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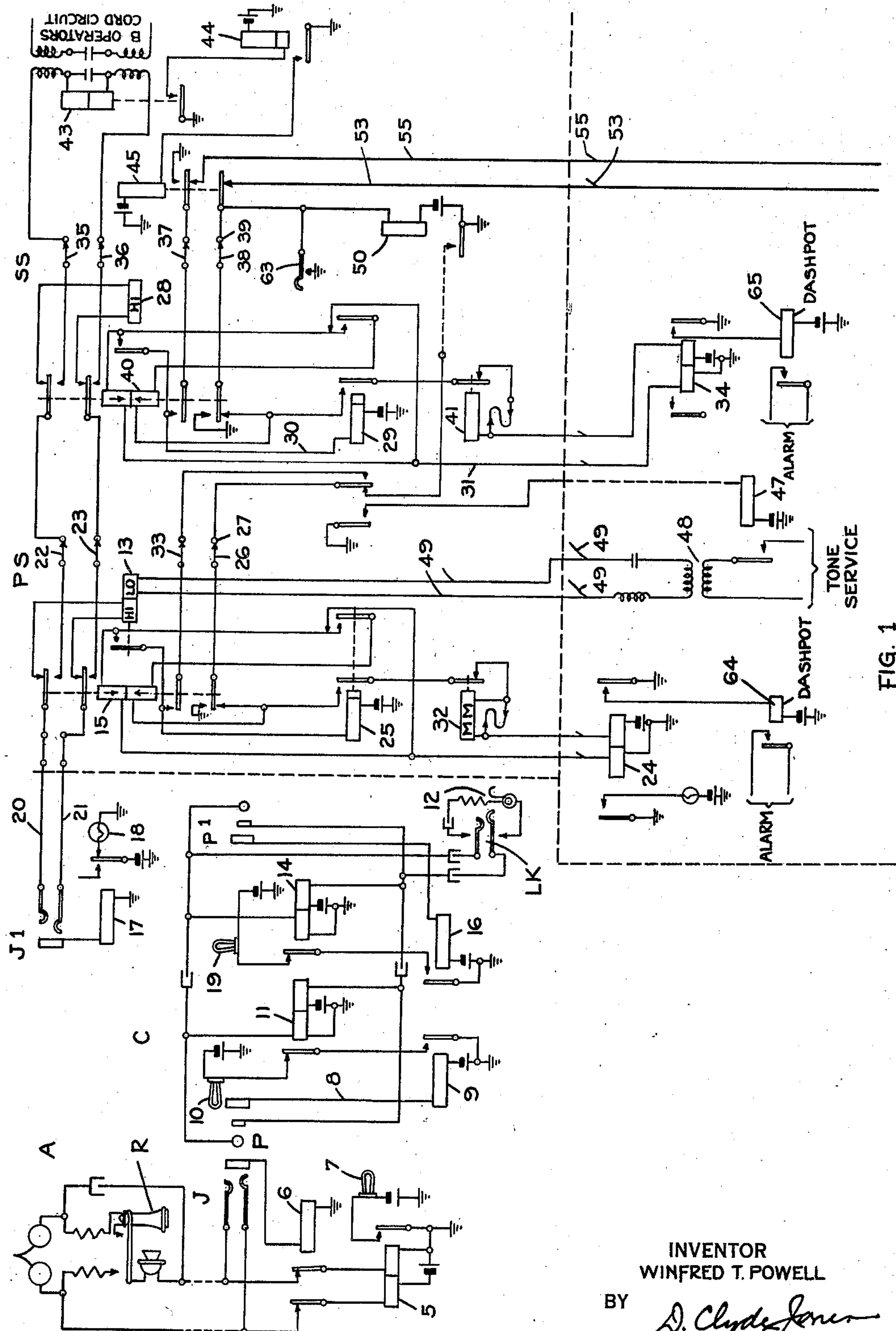
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2,172,805

