 and the jack 171, lower winding of relay 174, to ground through its armature and continuity spring. Relay 137 on operation closes a locking circuit for itself, through its armature and continuity spring, over conductor 151, which locking circuit is independent of the control of relay 163. At the upper, inner front contact and armature of relay 137, a break-point is closed in the calling end of the operator's cord circuit.

The secondary trunk selector at the right of Fig. 5, is now started in operation as the result of the operation of the relay 184, which is energized over the trunk conductors 185 and 186, in series to grounded battery, through the winding of relay 163 of Fig. 4, and to ground through the winding of relay 166. When the relay 184 is thus energized it effects the operation of the slow releasing relay 187 and this last named relay closes an operating circuit for the motor magnet 188 from grounded battery, resistance, winding of the motor magnet 188, its back contact and armature, inner front contact and armature of relay 187, back contacts and armatures of relays 189 and 190, to ground. Under the control of this circuit the motor magnet 188 advances the brushes 191, 192, 193, 194, 195 and 196 of the secondary trunk

selector until an idle trunk is located by one of its test brushes such as 192. At this time the motor magnet 188 is shunted and the relay 189 is operated in a circuit traceable from grounded battery, resistance, middle front contact and armature of relay 187, through the low resistance winding of relay 189, test brush 192, conductor 197, continuity spring and back contact of relay 198, lowermost back contact and armature of relay 199, to ground. The relay 189 is thus energized and the circuit previously described, as including the windings of relays 163 and 166 of Fig. 4, and the trunk conductors 185 and 186, are now extended through the armatures and front contacts of relay 189, selector brushes 191 and 193, the left hand windings of the repeating coil of Fig. 6, through the high and low resistance windings in series of relay 200. This last named relay is energized and at its armatures and front contact causes the actuation of the slow releasing relay 198. A locking circuit is thereupon completed for the relay 189 of Fig. 5, traceable from ground, lower armature and back contact of relay 190, upper high resistance winding of this relay, test brush 192, conductor 197, continuity spring and armature of relay 198, resistance, to grounded battery. The incoming and disconnect lamp 201, is now lighted from grounded battery (not shown) lamp 201, conductor 202, middle armature and back contact of relay 199, innermost front contact and armature of relay 198, back contact and armature of relay 203, to ground. On noting that the lamp 201 is lighted the operator depresses the answering key 204, of the telephone set (not shown), to the incoming trunk circuit over which the designation of the wanted line is received. On learning which line is wanted the B operator inserts the plug 205 into the jack 206 of the wanted line and depresses some one of the common ringing keys 207, 208, 209 and 210. The insertion of the plug into the jack 206, of the called line, extends a circuit for slow releasing sleeve relay 207, from grounded battery, winding of this relay, innermost back contact and armature of relay 199, sleeve contacts of the plug 205 and the jack 206, through the resistance of the cut-off relay (not shown), to ground. Let it be assumed that ringing key 207 is the proper key to select the desired ringing current to signal the wanted substation B. This key operates the slow releasing relay 208 which effects the operation of the frequency selecting relay 249 from grounded battery, winding of this relay, inner front contact and armature of relay 207, outer front contact and armature of relay 208, to ground. The relay 199 and ringing relay 210 are now energized in multiple. The circuit of the ringing relay 210 is traceable from grounded battery, resistance, its wind-

ing, right hand front contact and armature of relay 207, conductor 211, inner front contact and armature of relay 208, winding of the slow releasing relay 212, to ground. The circuit for the relay 199 extends from grounded battery, upper winding of this relay, right hand front contact and armature of relay 207, conductor 211, winding of relay 212, to ground. The relay 212 is energized in this circuit and actuates the meter magnet 213, to record the completion of the call. The relays 249 and 210 when actuated in the manner described are locked operated in multiple. The locking circuit of relay 249 is completed from grounded battery, winding of this relay, its front contact and armature, lowermost armature and back contact of relay 203, lowermost front contact and armature of relay 199, to ground. The locking circuit for relay 210 extends from grounded battery, resistance winding of this relay, its middle front contact and armature, conductor 213, and thence in multiple with the circuit just described for the relay 249. The relay 199 on operation closes a locking circuit for itself from grounded battery, its lower winding, innermost front contact and armature, through the sleeve contacts of the plug 205 and the jack 206, and the winding of the cut-off relay (not shown), to ground.

Ring current is now applied to the wanted station from the 50 cycle source of ringing current contact 214 of the interrupter, lamp 215, front contact and armature of relay 249, back contact and armature of relay 216, upper front contact and armature of relay 198, winding of the trip relay 217, innermost front contact and armature of relay 210, through the ring contacts of the plug 205 and the jack 206, over the lower side of the called line and through the ringer at substation D, which responds to 50 cycle ringing current, over the upper side of the called line through the tip contacts of the jack 206, plug 205, upper armature and front contact of relay 210, to ground. Under the control of this circuit, ringing current is supplied to the station D, until the subscriber thereat responds, at which time the trip relay 217 is energized. The closure of the armature and contact of the trip relay short-circuits the ringing relay 210, which deenergizes to disconnect the ringing current and to close break-points in the talking circuit. Also at this time the relay 203 is energized over the conductors 218 and 219, over the two sides of the called line in series. The energization of relay 203 short-circuits the 10,000 ohm winding of the relay 200, which permits the relays 163 and 166 of Fig. 3 to operate and the operation of relay 163, extinguishes the supervisory lamp 168.

