Nov. 29, 1927.

1,650,906

W. T. POWELL

TELEPHONE SYSTEM

Filed Feb. 21, 1925 2 Sheets-Sheet 1

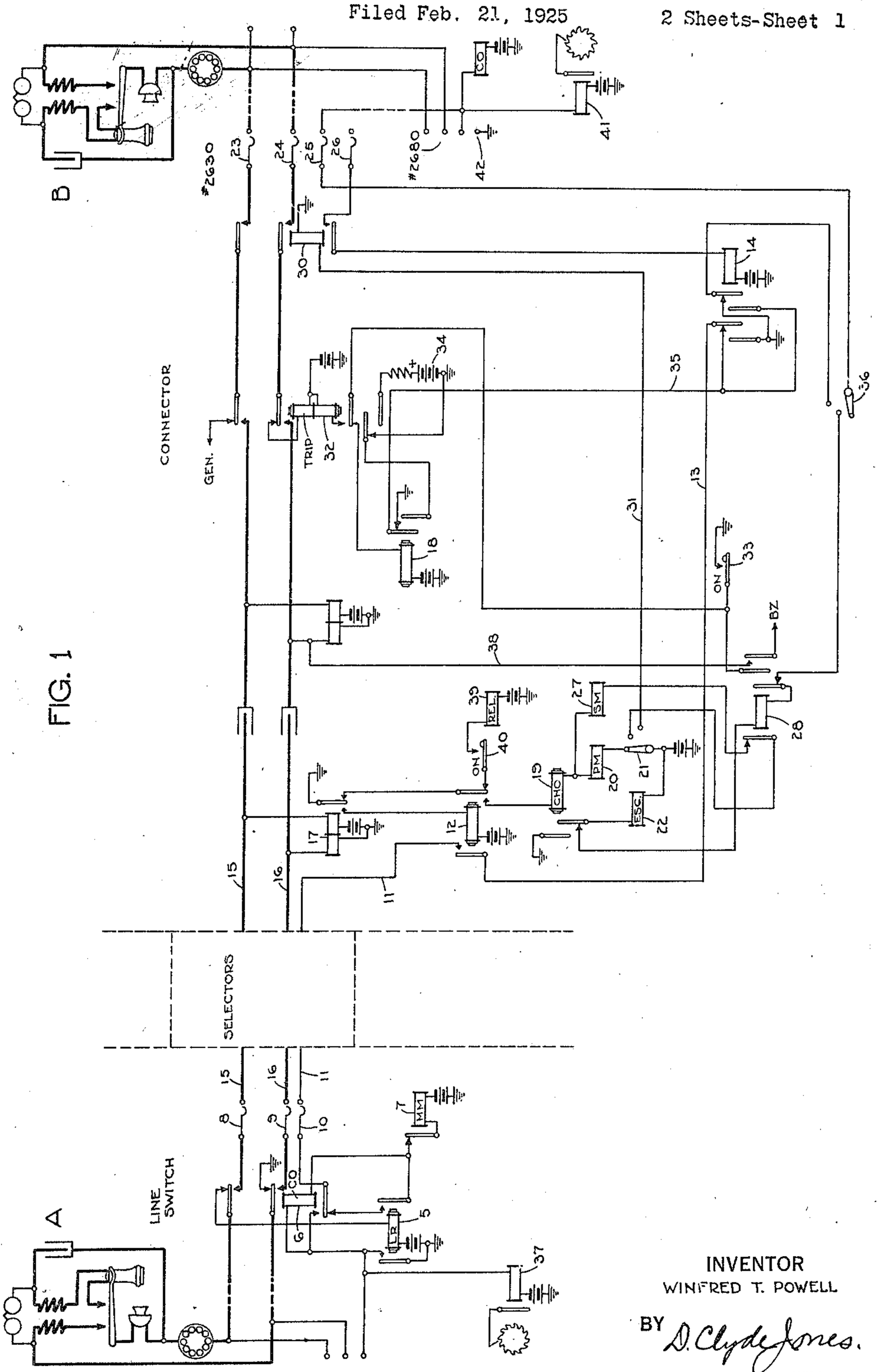

FIG. 1

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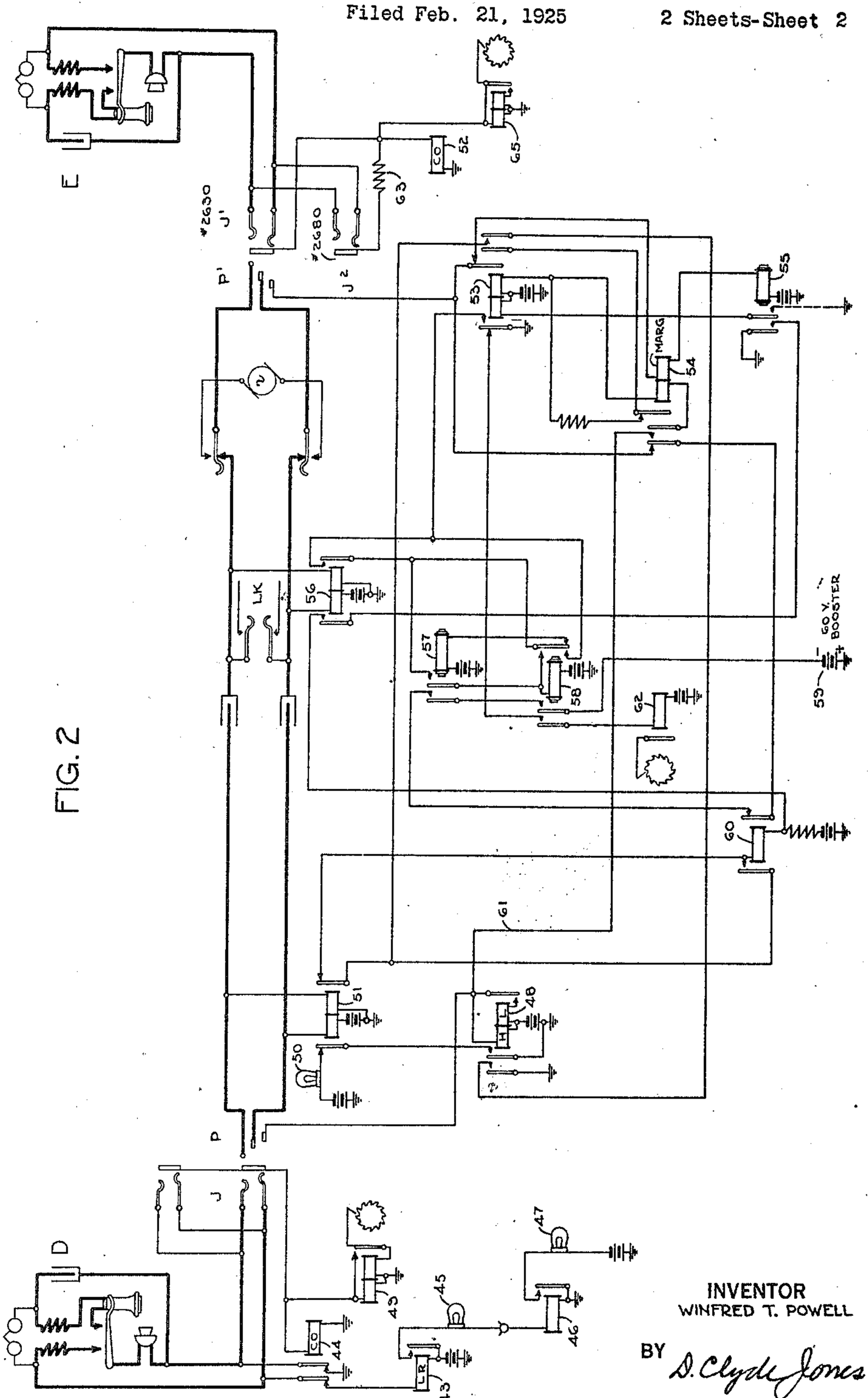

FIG. 2

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

Application filed February 21, 1925. Serial No. 10,952.

This invention relates to telephone systems and more particularly to telephone systems in which means are provided for charging certain of the calls originated.