CALL DISTRIBUTING SYSTEM

Filed Nov. 10, 1937

2 Sheets-Sheet 1



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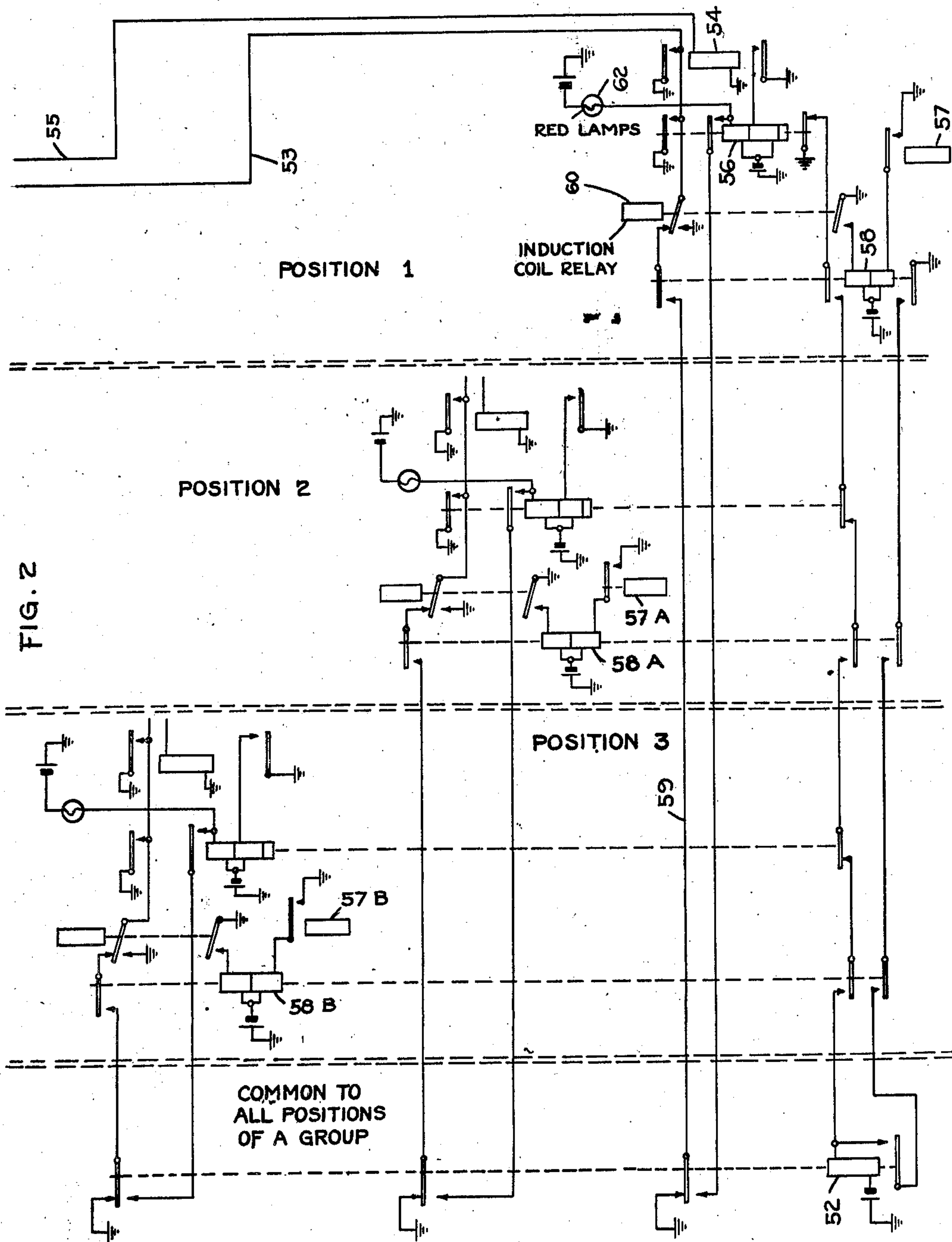
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2,172,805

CALL DISTRIBUTING SYSTEM

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6 Claims. (Cl. 179—27)

This invention relates to a telephone system and more particularly to a call distributing system.

In accordance with the present invention it is proposed to distribute calls from a plurality of exchanges to the B operators in succession at a given exchange and means are provided for assigning one call in addition to the call being answered at a position when all the positions of a group at said exchange are engaged in handling a call. By this arrangement one call and one call only is awaiting attention while a given B operator is engaged in completing a previous call even during busy periods.