When the subscriber at substation D hangs up his receiver, the relay 203 through which talking battery is fed to the called line de-

energizes and again includes the 10,000 ohm winding of the relay 200 in series with the trunk conductors 185 and 186 and the relays 163 and 166, causing them to deenergize. The deenergization of relay 163 causes the supervisory lamp 168 to be lighted, but the supervisory lamp 201 of Fig. 6, does not light at this time. When the subscriber at substation C hangs up his receiver, the answering supervisory lamp 135 is lighted, but no change is effected in connection with the B trunk circuit. The A operator now removes the plugs 130 and 149 from the jacks with which they have been in engagement, which causes the disconnect lamp 201 to be lighted, since the removal of plug 149 causes the relays 174, 183, 189 and 200 to deenergize. The relay 200 in turn causes the release of relay 198. The circuit for lighting the lamp 201 is thereby completed from grounded battery (not shown), lamp 201, conductor 202, middle armature and front contact of relay 199, inner back contact and armature of relay 198, inner back contact and armature of relay 203, to ground. On noting that the lamp 201 is lighted, the operator removes the plug 205 from the jack 206, since the trunk is held busy until relay 199 deenergizes.

Recall operation.

If the calling subscriber should give the wrong office designation the B operator at the distant office can cause the answering supervisory relay 135, at the originating office to flash in order that the A operator thereat may connect the telephone set to the calling telephone line and then extend the call to the proper office. Neither the relay 163 nor 166, in the A cord circuit will be operated when the B operator at the distant office answers but by depressing flash back key 219, an energizing circuit is closed from grounded battery through the contacts of the listening key and thence over the tip side of the connection through conductor 185, to the winding of relay 166. Relay 163 is shunted by the closure of the contacts of the key 219, and since relay 166 is operated and relay 163 is inert, the relay 148 is actuated from grounded battery, resistance, its winding conductor 220, outer armature and back contact of relay 163, front contact and armature of relay 166, uppermost front contact and armature of relay 137, right hand contact and armature of relay 132, to ground. Relay 148 when operated closes a locking circuit for itself through its inner left hand front contact and armature, conductor 221, uppermost front contact and armature of relay 137, to ground at the outer front contact and armature of relay 132. The answering supervisory lamp is then intermittently flashed in a circuit extended from grounded battery, lamp 135, inner armature

and front contact of relay 134, outer armature and front contact of relay 148, winding of relay 170, interrupter 222, to ground. While the answering supervisory lamp 135 is being flashed, the pilot lamp 223 is also intermittently lighted. The A operator at the originating office then removes the calling plug 149 from the jack with which it has been in engagement, which is effective to connect the telephone set to this cord circuit. The circuits are now in condition to initiate another trunk connection by plugging into the proper trunk jack.

What I claim is:

1. In a telephone system, an originating office, a distant office, a plurality of operators' positions at said distant office, telephone lines terminating at each of said offices, means including automatic switching devices and trunks for extending a calling telephone line at the originating office to a plurality of said B operators' positions, certain of said automatic switching devices operating to test trunks in pairs and to interconnect an idle trunk of a pair to a trunk connected to the calling telephone line, and means at each of said positions for connecting the calling telephone line thus extended to a wanted telephone line.

2. In a telephone system, an originating office, a distant office, a plurality of operators' positions at said distant office, party telephone lines terminating at said offices, trunk jacks at said operators' positions, a signal associated with each trunk jack, a plurality of trunks arranged in pairs, each trunk terminating in a trunk jack at each operator's position, means including automatic switching devices for testing said trunks in pairs and connecting a calling telephone line at the originating office to an idle trunk of one of said tested pairs, means responsive to the selection of a trunk for actuating its associated signals at the operators' positions, and means at each of said operators' positions for connecting the selected trunk to a wanted telephone line.

3. In a telephone system, an originating office, a distant office, a plurality of operators' positions at said distant office, party telephone lines terminating at said offices, trunk jacks at said operators' positions, a signal associated with each jack, a plurality of trunks each terminating in a trunk jack at each operator's position, means including automatic switching devices for connecting a calling telephone line at the originating office to an idle trunk, means responsive to the selection of a trunk for actuating its associated signals at the operators' positions, a plurality of link circuits at each of said operators' positions for connecting the selected trunk to a wanted telephone line, a plurality of sources of ringing current of several different characteristics associated

with said link circuits for selectively signaling said party telephone lines, and a single ringing key for each source of current, common to the link circuits at an operators position.

4. The method of handling telephone calls in an interoffice telephone system which consists in testing trunking channels in pairs, extending a telephone connection from one office to points at a distant office accessible to a plurality of operators through a selected idle trunking channel of the tested pairs, and manually completing the call to a wanted telephone line at any one of said points.