In certain types of telephone systems it is customary to provide a message charging device at each telephone line, so that the subscriber thereat, can be charged for calls. Under certain conditions it may be desirable to charge the call to the called subscriber instead of to the calling subscriber. An example of this condition may be in the case of a department store, which on certain occasions may advertise that when a predetermined number, other than the usual number is called, the call instead of being charged to the calling subscriber is charged on the called subscriber's meter.

One of the features of the present invention resides in the provision of means in a telephone system, whereby calls, which are normally charged to the calling subscriber, may under predetermined conditions, automatically controlled, be charged to the called subscriber.

Another feature of the present arrangement resides in the provision of means, whereby a call to a called subscriber, when completed through one channel, is charged to the calling subscriber and when completed through a second channel is charged to the called subscriber.

In the drawings, Fig. 1 diagrammatically represents a portion of an automatic telephone system, in which only a calling and called subscriber's line and substation are shown and a line switch and one connector for completing a connection between these two lines. It will be understood that in systems having more than one hundred lines, one or more selectors and trunks, arranged to be connected in series, may be interposed between the line switch and connector within the dotted rectangle having the legend "selectors".

Fig. 2 diagrammatically represents a portion of a manual system in which the present invention is incorporated.

Referring to Fig. 1, the invention will best be understood by describing the method of establishing a telephone connection between the calling line designated "A" and the called line designated "B". When the subscriber at "A" initiates a call, by removing his receiver from its switchhook, the line relay 5 is energized in the well known manner in a circuit completed through the armature and back contacts of the cut-off relay 6 and the two sides of the calling line in series, to ground. The line relay 5 when thus energized completes an operating circuit for the motor magnet 7, in the event that the brushes 8, 9 and 10 of the line switch are not in engagement with the terminals of an idle trunk, since this line switch is of the rotary "stay-put" type. This operating circuit extends from grounded battery, winding of the motor magnet 7, its armature and back contact, armature and front contact of the line relay 5, back contact and armature of the cut-off relay 6, test brush 10, test conductor, such as 11, of the busy trunk, front contact and armature of a slow releasing relay corresponding to 12, conductor such as 13, continuity spring and armature of relay 14, to ground. The cut-off relay during this time, although a circuit is completed for it from grounded battery, winding, armature and back contact of the motor magnet 7, winding of the cut-off relay 6, front contact and armature of relay 5, to ground, is not operated in this circuit, because it is short circuited by the operating circuit of the motor magnet 7, previously described. When, however, the motor magnet 7 has advanced the line switch brushes 8, 9 and 10 to the terminals of an idle trunk, whose test terminal is characterized by the absence of ground potential, due to the fact that the relay 12 associated with this trunk is not operated, the motor magnet is no longer operated and the mentioned short circuit, including the conductor 11, is no longer completed. The cut-off relay is operated in the mentioned circuit serially including the motor magnet 7, which is completed at the front contact and armature of the line relay 5. The motor magnet 7, however, is not operated in series with the cut-off relay 6. On the operation of the cut-off relay 6, the subscriber's line is extended through the upper armatures and front contacts of this relay through, the brushes 8 and 9, of the line switch conductors 15 and 16 of the selected trunk through both windings in series of the relay 17, to ground and grounded bat-

tery respectively. The relay 17 is operated in this circuit and at its front contact and armature actuates the slow releasing relay 12. The cut-off relay 6 at its upper armature and back contact interrupts the operating circuit of the line relay 5, but this last named relay is sufficiently slow releasing so that the operating circuit of the cut-off relay 6 is maintained until the relay 12 is operated to complete a holding circuit for the cut-off relay, extending from grounded battery, winding, armature and back contact of motor magnet 7, winding of the cut-off relay 6, its lower front contact and armature, test brush 10, holding conductor 11, front contact and armature of relay 12, conductor 13, continuity spring and back contact of relay 14, continuity spring and back contact of relay 18, to ground.

For purposes of this description it has been assumed that the calling subscriber's line has been extended through one or more selectors, depending on the size of the system, to the connector of Fig. 1 through which the called subscriber's line may be reached. It has been previously described, how the extension of the calling line to these conductors results in the operation of relay 17.