The drawings with Fig. 1 placed above Fig. 2 diagrammatically represent a portion of a telephone system wherein a calling telephone line and an A operator's cord circuit at a distant exchange are shown at the left of the vertical dotted line in Fig. 1; the portion of this figure at the right of this dotted line as well as all of the equipment shown in Fig. 2 are located at a distant office having B operators' positions for completing calls; the portion of the circuit arrangement illustrated in the upper righthand corner of Fig. 1 illustrates a primary selector and a secondary selector for selecting a B operator's position equipped with a cord circuit, this circuit has not been completely shown nor has the called telephone line been illustrated; the portion of Fig. 1 below the horizontal broken line illustrates the equipment common to a group of primary and secondary selectors.

It will be understood that the A operators at several distant exchanges are provided with jacks, which jacks may be arranged in groups and connected by incoming trunks to a group of primary selector switches having access to secondary switches, which select B operators' positions. By way of example, it is assumed, that there are 400 incoming trunks from the various distant exchanges and since each trunk terminates in a primary selector there will be 400 of these primary selectors. It is preferred to arrange these primary selectors into ten groups so that there will be 40 primary selectors in each group. The secondary selector switches are likewise divided into ten groups, but since there are only 240 outlets leading to the 240 B trunks from the secondary selectors, there are only 24 secondary selectors in each group or a total of 240 secondary selector switches. The primary and secondary selectors herein disclosed are preferably of the twenty five point rotary type which remain in the position last used.

It is believed that the invention will best be understood by describing the operations involved in establishing a telephone call from a subscriber's substation telephone as A terminating at one office, to a B operator's position located at a distant office. When the subscriber at substation A originates a call by removing his receiver from its switch hook, the line relay 5 is energized over the two sides of the calling subscriber's line in series, back contacts and armatures of cut off relay 6, the windings of the line relay 5, to grounded battery and to ground respectively. This energizes the line relay which attracts its armature to light the line lamp 7 associated with the jack J of the calling subscriber's line. The operator at the position where the jack J is located, selects a cord circuit C and inserts the answering plug P thereof into the jack J. The insertion of the plug P into the jack J completes a circuit for energizing cut off relay 6 from ground, winding of this relay, sleeve contacts of the jack and plug, conductor 8, winding of the relay 9 to grounded battery. Cut off relay 6 when energized, opens the previously described circuit for line relay 5 which deenergizes to extinguish the line lamp 7. The relay 9 on energization, closes a break point in the circuit for lighting the supervisory lamp 10. This lamp is not lighted at this time, since the supervisory circuit is not open at the armature and back contact of the supervisory relay 11, which is energized over the answering end of the cord circuit C and the two sides of the calling line in series. Immediately after the operator inserts the plug P into the jack J, she operates the listening key LK of the cord circuit in use to connect her head set 12 to this circuit and requests the number of the wanted line.

On receiving this information, the operator inserts the plug P' at the calling end of the cord circuit C into the jack J' of a trunk connected to the wanted office. As soon as this operation is completed, the relay 13 associated with the primary selector switch PS of the selected trunk is operated in a circuit traceable from ground battery, righthand winding of the supervisory relay 14, the lower side of the calling end of the cord circuit C, ring contacts of the plug P', jack J', inner, upper, back contact of relay 15, through the lefthand, high resistance winding of the relay 13, upper back contact and armature of relay 15, tip contacts of the jack J' and the plug P', upper side of the cord circuit C, lefthand winding of relay 14 to ground. Relay 14 does not energize in series with relay 13 to permit

