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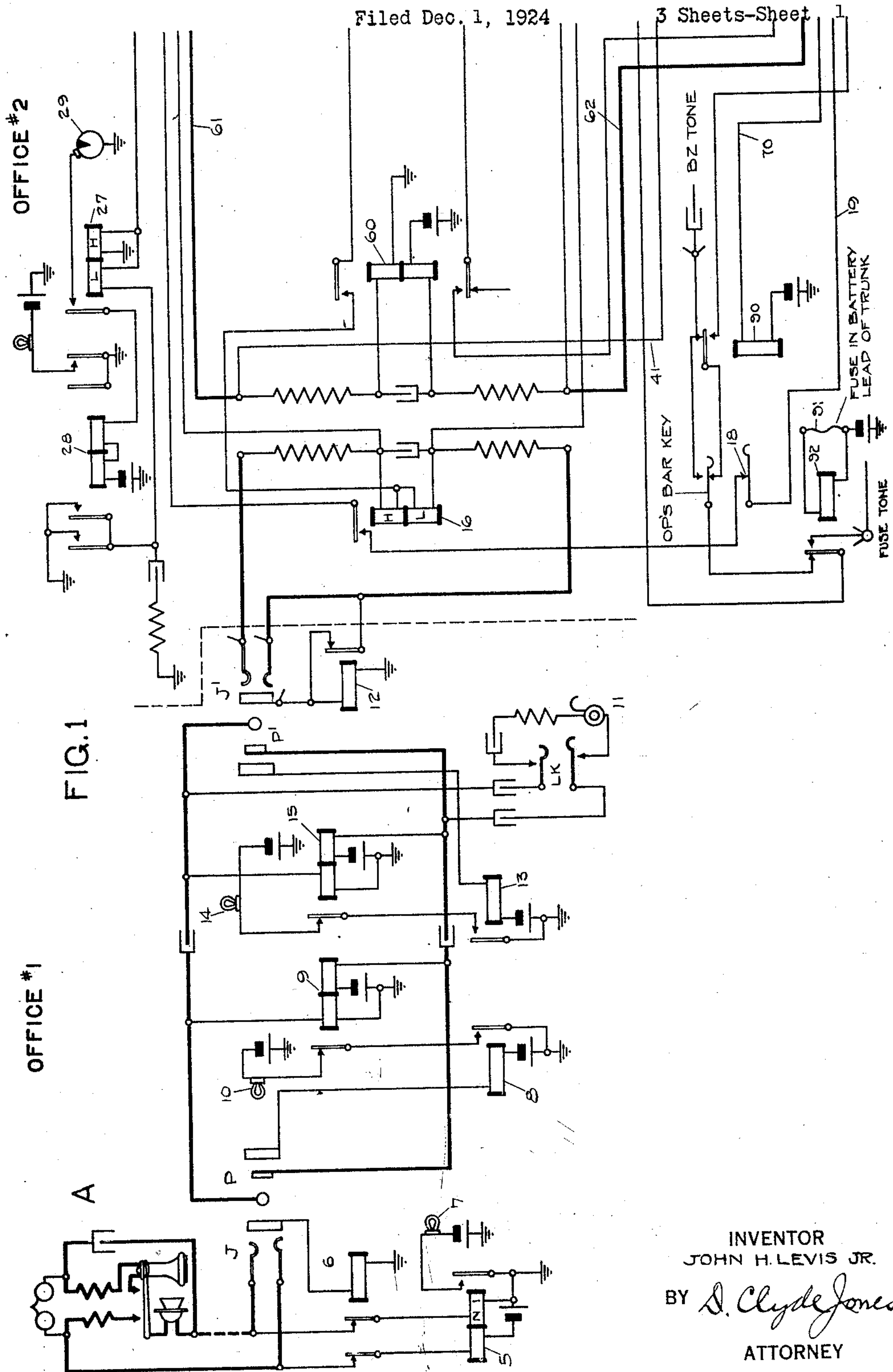
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MANUAL TELEPHONE SYSTEM