The connector switch is now in condition to receive impulses corresponding to the tens digit of the wanted number, which in this instance is #2630. The subscriber at "A" now operates his dial sender in the well known manner to transmit the tens series of impulses. In response to each of the impulses of this series, the impulse relay 17 retracts its armatures, but the slow releasing relay 12 does not release its armatures during the normal interruption of its operating circuit at the front contact and armature of relay 17. On each retraction of the armature of relay 17, a circuit is closed from ground, armature and back contact of relay 17, right hand armature and front contact of relay 12, winding of the change-over relay 19, primary motor magnet 20 and the side switch wiper 21 in its first position, to grounded battery. On the first completion of this circuit, the change-over relay 19 attracts its armatures and thereby completes a circuit from ground, its armature and continuity spring, winding of the escape magnet 22, to grounded battery. As is well known, the escape magnet on its deenergization serves to advance the side switch wiper one step. On each completion of the circuit described as extending through the change-over relay 19, the primary motor magnet 20, advances the brushes 23, 24, 25 and 26 of the connector, one step in their primary movement. At the close of the tens series of impulses the impulse relay 17 holds its armature attracted for an appreciable interval, so that the change-over relay 19 deenergizes, opening the holding circuit of the escape magnet 22, which thereupon deenergizes to advance the side switch wipers into their second position.

The connector switch circuits are now in readiness to receive the units series of impulses transmitted from the calling subscriber's dial. In response to each of these impulses, the impulse relay 17 retracts its armature as in the case of the previous series of impulses, but the units impulses are now effective to control the secondary motor magnet 27 over a circuit extending from ground, armature and back contact of relay 17, right hand armature and front contact of relay 12, change-over relay 19, secondary motor magnet 27, back contact and armature of relay 28, side switch wiper 21, in its second position, to grounded battery. On the first completion of this circuit, the change-over relay 19 is energized as it was during the tens series of impulses and likewise holds the escape magnet 22 energized. In response to each of the units impulses, the secondary motor magnet has its operating circuit closed, so that it operates the brushes 23 to 26 of the connector in a step-by-step movement in a secondary direction.

At the close of the units series of impulses, if the called subscriber's line is idle, the escape magnet 22 deenergizes and moves the side switch wipers into their third position. This results in the closure of an operating circuit for the relay 30, from ground, winding of this relay, conductor 31, side switch wiper 21 in its third position, to grounded battery.

When the relay 30 is operated, ringing current is applied from the ringing generator GEN, back contact and upper armature of the trip relay 32, upper armature and front contact of relay 30, connector brush 23, over the upper side of the called subscriber's line and through the substation circuit and ringer at substation "B," over the lower side of the called line, connector brush 24, front contact and armature of relay 30, inner armature and back contact of the trip relay 32, upper winding of this relay, to grounded battery. During the time that ringing current is being applied over this circuit, the slow releasing relay 18 is energized from grounded battery, its winding, inner back contact and armature of relay 32, off-normal contacts 33 to ground.

When the called subscriber answers, the trip relay 32 is energized in the well known manner and locks itself operated from grounded battery, through its lower winding, front contact and armature, to ground through the off-normal contacts 33. This opens the operating circuit of relay 18, but since it is slow releasing it temporarily closes the circuit from the booster battery 34, armature and continuity spring of relay

32, armature and continuity spring of the relay 18, conductor 35, back contact and continuity spring of relay 14, conductor 13, armature and front contact of relay 12, conductor 11, test brush 10 of the line switch, lower armature and front contact of the cut-off relay, winding of the meter magnet 37, to grounded battery, for operating this meter. This last described circuit is closed only momentarily, since the slow releasing relay 18 deenergizes shortly after the opening of its circuit, and thereby insures that the calling subscriber will only be charged once for each call.