5. In a telephone system, an originating office, a distant office, a plurality of party telephone lines terminating at each of said offices, means including trunks and automatic switches for extending a calling telephone line at the originating office to said distant office, a plurality of links at said distant office for connecting a selected trunk to a wanted telephone line, a plurality of sources of ringing current of several different characteristics associated with said link circuits for selectively signaling said party telephone lines, and a single ringing key for each source of current, common to said link circuits.

6. In a telephone system, an originating office, a distant office, telephone lines terminating at each of said offices, means including automatic switches and trunk circuits for interconnecting calling and called telephone lines, means for releasing from a called telephone line one of said trunks of a connection and means for preventing the subsequent seizure of a trunk by the extended calling telephone line if the calling subscriber thereon has not terminated the connection at this time.

7. In a telephone system, an originating office, a distant office, telephone lines terminating at each of said offices, means including trunks and automatic switches for interconnecting a calling telephone line at the originating office with a wanted telephone line at the distant office, means for releasing a trunk and a switch of the connection, means for preventing one of the automatic switches that extended the calling line from seizing a second idle trunk, until the calling telephone line originates a second call and means controlled from the originating office for disabling said means.

8. In a telephone system, an originating office, a distant office, telephone lines terminating at each of said offices, means including automatic switches and trunks for interconnecting said offices, means including operators' equipment at each of said offices for connecting the calling and called telephone lines through said trunks and automatic switches, a signal at the distant office

arranged to be automatically intermittently operated under the control of the calling telephone line, a signal arranged to be intermittently and automatically operated at said originating office, and means including an operator's equipment at the distant office for causing the operation of the signal at the originating office.

9. In an automatic telephone system, an originating office, a distant office, telephone lines terminating at each of said offices, means including trunks for interconnecting said offices, operator's equipment at each of said offices, for interconnecting a calling and a called telephone line through said trunking means, a recall device at each of said offices, means controlled over the calling telephone line for actuating the recall device at the distant office, and means including the operator's equipment at the distant office for disabling the recall device, thereat, and for actuating the recall device at the originating office.

10. In a telephone system, an originating office, a terminating office, party telephone lines terminating at each of said offices, trunks and automatic switches for interconnecting said originating office and said distant office, cord circuits at said originating office for extending a calling telephone line to any wanted telephone line terminating at said office and for extending any calling telephone line to a wanted trunk, cord circuits at said distant office for interconnecting telephone lines terminating thereat and for extending a trunk connected to a calling line at the originating office to a wanted telephone line at said distant office, sources of ringing current of different character at each of said offices, and a single ringing key at each office for each source of ringing current common to the cord circuits at said offices.

11. In an automatic telephone system, an originating office, a distant office, operators' positions at each of said offices, party telephone lines terminating at each of said offices, a plurality of trunks terminating at each of said offices, a plurality of cord circuits at each operator's position at each of said offices for interconnecting telephone lines terminating at said offices and for interconnecting a telephone line and a trunk, sources of ringing current of different character at each of said offices for signaling party lines terminating thereat, a single ringing key common to all the cord circuits of an operator's position for selecting each source of ringing current, and means including at least one automatic switch for simultaneously testing two trunks terminating at the distant office and for connecting one of said trunks to a trunk terminating at the originating office which trunk has been extended through a cord circuit to a calling telephone line at the originating office.

12. In an automatic telephone system, an

originating office, a distant office, telephone lines terminating at each of said offices, means including trunks for interconnecting said offices, operators' equipment at each of said offices for interconnecting a calling and a called telephone line through said trunking means, a recall device associated with the operators' equipment at each of said offices, means controlled over the calling telephone line for actuating the recall device at the distant office, and means including the operators' equipment at the distant office for actuating the recall signal at the originating office while said trunking connection is maintained between said offices.

13. In an automatic telephone system, an originating office, a distant office, telephone lines terminating at each of said offices, trunks terminating at each of said offices, means including an automatic switch functioning to test simultaneously pairs of trunks and to interconnect an idle trunk of one of said pairs to an idle trunk of a second pair of trunks for extending connections between calling telephone lines at the originating office and called telephone lines at the distant office, operators' equipment at

each of said offices for interconnecting calling and called telephone lines through said trunks, a recall device at each of said offices, means controlled over the calling telephone line for actuating the recall device at the distant station, and means including operators' equipment at the distant office for actuating the recall device at the originating office.

14. In a telephone system, an originating office, a distant office, a plurality of operators' positions at said distant office, telephone lines terminating at each of said offices, an automatic switch at each of said offices, trunks arranged in pairs terminating at each of said automatic switches, said automatic switches functioning in tandem to test said pairs of trunks simultaneously and to extend a telephone line through certain of said tested trunks to said operators' positions and means at each of said positions for extending the calling telephone lines to wanted telephone lines.

In witness whereof, I hereunto subscribe my name this 3rd day of May A. D., 1924.

WINFRED T. POWELL.