Filed Dec. 1, 1924

3 Sheets-Sheet 1



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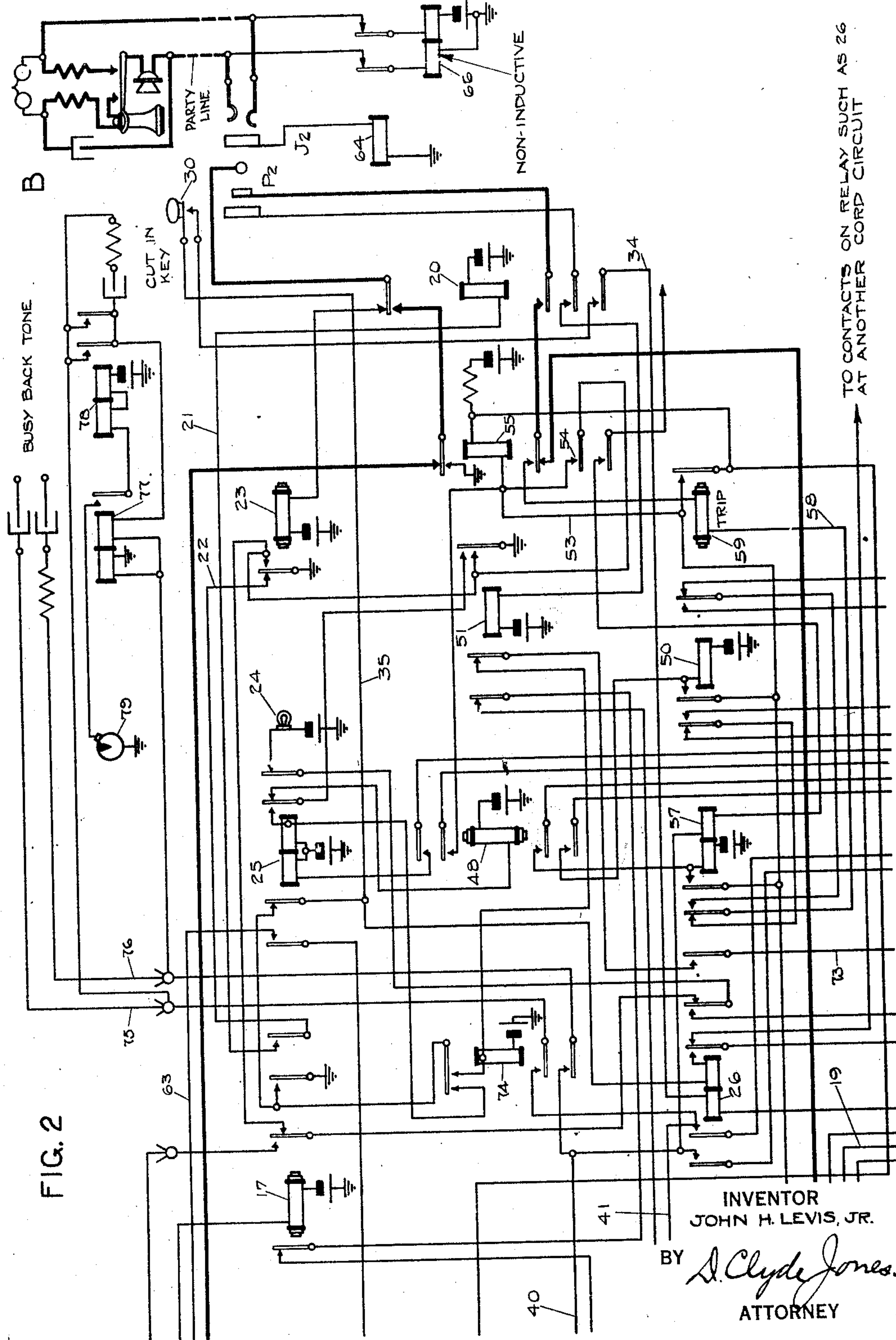
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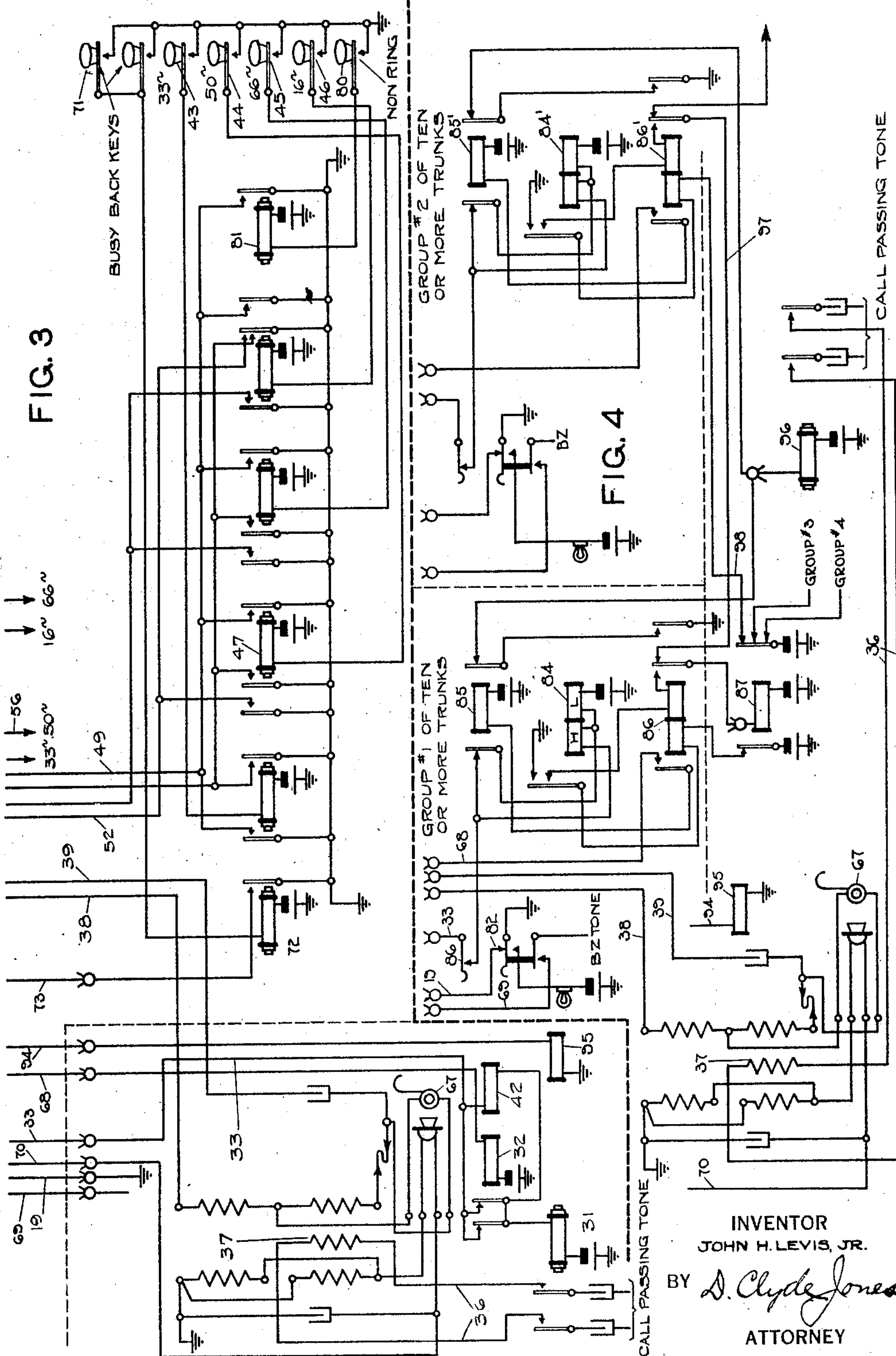
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MANUAL TELEPHONE SYSTEM

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3 Sheets-Sheet 3



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MANUAL TELEPHONE SYSTEM.