Let it now be assumed that the called subscriber's line is busy at the time when it is tested by the connector test brush 25, at the close of the units series of impulses, at which time the escape magnet normally deenergizes. When, however, the called line is busy, the escape magnet is held operated from grounded battery, its winding, continuity spring and back contact of relay 19, winding of the test relay 28, its continuity spring and back contact, side switch wiper 36 in its second position, test brush 25 and through a multiple test terminal of the called line and a test brush similar to 25 at the connector, which has previously seized the called line, and thence by a side switch wiper similar to 36 in its third position to ground through the continuity spring and back contact similar to relay 14. On the operation of test relay 28, this relay closes a locking circuit for itself from ground at the off-normal contacts 33, through its inner armature and continuity spring and its winding, back contact and continuity spring of the change-over relay 19, winding of the escape magnet 22, to battery. The escape magnet thus holds the side switch wipers in their second position and the busy test relay 28 through its outer armature and front contact connects a source of busy tone current from BZ over conductor 38, to the calling substation.

When the calling subscriber terminates the call, either because he has finished his conversation or because the called line is busy, he replaces his receiver on its switchhook and thereby causes the impulse relay 17 to deenergize. This opens the operating circuit of the slow releasing relay 12, which shortly afterwards deenergizes and completes a circuit for the release magnet 39 through, off-normal contacts 40, back contact and armature of relay 12, back contact and armature of relay 17, to ground. The release magnet 39 is thus energized and in the well known manner restores the brushes 23 to 26 of the connector and also the side switch wipers to their normal position. Also when relay 12 deenergizes, it opens the holding conductor 11, which has maintained the cut-off relay 6, of the calling line operated. This last named relay deenergizes and disconnects the calling line from brushes 8 and 9, so that the brushes of the line switch may remain in engagement with the terminals of the trunk last used.

Let it be assumed that the called subscriber at "B" has indicated that calls directed to his substation designated by a special number such as #2680, which is different from the normal designation and thereby reaches his substation through a different channel, may be charged on his message register such as 41. Under this condition a calling subscriber, such as "A" establishes his connection in the manner already described, but in this instance, dials such a designation that the brushes 23 to 26 are set on the terminals designated #2680, which also lead to substation "B". It will be noted that in this instance an additional terminal such as 42, associated with this line is connected to ground, so that when connector brush 26 engages this contact 42, a circuit is closed from ground, front contact and armature of relay 30, winding of relay 14, to grounded battery. In this instance relay 18 is operated as soon as the off-normal contacts 33 are closed as in the case of the previous call and when the trip relay 32 is energized, at the time when the called party answers, a circuit from the booster battery 34 is extended through the armature and continuity spring of relay 32, armature and continuity spring of relay 18, inner armature and continuity spring of relay 14, side switch wiper 36 in its third position, test brush 25, winding of the called meter magnet 41, to grounded battery. In this way the called meter magnet 41 operates to charge the call originated by the calling subscriber. The release of the connection is established in the manner already described.

Fig. 2 shows a modified form of the invention applied to a manual telephone system. When a calling subscriber in this system, whose substation is indicated at "D" originates a call, line relay 43 is energized in the well known manner through the armatures and back contacts of the cut-off relay 44 and the two sides of the calling subscriber's line in series. With the line relay operated, the line lamp 45 is lighted in series with the pilot relay 46, which in turn lights the pilot lamp 47. The operator on noting that the line lamp 45 is lighted, inserts the plug P into the jack J of the calling line. This is effective to energize the sleeve relay 48 from grounded battery, its left hand winding, sleeve contacts of the plug P and the jack J, winding of the cut-off relay 44, to ground. Relays 48 and 44 are thus energized. The last named relay on operation disconnects the line relay 43 from its line and thereby extinguishes the lamps 45 and 47. The relay 48 on operation closes a locking circuit for itself from grounded battery through its

low resistance winding, its front contact and armature and thence to ground through the cut-off relay 44. The meter 49 of the calling line does not receive sufficient current to operate at this time. The energization of the relay 48 closes at its inner armature and front contact, a break-point in the circuit of the supervisory lamp 50, but this last named lamp does not operate, due to the fact that the supervisory relay 51 is energized, over the answering end of the cord circuit and the two sides of the calling line in series. The operator's telephone set is now connected to the cord circuit, either automatically or manually. For the purpose of disclosing this invention, the operator's telephone set (not shown) is indicated as being connected to the cord circuit through listening key contacts LK.