the lighting of the calling supervisory relay at this time. Relay 13 is energized, completing an energizing circuit for the slow releasing relay 25 from grounded battery, winding of this relay, armature and front contact of relay 13, outer right hand back contact of relay 25, lefthand winding of common relay 24 to ground. The relay 25 is thus energized to attract its armatures but the relay 15 will not be energized as will be pointed out until an idle trunk is located. If the trunk being tested is busy, the slow releasing relay 25 will now have a locking circuit completed for itself from grounded battery, its winding, armature and front contact of relay 13, front contact and armature of relay 25, thence through the lower winding of relay 15, back contact and lower armature of relay 15, primary selector test brush 26, test terminal 27, which terminal has ground potential thereon, this ground potential being applied through a test brush such as 26, lower armature and front contact to ground at a switching relay such as 15 associated with a primary selector that has previously seized this trunk. Relay 15 will not be operated in this last described circuit since its upper and lower windings are energized in opposition. If the brushes of the primary selector switch PS are resting on the terminals of an idle trunk, the switching relay 15 will be immediately energized and at its upper front contacts and armatures, extends the tip and ring trunk conductors 20 and 21 through the brushes 22 and 23 to an idle secondary selector SS. The circuit for operating the switching relay 15 extends from ground, lefthand winding of the relay 24, upper winding of the relay 15, outer front contact and armature of the relay 25, lower winding of relay 15, inner front contact and armature of relay 25, armature, back contact and winding of the motor magnet 32, righthand winding of relay 24 to grounded battery. It should be noted that the windings of relay 15 are energized at this time in a direction to aid each other. When the switching relay is energized, it closes its lower front contacts and armature and at its lowermost armature and front contact, applies ground potential through the test brush 26 of the primary selector to the terminal 27 of the selected secondary trunk on which the primary switch brushes are resting. It will be understood that the presence of ground potential on the multiple terminals 27, makes this trunk test "busy" to other primary selectors.

When the primary trunk has thus been selected and the switching relay 15 has been operated, the relay 28 associated with the primary trunk is energized over the two sides of this trunk, the brushes 22 and 23 of the primary selector and over the two sides of the incoming trunk through the windings of the supervisory relay 14 in series at the cord circuit C, and thence to ground and grounded battery respectively. As soon as high resistance relay 28 is thus energized, it causes the energization of the slow releasing relay 29 in a circuit extending from grounded battery, winding of relay 29, conductor 30, armature and front contact of relay 28, continuity spring and back contact of relay 29, conductor 31, lefthand winding of the common alarm relay 34 to ground. Relay 29 will be locked operated in a circuit arrangement substantially identical with that of slow releasing relay 25, previously described.

With the switching relay 15 and the slow releasing relay 29 both operated, the slow releasing relay 25 of the primary selector switch is now held operated from grounded battery, winding

of this relay, inner lower front contact and armature of relay 15, holding brush 33 of the primary selector, inner lefthand front contact and armature of relay 29, test terminal 27, test brush 26 of the primary selector, lowermost armature and front contact of relay 15 to ground. The ground at the lowermost front contact and armature of the switching relay 15 is applied through the test brush of the primary selector to the multiple terminals 27 of the primary trunk as long as this trunk is engaged so that it cannot be seized by another primary selector.

If the brushes of the primary selector were in engagement with the terminals of a busy primary trunk when the relays 13 and 25 at the primary selector were energized in response to the insertion of the plug P' into the jack J', the primary selector would immediately start to hunt for an idle primary trunk, since, as described above, switching relay 15 does not operate at this time but the slow releasing relay 25 is held operated. The stepping circuit of the primary selector extends from grounded battery, righthand winding of the relay 24, winding, back contact and armature of the motor magnet 32 of the switch, inner armature and front contact of relay 25, lowermost back contact and armature of the switching relay 15, primary selector test brush 26 and grounded multiple terminals such as 27 of busy primary trunks. It will be recalled that ground on the test terminal such as 27 of busy primary trunks is applied thereto through a test brush such as 26 of a primary selector that has previously seized this trunk, and through the lowermost armature and front contact to ground at the switching relay such as 15 of that switch. As long as the test brush 26 of the primary selector of the present connection encounters busy terminals 27, the circuit for the motor magnet 32 will be completed in the manner described and this motor magnet will interrupt its own circuit to advance the primary switch brushes until an idle trunk is reached. At this time the switching relay 15 will be energized in the manner already described and will be maintained energized as long as the connection is established.