Application filed December 1, 1924. Serial No. 753,141.

This invention relates to manual telephone systems and more particularly to manual telephone systems of the multi-office type.

In former telephone systems it has usually been customary to employ order wires between an originating office and a terminating office for the use of the operators in issuing instructions as to the designation of the wanted telephone line and for the assignment of a trunk to be employed in completing the connection. The use of such an order wire system has not only resulted in numerous errors but has greatly slowed down the efficiency of the operators.

The present invention has for its purpose the elimination of such order wires and the originating operator instead of being assigned a trunk by the terminating operator selects an idle trunk leading to the wanted office. Means are provided in the form of a signal to the originating operator to inform her when a terminating operator is ready to receive the designation of the wanted telephone line. In accomplishing this result novel arrangements are incorporated in the system.

One of the main features of the present invention is the novel method of associating a terminating operator's telephone set with a trunk circuit to which a calling telephone line has been extended.

Another feature of this invention is the circuit arrangement by which a set of keys, comprising one key for each source of ringing current employed, is common to a group of trunk circuits and is arranged to cooperate with the circuits by which an operator's telephone set is connected to a trunk circuit taken for use.

Other features of the invention will appear in the detailed description and appended claims.

The drawings with Figs. 1 and 2 arranged in the order named and with Fig. 3 below Fig. 2, diagrammatically represent a multi-office telephone system. At the extreme left of Fig. 1 there is represented a calling subscriber's substation and telephone line. At the left of the dotted line of this figure there is shown an A operator's cord circuit, as well as a multiple trunk jack located at an originating office. At the right of this dotted line, as well as in Figs. 2 and 3, there is represent-

ed a trunk circuit together with the common equipment associated with a plurality of trunk circuits all located at a second office, which is herein referred to as a terminating office. At the extreme right of Fig. 2 there is shown a party telephone line, only one of the substation circuits of which, is shown. Near the upper left hand corner of Fig. 3 there is shown an operator's telephone set and certain equipment which is used when manual means is used to associate the operator's telephone set with a trunk circuit. In Fig. 4 which is shown below the heavy dotted line appearing below Fig. 3, there is shown the equipment, which is employed when automatic means is used to associate an idle operator's telephone set with a trunk circuit taken for use. It will be understood that the arrangement of Fig. 4 may replace the circuits and equipment shown in the rectangle, at the left of Fig. 3. The same numerals have been applied to the corresponding conductors of Figs. 3 and 4, so that it will be readily understood how the modification of Fig. 4 may replace the manual cut-in arrangement within the rectangle, of Fig. 3. It will be noted in Fig. 3 that the conductor 69 is incomplete, since it is only used with the modification of Fig. 4.

It is believed that the invention will best be understood by describing the method of establishing a telephone connection from a calling subscriber at "A", whose line terminates at one office, with a subscriber's line such as "B", which terminates at a distant office. When the subscriber at A initiates a call by removing his receiver from its switch-hook, the line relay 5, the right hand winding of which is non-inductive, is energized in a circuit through both windings in series and through the back contacts of the cut-off relay 6, over both sides of the line in series. The operation of the line relay 5 lights the line lamp 7, whereupon, the A operator at the originating office connects the answering end of the cord circuit such as that shown in Fig. 1 with the jack J of the calling line. The cut-off relay 6 is then energized over a circuit extending through the sleeve contacts of the jack J and the plug P through the winding of the sleeve relay 8 to grounded battery. The cut-off relay when thus energized disconnects the line relay from the

calling line which in turn extinguishes the line lamp 7. The connection of the answering end of the cord circuit to the calling line also energizes the answering supervisory relay 9, which in this instance serves to supply talking battery to the calling line. With the relay 9 operated, the supervisory lamp 10, although its circuit is closed at the sleeve relay, still has an open break-point in its circuit, at the armature and back contact of the supervisory relay 9.

The operator's telephone set, only the receiver of which is shown at 11, is then connected telephonically to the calling line either manually or automatically. As shown in Fig. 1 the operator's telephone set is connected to the calling line by the depression of the listening key LK. The operator thus obtains the designation of the wanted line and as soon as she ascertains that this line terminates at a distant office, she proceeds to test for an idle trunk leading to the wanted office. This test is accomplished by touching the tip of the plug P' to the sleeve of the jack J'. Busy trunks are characterized by such a potential on the sleeve contacts of the jacks, that a distinctive click is heard in the operator's head set as soon as the tip of the plug engages any of such jacks. When the operator finds an idle trunk she inserts the plug P' of the cord circuit taken for use, into its jack J'. This connection effects the energization of the relays 12 and 13 in series in a circuit extending through the sleeve contacts of the plug P' and jack J' and the energization of the relay 13 closes a break-point in the circuit for lighting the supervisory lamp 14. When, however, the supervisory relay 15 is energized, the lamp 14 is extinguished. The inter-engagement of the tip and ring contacts of the plug P' and the jack J' serves to complete a circuit from ground through the left hand winding of the relay 15, tip contacts of the plug P' and the jack J', upper left hand winding of the repeating coil, through the high and low resistance windings in series of the relay 16, lower left hand winding of the repeating coil, ring contacts of the plug P' and the jack J', right hand winding of the relay 15, to grounded battery. The relay 15 does not operate in series with the high resistance winding of the relay 16, but this last named relay attracts its armatures and thereby effects the operation of the slow releasing relay 17 from grounded battery, winding of this relay, upper armature and front contact of relay 16, through the contacts 18 of the operator's individual barring key, conductor 19, to ground. With the relay 17 operated, relay 20 shown at the right of Fig. 2, is energized in a circuit from grounded battery, its winding, conductor 21, outer, front contact and armature of relay 17, conductor 22, back contact and armature of the slow releasing relay 23, to ground. Also with the relay 17 operated

the incoming lamp signal 24 associated with the plug P², individual to the trunk taken for use, is intermittently lighted. Its lighting circuit extends from grounded battery, lamp 24, outer back contact and armature of relay 25; outer armature and back contact of relay 26, inner right hand armature and front contact of relay 17, through the high resistance winding of relay 27, to ground. The relay 27 is thus energized, but the lamp 24 does not light in series with the high resistance of this relay, but with the relay 27 operated the relay 28 is intermittently operated in series with the interrupter 29. Each time that the relay 28 is energized, it extends the circuit for the lamp 24 through the low resistance left hand winding of relay 27 and the armatures and contacts of relay 28, to ground, and since this circuit is in shunt with the high resistance winding of relay 27, the lamp 24 is lighted.