When the operator's telephone set is connected to the calling line, the operator inquires the designation of the wanted number. It is assumed that this call is to be charged to the calling subscriber, so that he gives the designation number #2630, to indicate the called line. The operator then tests the called line in the well known manner and since it is assumed that this line is idle, inserts the plug P′ into the jack J′ of this line. The cut-off relay 52 of the called line, then operates from ground through the sleeve contacts of the jack J′ and the plug P′, continuity spring and back contact of the relay 53, right hand winding of the marginal relay 54, winding of the slow releasing relay 55, to grounded battery. Relays 54 and 55 are energized in this circuit. Relay 55 closes a circuit from ground through its inner front contact and armature, left hand winding of relay 53, to grounded battery. This last relay, when operated, closes a locking circuit for itself, its right hand winding, left hand winding of the relay 54, inner armature and continuity spring of this relay, inner armature and continuity spring of relay 53, sleeve contacts of the plug P′ and the jack J′, to ground through the cut-off relay 52. The operation of the relay 53 opens the energizing circuit of the relay 55, but since it is slow releasing, it temporarily holds its armatures attracted. When the called party answers the supervisory relay 56 is energized over the two sides in series of the called end of the cord circuit and the subscriber's line. This effects the energization of the slow releasing relay 57, from grounded battery, winding of this relay, back contact and armature of the relay 58, armature and front contact of the relay 56, front contact and armature of relay 53, to ground. The relay 58 on operation, at its right hand armature opens the holding circuit of the relay 57 and closes a locking circuit for itself through its right hand front contact and armature, to ground at the left hand front contact and armature of the relay 53. Before the relay 57 deenergizes, however, a circuit is closed from the booster battery 59, inner armature and front contact of relay 58, outer armature and front contact of relay 57, back contact and armature of relay 60, outer left hand armature and front contact of relay 54, now energized, conductor 61, through the sleeve contacts of the plug P and the jack J, through the left hand winding of the meter 49, which operates to charge the call. The meter 62 is provided to count the number of calls, which the operator handles.

At the close of the conversation, when the calling subscriber replaces his receiver on its switchhook, the supervisory relay 51 deenergizes and since the relay 48 is operated at this time, the supervisory lamp 50 is lighted as a signal to the operator to disconnect the plugs P and P′ from the jacks with which they have been in engagement.

Let it be assumed that the called subscriber at substation "E" has indicated that the charge may be reversed on all calls to his substation, by giving as the designation #2680. Let it further be assumed that under such conditions the calling subscriber "D" initiates a call, whereupon the operator, whose cord circuit is shown in Fig. 2, inserts the plug P into the jack J, so that the call proceeds in the manner already outlined, except that in this instance the operator inserts the plug P′ into the jack J^2. Under these conditions the marginal relay 54, does not operate, since the resistance 63 is now included in its operating circuit. Otherwise the operation is similar to that previously described, so that in this instance the booster battery 59 is applied through the inner armature and front contact of relay 58, outer armature and front contact of relay 57, back contact and armature of relay 60, outer armature and back contact of relay 54, through the sleeve contacts of the plug P′ and the jack J^2, resistance 63 to ground through the cut-off relay 52 and the meter magnet 65 in multiple. The meter magnet 65 on operation locks itself operated until the plug P′ is removed from the jack J^2.

At the close of the conversation when the calling subscriber replaces his receiver on its switchhook, the supervisory relay 51, deenergizes to light the supervisory lamp, as previously indicated. This is a signal to the operator to remove the plugs P and P′ from the jacks with which they have been in engagement.

It will be understood that during such pe-

riods as the called party, does not wish to have calls charged to him which were not originated on his line, ground may be disconnected from terminal 42, in the disclosure of Fig. 1, and in the case of the manual system disclosed in Fig. 2, the resistance 63 is either removed or short circuited, so that it is no longer effective.