On noting that the incoming signal lamp 24 is flashing the operator depresses her cut-in key 30, which serves to connect her telephone set shown in the upper left hand corner of Fig. 3, to the trunk circuit of Fig. 2. The depression of the key 30 closes a circuit from grounded battery, winding of the slow releasing relay 31, armatures and back contacts of relay 32, conductor 33, left hand winding of the relay 26, conductor 34, lowermost armature and front contact of relay 20, operated contacts of the key 30, conductor 35, inner left hand armature and back contact of relay 25, front contact and middle armature of relay 17, to ground, for operating relays 26 and 31.

The energization of relay 26 extends the conductors 38 and 39 of the operator's telephone set to the trunk circuit taken for use and also closes a circuit for dimly lighting the supervisory lamp 24 to indicate to the operator to which trunk circuit her telephone set is connected. This lighting circuit is traceable from grounded battery, lamp 24, back contact and armature of relay 25, middle armature and front contact of relay 26, conductor 94, winding of the resistance coil 95, to ground. It will be noted that this circuit is controlled at a back contact of relay 25, so that when this last named relay is energized at the time when ringing current is selected for the called line the lamp 24 is extinguished.

The operation of the relay 31 connects the source of call-passing tone to the conductors 36, which include a winding 37 of the induction coil associated with the operator's telephone set. This call-passing tone is transmitted to the A operator at the originating office and is a signal to that operator, that the B operator is ready to receive the designation of the wanted line. The tone current just referred to is induced in the conductors 38 and 39, which are extended through the left hand armature and front contacts of relay 26 and thence to the right hand windings of the repeating coil, shown at the right of Fig. 1,

over the conductors 40 and 41. This tone current is then induced in the left hand windings of the repeating coil and thence to head set 11. The call-passing tone is also heard in the B operator's head set at the same time that the A operator is notified, so that both operators on the connection are notified to be in readiness to extend the call. When the relay 26 is operated, it is locked in this condition in a circuit traceable from grounded battery, winding of the relay 32, right hand armature and front contact of the relay 26, winding of this relay, left hand armature and back contact of relay 25, front contact and middle armature of relay 17, to ground. The energization of the relay 32 in this last circuit opens the original operating circuit of the relay 31, but this last named relay is now held operated in series with the resistance coil 42 and the remainder of the circuit previously described including the conductor 33.

After receiving the call-passing tone the A operator repeats or passes the number of the wanted telephone line to the B operator at the distant office. The B operator then touches the tip of the plug P^2 of the trunk taken for use, with the sleeve of the jack J^2 of the wanted line. If this line is busy the B operator hears a distinctive click in her telephone 67, which is a signal that the call cannot be completed.

Let it be assumed that at the time of this test the wanted line is idle, whereupon the B operator inserts the plug P^2 into the jack J^2 of the wanted line and since it is also assumed that the wanted line is a party line, the operator depresses some one of the stations keys 43, 44, 45 and 46 to connect the proper source of ringing current to the wanted line to ring the desired station thereon.

With the relay 20 energized and the plug P^2 in engagement with the jack J^2 , the sleeve relay 51 is energized from grounded battery, its winding, middle front contact and armature of relay 20, sleeve contacts of the plug P^2 and the jack J^2 , winding of the cut-off relay 64, to ground. The operation of the relay 51 causes the energization of the relay 48 in a circuit closed from grounded battery, winding of this relay, inner back contact and armature of relay 25, front contact and armature of relay 51, to ground.

If the wanted station B responds to the source of 50 cycle ringing current, the operator depresses the ringing key 44 which results in the energization of the slow releasing relay 47. This last named relay thereupon attracts its armatures to complete an operating circuit for the relay 25 of Fig. 2, from grounded battery, left hand winding of this relay, uppermost front contact and armature of relay 48, conductor 49, right hand front contact and armature of relay 47, to ground. The relay 25, as soon as it is operated, closes a locking circuit for itself from grounded bat-

tery through its right hand winding, front contact and armature, right hand front contact and armature of relay 51, to ground. Also at this time the ringing frequency selecting relay 50 is energized from grounded battery, lowermost contact and armature of relay 48, conductor 52, left hand front contact and armature of relay 47, to ground. The relay 50 closes a locking circuit for itself through its innermost front contact and armature, conductor 53, contact 54 and armature of relay 55, front contact and armature of relay 51, to ground. The energization of relay 47 also closes an operating circuit from grounded battery, resistance, winding of the ringing relay 55, inner front contact and armature of relay 48, left hand front contact and armature of relay 47, to ground. The relay 55, when thus operated closes a locking circuit for itself through its front contact 54 and armature, right hand front contact and armature of relay 51, to ground.

Ringling current from the 50 cycle source is now applied to the called line through conductor 56, outer front contact and armature of relay 50, outermost back contact and armature of relay 57, conductor 58, winding of the trip relay 59, innermost lower front contact and armature of relay 55, front contact and armature of relay 20, through the ring contacts of the plug P^2 and the jack J^2 , over the lower side of the called line and through the ringer at the wanted station, over the upper side of the called line, tip contacts of the jack J^2 and the plug P^2 , upper armature and front contact of relay 20, armature and front contact of relay 55, to ground. Ringling current is applied over this circuit until the called party answers, at which time the trip relay 59 is energized to close a short circuit about the ringing relay 55, which thereupon deenergizes and opens the ringing circuit just traced. Also the deenergization of the ringing relay 55 opens the circuit of the frequency selecting relay 50, which thereupon retracts its armatures. Also when the called party answers the supervisory relay 60 is energized over the two sides 61 and 62 of the trunk and through the two sides of the called line in series. As soon as this supervisory relay attracts its armatures, it closes a short circuit about the high resistance winding of relay 16, so that the supervisory relay 15 at the originating office attracts its armatures to open the circuit of the supervisory lamp 14. The short circuit about the high resistance winding of relay 16 extends from one side of the high resistance winding of this relay, upper, front contact and armature of relay 60, outermost armature and front contact of relay 25, conductor 63, to the other side of the high resistance winding of relay 16.

Talking battery is supplied to the calling

substation through the windings of the supervisory relay 9, while talking battery is supplied to the called substation through the windings of the supervisory relay 60.

At the close of the conversation, when the calling party hangs up his receiver, the supervisory relay 9 retracts its armatures to light the supervisory lamp 10. When the called party hangs up his receiver the supervisory relay 60 deenergizes and opens the short circuit about the high resistance winding of the relay 16. The high and low resistance windings of this last named relay are thereupon included in the circuit previously described as extending from both windings of the supervisory relay 15, which causes this relay to retract its armatures to light the supervisory lamp 14. The A operator thereupon removes the plug P and the plug P' from the jacks with which they have been in engagement. When the relay 16 deenergizes, it causes the slow releasing relay 17 to retract its armatures and this last mentioned relay at its outermost front contact opens the circuit which has been holding the relay 20 operated. The relay 20 then retracts its armatures and at its middle armature and front contact opens the holding circuit of the sleeve relay 51. This last named relay at its right hand armature and front contact opens the locking circuit, which has been holding the relay 25 energized. When the relay 20 deenergizes to open the holding circuit of the relay 51, it also opens the energizing circuit of the cut-off relay 64 of the called line permitting it to deenergize.

The slow releasing relay 23 is now energized from grounded battery winding of this relay, upper back contact and armature of relay 20, through the tip contacts of the plug P² and the jack J², left hand winding of the line relay 66, to ground. The purpose of the relay 23 is to prevent a called subscriber such as B from being reconnected to the trunk circuit last used, in the event that he initiates a call before the plug P² is removed from the jack J². With this relay energized, lamp 24 is lighted as a disconnect signal in a circuit now extended from grounded battery lamp 24, back contact and armature of relay 25, armature and back contact of the relay 26, inner armature and back contact of the relay 17, front contact and armature of relay 23, to ground. The B operator on noting that the lamp 24 is lighted steadily, removes the plug P² from the jack J². When this plug is removed from the jack, the relay 23 deenergizes and all the equipment is in readiness for use in a succeeding call.

Let it be assumed that the wanted line was busy when the operator touched the tip of the plug P² to the sleeve jack J² in testing its line. The operator then depresses one of the busy-back keys 71 to transmit a busy-back signal to the calling subscriber. It will be

noted that two busy-back keys 71 have been shown, by which it was intended to indicate that two of these keys are placed on each operator's position. One of these keys is placed at the right of the operator's position and the other key is placed at the left, so that one of these keys is easily accessible to either hand of the operator. When the operator depresses a busy-back key 71, a circuit is closed from ground, contacts of this key, winding of the slow releasing relay 72, to grounded battery. The operation of the relay 72 completes a circuit from ground, its armature and front contact, conductor 73, outer armature and front contact of relay 26, inner armature and back contact of relay 51, winding of the relay 74, to grounded battery. This operates the relay 74, so that it closes a locking circuit for itself from grounded battery, its winding, upper front contact and armature, middle front contact and armature of relay 17, to ground. A source of busy tone current is connected from conductors 75 and 76, through the lower make contacts of relay 74 to conductors 40 and 41 and through the right hand windings of the repeating coil of Fig. 1. Busy tone current is induced in the left hand winding of the repeating coil and thence through the condensers of the A operator's cord circuit to the calling line. Under the control of relays 77 and 78 and interrupter 79, supervisory relay 60 is intermittently operated to flash the lamp 14 as a visual indication to the A operator that the wanted line is busy.

It sometimes happens that the B operator desires to connect a trunk circuit with another circuit without the necessity of applying ringing current to said circuit. Such a mentioned connection may arise when it is necessary to extend a trunk circuit to an intercepting operator, or when the B operator by mistake removes the trunk plug P² from the jack J² of the wanted telephone line. In such a case the subscriber is waiting on his telephone line and the connection must be reestablished without reapplying signaling current to his line. Under such conditions when the operator desires to connect her trunk circuit to an outgoing circuit without applying ringing current, she depresses a non-ring key such as 80 of Fig. 3, with the result that the relay 81 is energized. In handling such a call the operator depresses the non-ring key 80 at the same stage in the operation as when she depresses a ringing key, at which time relays 20, 51 and 48 are operated. When relay 81 attracts its armature, it closes a circuit from ground, front contact and armature of relay 81, conductor 49, upper armature and front contact of relay 48, left hand winding of relay 25, to grounded battery. The relay 25 is energized and then locks itself operated in the manner already described. The operation of the relay 25 extinguishes the incom-

ing lamp signal 24 and at its inner armature and back contact opens the locking circuit of relay 26 which has been functioning to hold the operator's telephone set in connection with the trunk circuit. At the outer left hand armature and front contact of relay 25, the short circuit including the conductor 63, about the high resistance winding of relay 16 of Fig. 1, is closed, so that the supervisory relay 15 at the originating office is operated to extinguish the supervisory signal 14. The remainder of the connection otherwise proceeds in the same manner and is released in the same way as a usual connection.