What I claim is:

1. In a telephone system, a calling telephone line, a called telephone line, a message charging device associated with each of said telephone lines, two channels through which said called line may be reached, means for interconnecting said telephone lines through said channels, and means responsive to the completion of said interconnection through one channel functioning to actuate the message charging device of the calling telephone line and functioning to actuate the charging device of the called telephone line when said telephone lines are interconnected through a second channel.

2. In a telephone system, a calling telephone line, a called telephone line, a message charging device associated with each of said telephone lines, two channels of different character through which said called line may be called, means for interconnecting said telephone lines through one of said channels, and means responsive to the completion of said interconnection through one channel functioning to actuate the message charging device of the calling telephone line, and functioning to actuate the message charging device of the called telephone line when said telephone lines are interconnected through a second channel.

3. In a telephone system, a calling telephone line, a called telephone line, a message charging device associated with each of said telephone lines, means for interconnecting said lines, means including said interconnecting means for establishing at will two different conditions at the called telephone line, and discriminating means associated with said interconnecting means for operating the message charging device of the calling telephone line upon response of the called party if one condition exists at the called telephone line and for operating the message charging device of the called telephone line upon response of the called party if another condition exists at said last mentioned line.

4. In a telephone system, a calling telephone line, a called telephone line, a message charging device associated with each of said telephone lines, two different channels connected to said called telephone line, a different condition present at each of the channels of said called telephone line, means for interconnecting said lines through either of the channels of said called telephone line, and discriminating means associated with said interconnecting means for operating the message charging device of the calling telephone line or the message charging device of the called telephone line depending on the condition present at the channel used in interconnecting said telephone lines.

5. The method of charging for telephone calls which consists normally in charging a call to the calling telephone line when two telephone lines are interconnected by way of one of a plurality of multiple terminals associated with the called line and in charging the call to the called telephone line when these two telephone lines are interconnected by way of another of said plurality of terminals.

6. The method of charging for telephone calls which consists in assigning two designations to a telephone line, charging a call to said first telephone when one designation is employed by a second telephone line in extending a connection between said telephone lines, and charging said call to said second telephone line when a second designation is employed by said second telephone line in extending a connection between said telephone lines.

7. In a telephone system, a calling telephone line, a called telephone line, a charging device individual to each of said telephone lines, sets of multiple conductors connected to conductors of said called telephone line, one of said sets of conductors being characterized by one condition and the other set of conductors being characterized by a different condition, means including a link circuit for interconnecting said telephone lines through either of said sets of multiple conductors, and means controlled by the condition at the set of conductors to which said link circuit is connected in interconnecting said telephone lines for determining on which of said charging devices said interconnection is charged.

8. In a telephone system, a plurality of telephone lines, multiple sets of terminals for each telephone line, a message charging device for each telephone line, a link circuit used in interconnecting said telephone lines through one of said sets of multiple terminals of one of said telephone lines, a first circuit associated with said link circuit for operating the charging device of one of two telephone lines when they are interconnected through one set of multiple terminals, and a second circuit including a portion of said first circuit for operating the charging device of the other of said two telephone lines when they are interconnected through another set of multiple terminals.

9. In a telephone system, a plurality of telephone lines, multiple sets of terminals for each telephone line, a message charging device for each telephone line, a link circuit used in interconnecting said telephone lines

through either of said sets of multiple terminals of one of said telephone lines, at least one of said sets of terminals being characterized by the presence of a charging condition, at least another of said sets of terminals being characterized by the absence of a charging condition, an operating battery connected to the message charging device of an originating telephone line when said telephone line is connected through said link circuit to a set of terminals of a terminating telephone line characterized by the absence of a noncharging condition, and a relay responsive to a charging condition at the terminals of a terminating telephone line when a telephone line is connected to said terminating telephone through a set of terminals characterized by a charging condition, said relay operating to connect said operating battery to the message charging device of said terminating telephone line.

10. The method of charging for telephone calls which consists normally in charging a call to the calling telephone line upon response of the called party when two telephone lines are interconnected in one manner and in charging the call to the called telephone line upon response of the called party when these two telephone lines are interconnected in another manner.

In witness whereof, I hereunto subscribe my name this 18th day of February A. D. 1925.

WINFRED T. POWELL.