Referring now, especially to the modification of Fig. 4, it will be understood that this last named arrangement is provided to connect the operator's telephone set automatically to one trunk circuit at a time, to which a calling telephone line has been extended. When the arrangement of Fig. 4 is employed, the circuits and equipment in the rectangle at the left of Fig. 3 are omitted and the conductors 19, 33, 38, 39, 68, 69 and 70 are connected to correspondingly designated conductors of Fig. 4, also all cut-in keys, such as 30, are permanently held closed. In this modified arrangement the trunk circuits terminating at an operator's position are arranged in groups. A suitable arrangement consists in providing forty trunks terminating at each operator's position, divided into groups of ten. It will be understood that each of these trunks may be similar to that disclosed in Figs. 1 and 2.

When this modification is used, the initiation of a call by the subscriber at A is followed by the operator inserting the plug P of an idle cord circuit into the jack J of the calling line and then depressing a listening key LK to connect her telephone set 11 to the calling telephone line. On learning that the wanted line terminates at the distant office, the A operator tests the trunks in a group leading to the wanted office by touching the tip of the plug P' of her cord circuit to the multiple trunk jacks such as J'. When an idle trunk such as that shown in Fig. 1 is found, the operator inserts the plug P' into its jack J'. The call now proceeds in the manner already described with the operation of the relay 16 and the consequent energization of the slow releasing relay 17 in a circuit now described from grounded battery, its winding, upper armature and front contact of relay 16, operator's bar key 18, conductor 19, to ground through contacts 82 of the key which is used to bar the #1 group of trunks from use. The operation of the relay 17 results in the actuation of the relay 20 so that the relay 84 of Fig. 4 is energized from grounded battery, its low resistance winding, armature and back contact of relay 85, contacts 86 of the group bar key, conductor 33, left hand winding of the relay 26,

conductor 34, lowermost armature and front contact of relay 20, contacts of the key 30 now always held closed, conductor 35, inner armature and back contact of relay 25, middle contact and armature of relay 17, to ground. As soon as the relay 84 is energized it closes a circuit from ground, its front contact and armature, left hand winding of the relay 86, back contact and armature of relay 87, to grounded battery. Relay 86 operates and closes a locking circuit for itself from grounded battery, winding of the relay 87, inner armature, front contact and right hand winding of the relay 86, front contacts and armatures of relay 84, to ground. The operation of the relay 87 disables the other groups of trunks, so that it is necessary for the operator to complete all calls existing in one group of trunks, before she starts to complete calls in any of the other groups. Also when the relay 86 is operated, it closes an energizing circuit for the relay 85 from grounded battery, winding of this relay, left hand front contact and armature of relay 86, conductor 68, inner armature, front contact and winding of relay 26, inner armature and back contact of relay 25, middle front contact and armature of relay 17, to ground. The relay 26, when thus held operated connects the operator's telephone set of Fig. 4 over the conductors 38 and 39 to the trunk circuit taken for use. As soon as the relay 85 is operated it opens the circuit including only the low resistance winding of relay 84, so that this last named relay is now held operated from grounded battery, through its high and low resistance windings in series and thence over conductor 33. The high resistance winding of relay 84 in this last described circuit prevents the operation of a second relay similar to 26 at another trunk circuit, in the event that calls are waiting extension on each of two trunks at the same time.

When the B operator's telephone set is connected to the trunk circuit and when she has received the designation of the wanted telephone line, she tests this line by touching the tip of the plug P² to the sleeve of the jack J². If the wanted line is idle the plug P² is inserted into the jack J² and the operator selects the proper ringing frequency by depressing some one of the ringing keys 43 to 46 inclusive. As has been previously pointed out this results in the operation of the relay 25, which in turn results in the deenergization of the relay 26. This last named relay on deenergization disconnects the operator's telephone set from the trunk, so that it can be connected to another trunk circuit on which a call is awaiting extension.

The remaining operations of completing the telephone connection and for disestablishing the same, are identical with corresponding operations previously described in connection with the arrangement where the op-

erator's telephone set is connected to a trunk as a result of the depression of a manual cut-in key.

The foregoing description of the modified arrangement has been made without reference to the fact that other trunks in the same group as the one just described, as well as other trunks in other groups, may be simultaneously awaiting the connection of the operator's telephone set to them. The circuits of Fig. 4 are arranged so that the operator's telephone set is connected in succession to trunks in the same group as the trunk to which this telephone set has just been connected, even if trunks in other groups are awaiting extension by the operator. As soon as all of the trunks, awaiting extension in one group, have been extended to the called lines, the operator's telephone set is then connected to a trunk in the next group of trunks, which group is represented in the lower right hand corner of Fig. 4, even if trunks in the last two groups (not shown) are awaiting extension. The means by which this result is accomplished will now be described.

It will be remembered that the relay 84 of Fig. 4, is energized through its low resistance winding, the left hand armature and back contact of relay 85, contacts 86, conductor 33, left hand winding of relay 26, conductor 34, lower armature and front contact of relay 20, permanently closed contacts of key 30, conductor 35, inner armature and back contact of relay 25, middle contact and armature of relay 17, to ground. Relays 26 and 84 are thus operated. This causes the relay 86 to be operated in a circuit from grounded battery, left hand winding of this relay, front contact and armature of relay 84, to ground. Relay 86 is thus operated and locks itself operated in series with the relay 87, from grounded battery, winding of this relay, armature, front contact and winding of relay 86, front contact and armature of relay 84, to ground. Relay 87 at its armature and back contact opens conductors such as 98, which lead to the other groups corresponding to relay 86' associated with the other groups of trunks. With the relays 86 and 26 operated, the relay 85 is energized from grounded battery, its winding, armature and front contact of relay 86, conductor 68, armature, front contact and winding of relay 26, to ground through the circuit previously described. With the relay 85 thus energized, the original energizing circuit of relay 84, including only the low resistance winding of this last named relay is opened, but it is held operated through its high and its low resistance windings in series. The resistance of these two windings is such that no other relay similar to 26, associated with trunks of this group will be operated, even though calls are awaiting extension thereon, while the relay 26 in Fig. 2 has its operat-

ing circuit closed through its left hand winding. When, however, the relay 26 of Fig. 2, deenergizes, a relay corresponding to 26 at another trunk circuit of this group, has its operating circuit closed, so that the relay 84 is held operated, at this time and continues to be held operated as long as calls are awaiting extension in group #1. When all the calls awaiting extension in a group are answered, relay 84 deenergizes, which in turn causes the relays 86 and 87 to deenergize. If a trunk in group #2 is now awaiting extension, the relay 84' will be operated in a manner similar to that already described, with the result that the relays 85' and 86' are operated. The relay 87 is also operated in series with the locking winding of relay 86'. The operation of relay 87, at its left hand armature, disables the energizing circuit of the relay 86, associated with the first group of trunks, so that the operator's telephone set cannot be connected with trunks of that group. At the inner-right hand armature and back contact of relay 86', the extended starter wire 97, is opened, to disable the locking circuits of relays corresponding to 86. With the relay 86' operated, an energizing circuit for the relay 96 is closed and this relay extends the call passing tone over the conductors 36 in the manner already described.

Certain emergency equipment is provided in the present system which will now be described. In the lower right hand corner of Fig. 1 there is shown a relay 90, which is connected by conductor 70, with the operator's telephone set. This relay is held operated as long as the operator is at her position, but when the position is disabled, means such as a plug (not shown) functions to interrupt the conductor 70 to effect the deenergization of relay 90, which results in the application of busy-tone to the trunk jack, such as J' of the trunks terminating at this operator's position. This tone circuit extends from BZ, armature and back contact of relay 90, normally closed contacts of the operator's barring key, back contact and armature of relay 92, outer back contact and armature of relay 51, left hand armature and back contact of relay 17 and thence through the lower left hand winding of the repeating coil to the jack J'. Similarly when an operator bars a trunk from use by depressing a bar key individual to that trunk, the same tone is connected to the jack J' of a circuit similar to that just described.

Although a plurality of battery symbols appear in the circuits of Figs. 1, 2, 3 and 4, it will be understood that a single battery is employed and that this battery is connected into the circuits of the trunk of these figures through a protecting fuse 91. If for any reason the fuse is opened the relay 92 then receives sufficient current to energize and

give an alarm in the form of a fuse tone connected to the jack J' of the trunk over the previously described tone circuit. In this way the operator at the originating office is warned against seizing a trunk which is disabled because of the fact that its fuse is open.

What I claim is:

1. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines having stations, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, means controlled in part by the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, means for extending said trunk to a wanted telephone line, a plurality of sources of ringing current for signaling stations on said party lines, a single ringing key for each source of ringing current common to said trunk circuits, and means responsive to the depression of one of said ringing keys for selecting the proper source of signaling current to signal the wanted station on said wanted telephone line.

2. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines having stations, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set at the terminating office, automatic means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, means for extending said trunk to a wanted telephone line, a plurality of sources of ringing current for signaling stations on said party line, a single ringing key for each source of ringing current common to said trunk circuits, and means responsive to the depression of one of said ringing keys for selecting the proper source of signaling current to signal the wanted station on said wanted telephone line.

3. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines having stations, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, a signal lamp individual to said trunk, a circuit for lighting said lamp when said trunk is extended to a calling telephone line, an operator's telephone set, means controlled in part by the extension of said calling telephone line to said trunk for con-

necting said operator's telephone set to said trunk to the exclusion of other trunks, means including a portion of said first mentioned circuit for dimly lighting said lamp while said operator's telephone set is connected to said trunk, means for extending said trunk to a wanted telephone line, a plurality of sources of ringing current for signaling stations on said party lines, a single ringing key for each source of ringing current common to said trunk circuits, and means responsive to the depression of one of said ringing keys for selecting the proper source of signaling current to signal the wanted station on said wanted telephone line.

4. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines having stations, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, a signal lamp individual to said trunk, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, means for lighting said lamp in a distinctive manner to indicate that said telephone set is connected to said trunk, means for extending said trunk to a wanted telephone line, a plurality of sources of ringing current for signaling stations on said party lines, a single ringing key for each source of ringing current common to said trunk circuits, and means responsive to the depression of one of said ringing keys for selecting the proper source of signaling current to signal the wanted station on said wanted telephone line.

5. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, trunks connecting said offices, means at the originating office for extending a calling telephone line terminating thereat to one of said trunks, an operator's telephone set at the terminating office, automatic means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks and for transmitting a tone to the originating office when such connection has been made, and means for extending said trunk to a wanted telephone line.

6. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines having stations, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, means controlled in part by the extension of said

calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, signaling means controlled by said operator's telephone set connecting-means for signaling the originating office when said operator's telephone set is connected to said trunk, a plurality of sources of ringing current for signaling stations on said party lines, a single ringing key for each source of ringing current common to said trunk circuits, and means responsive to the depression of one of said ringing keys for selecting the proper source of signaling current to signal the wanted station.

7. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, means controlled in part by the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, means for indicating when a wanted telephone line is busy, and means including an operator-controlled key common to a plurality of said trunks for signaling the originating office that a wanted line is busy.

8. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, a plurality of trunks arranged in groups for interconnecting said offices, means at the originating office for extending calling telephone lines, terminating thereat to trunks, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone lines to said trunks for connecting said operator's telephone set to one of said trunks to the exclusion of other trunks, said connecting means including a circuit arrangement for connecting said operator's telephone set to other selected trunks in the same group in succession and then for connecting said operator's telephone set to other trunks of another group in succession to the temporary exclusion of all of said other groups of trunks, and means for extending selected trunks to wanted telephone lines.

9. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, a plurality of trunks arranged in groups for interconnecting said offices, means at the originating office for extending calling telephone lines terminating thereat to trunks, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone lines to said trunks for connecting said operator's telephone set to one of said trunks to the exclusion of other trunks, said connecting means including a

circuit arrangement for connecting said operator's telephone set to other selected trunks in succession of the group last used and then for connecting said operator's telephone set to the trunks of another group in succession to the temporary exclusion of all of said other groups of trunks, signaling means connected to the trunk to which said operator's telephone set is connected, to indicate that said connection has been made, and means for extending selected trunks to wanted telephone lines.

10. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, a plurality of trunks arranged in groups for interconnecting said offices, means at the originating office for extending calling telephone lines terminating thereat to trunks, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone lines to said trunks for connecting said operator's telephone set to one of said trunks to the exclusion of other trunks, said connecting means including a circuit arrangement for connecting said operator's telephone set to other selected trunks in succession of the group last used and then for connecting said operator's telephone set to other trunks of another group in succession to the temporary exclusion of all of said other groups of trunks, means for characterizing engaged telephone lines as busy, operator controlled means for signaling the originating office that a wanted telephone line is busy, and means for extending selected trunks to idle wanted telephone lines.

11. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines with a plurality of stations, a plurality of trunks arranged in groups for interconnecting said offices, means at the originating office for extending calling telephone lines terminating thereat to trunks, means for connecting trunks to wanted telephone lines, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone lines to said trunk for connecting said operator's telephone set to one of said trunks to the exclusion of other trunks, said connecting means including a circuit arrangement for connecting said operator's telephone set to other selected trunks in the same group in succession and then for connecting said operator's set to other trunks of another group in succession to the temporary exclusion of all of said other groups of trunks, a plurality of sources of ringing current for signaling stations on said party lines, a single key for each source of ringing current, said keys being common to said trunk circuits, and means responsive to the depression of one of said ringing keys for

selecting the proper source of signaling current to signal the wanted station on a wanted telephone line.

12. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, a plurality of trunks arranged in groups for interconnecting said offices, a signal lamp individual to each trunk, means at the originating office for extending calling telephone lines terminating thereat to trunks, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone lines to said trunks for connecting said operator's telephone set to one of said trunks to the exclusion of other trunks, said connecting means including a circuit arrangement for connecting said operator's telephone set to other selected trunks in the same group in succession and then for connecting said operator's telephone set to other trunks of another group in succession to the temporary exclusion of all of said other groups of trunks, means for dimly lighting the lamp signal associated with the trunk to which said operator's telephone set is connected, and means for extending selected trunks to wanted telephone lines.

13. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set at the terminating office, a source of signaling current, a relay individual to each trunk for connecting said operator's telephone set to said trunk and for connecting said signaling current to said trunk, both of said connections by said relay existing concurrently, automatic means responsive to the extension of said calling telephone line to said trunk for actuating said relay, and means for extending said trunk to a wanted telephone line.

14. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being party lines each provided with stations, a plurality of trunks arranged in groups for interconnecting said offices, means for connecting said trunks to wanted telephone lines, a lamp individual to each of said trunks, an operator's telephone set at said terminating office, automatic means responsive to the extension of said calling telephone lines to said trunks for connecting said operator's telephone set to one of said trunks of a group to the exclusion of other trunks, said connecting means including a circuit arrangement for connecting said operator's telephone set to other selected trunks in the same group in succession and then for connecting said operator's telephone set to other trunks of another group in succession to the temporary exclusion of all of said other groups of trunks,

means for actuating in a distinctive manner the lamp of said trunk to which said operator's telephone set has been connected, a plurality of sources of ringing current for signaling stations on said party lines, a single ringing key for each source of ringing current common to said trunk circuits, and means responsive to the depression of one of said common ringing keys for selecting the proper source of signaling current to signal the wanted stations on said wanted telephone lines.

15. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, trunks, each having conductors extending between said offices, a normally open break point in certain of the conductors of each trunk circuit, a relay for closing said break point, means in the originating office for extending calling telephone lines to a trunk circuit, means responsive to such extension for operating said relay, a second relay operated in response to the disconnection of said calling telephone line from said trunk while said trunk is connected to a called telephone line, said second relay serving to disable said first relay, and means for connecting said trunk to a wanted telephone line at the terminating office.

16. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, means controlled by the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, means for indicating to the originating office that said operator's telephone set has been connected to said trunk, means for indicating when a wanted telephone line is busy, and means including a busy-back key common to a plurality of said trunks for signalling the originating office when a wanted line is busy.

17. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being provided with a plurality of stations responsive to signalling current of different character, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, automatic means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk to the exclusion of other trunks, sources of signaling current for signalling said stations, a single key for each source of current common to said trunks for selecting the proper source of current to signal a wanted station on a

called telephone line, means for indicating when a wanted telephone line is busy, and means including a busy-back key common to a plurality of said trunks for signalling the originating office that a wanted line is busy.

18. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being provided with stations, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, automatic means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk, a signal at the terminating office for indicating to the operator which trunk said telephone set is connected, means for indicating that a wanted telephone line is busy, means including a busy-back key common to a plurality of said trunks for signalling the originating office when a wanted telephone line is busy, sources of signalling current for signalling said stations, and a single key for each source of current common to said trunks for selecting the proper source of current to signal a wanted station on a called telephone line.

19. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, signalling means for indicating to the originating office when a wanted telephone line is busy, a relay individual to said trunk for connecting said operator's telephone set thereto, said relay also serving to control in part said busy sig-

nalling means, and a busy-back key common to said trunks for initiating the transmission of said busy-back signal to the originating office.

20. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, certain of said telephone lines being provided with a plurality of stations responsive to signalling current of different character, trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk, means for transmitting a tone signal to the originating office when said operator's telephone set has been connected to said trunk, sources of signalling current for signalling said stations and a single key for each source of current common to said trunks for selecting the proper source of current to signal a wanted station on a called telephone line.

21. In a telephone system, an originating office, a terminating office, telephone lines terminating at each of said offices, a plurality of trunks for interconnecting said offices, means at the originating office for extending a calling telephone line terminating thereat to a trunk, an operator's telephone set, means responsive to the extension of said calling telephone line to said trunk for connecting said operator's telephone set to said trunk, and a tone for indicating to the originating office and to said operator that said telephone set is connected to said trunk.

In witness whereof, I hereunto subscribe my name this 29 day of November A. D. 1924.

JOHN H. LEVIS, JR.