When the idle trunk has been seized, e. g. that shown in the upper portion of Fig. 1, the relay 28 and the slow releasing relay 29 will be energized as previously described. If the brushes 35 and 38 inclusive are resting on the terminals of an idle B cord circuit, the switching relay 40 will be energized in a circuit identical with that described for the switching relay 15 of the primary selector. However, if the secondary selector brushes are resting on the terminals of a busy secondary trunk when this switch is seized, an operating circuit for the motor magnet 41 of this switch is closed to grounded battery, righthand winding of the alarm relay 34, winding of the motor magnet 41, its back contact and armature, inner armature and front contact of relay 29, lowermost back contact and armature of relay 40, test brush 38 and the grounded terminal 39 of busy cord circuits. As long as the test brush 38 encounters busy test terminals 39, this circuit for the motor magnet is completed and the motor magnet interrupts its own circuit to step the brushes of the secondary selector until an idle B cord circuit is located, the test terminal of which will be characterized by the absence of ground potential thereon. As soon as this idle B cord circuit is located, the switching relay 40 will be operated in the same manner as switching relay 15 previously described, and will extend the con-

nection from the supervisory relay 14 in the originating cord circuit over the two sides of the connection thus far established, through both windings in series of the relay 43, individual to the selected cord circuit. The energization of the relay 43, energizes the relay 44 which in turn energizes the relay 45. The relay 45, at its front contact and armature, extends ground through the holding brush 37 of the secondary selector, inner front contact and armature of the switching relay 40, conductor 30, winding of the relay 29, to grounded battery. This ground holds relay 29 after relay 28 is released by the opening of the upper back contacts of relay 40.

The B cord circuit may be substantially the same as that disclosed in Figs. 6 and 7 of applicant's Patent #1,861,754, granted June 7, 1932, from which patent, it will be understood that as soon as the B cord circuit is selected, the B operator will receive the wanted station designation from the A operator and will complete the connection to the wanted subscriber in the manner therein set forth.

Since the number of primary trunks or outlets is greater than the number of secondary trunks or outlets into which calls are distributed, it is possible for all of the secondary trunks of a group of secondary switches to be in use while there still remain a number of primary selectors in this group which are not being used. In other words, when the twenty four primary selectors of any group are in use, all of the available outlets or trunks of this group are engaged but there are still 16 additional outlets from A operator's position associated with this group which are not in use. Because of this condition, it becomes necessary to indicate to an A operator, that all of the outlets of a given group of primary selectors are busy. In order to effect this result, there is provided, a tone relay 47 at the lower part of Fig. 1, which relay is energized when all of the secondary selectors associated with a particular group of primary outlets are busy. This relay is energized by a circuit extending from grounded battery, winding of this relay and through the outer lefthand contacts and armatures in series of the relays similar to 29 to ground at the last of such relays in the series. When all of these relays of the group are actuated so that the tone relay 47 is thus energized, it completes at its front contact and armature a connection to a tone source. This tone is induced through the transformer 48 into the circuit including the multiple conductors 49 connected in series with the right-hand windings of the relays 13. At these windings, the tone is induced into the lefthand winding of relays 13 of the group and is communicated through the upper back contacts and armatures of relays 15 to the jacks such as J'. Thus if the operator plugs into a jack connected to a primary selector which cannot find an idle secondary trunk in this group she will immediately hear the group busy tone in her headset which will be a signal to her to plug the cord circuit in use into an outlet leading into another group.

Since all trunks leading to each B operator's position are made busy during the time that the B operator thereat is engaged in handling a call, it also becomes necessary to prevent the selection of this B position by any secondary selector while this busy condition exists. Furthermore, it may happen that all the outlets from a secondary selector group are made busy due to the above condition so that the secondary switches associated with such a group must be made to test

busy. This is accomplished by the common connection to the inner lefthand back contact and armature of relays such as 29. When all outlets of a particular secondary group are busy, all of the associated make busy relays 50 of this group will be energized for completing a series circuit to the common conductor which leads thru the back contacts of all of the relays such as 29 of all secondary switches having access to the last make busy relay 50 of the series. This series circuit is extended through the mentioned back contacts of relays such as 29 to the test terminals such as 27 of these secondary switches, so that they cannot be selected by a primary selector switch.

Thus a system is provided whereby calls are normally distributed one at a time to idle B operator positions as long as there is at least one B position idle. However in accordance with the present invention, when all B positions are busy, one additional call only is permitted to be assigned to each position, and there await its turn so that during periods of heavy traffic, one waiting call is distributed to each of the various B positions of the group. It will be understood that such waiting calls will immediately take their turn in the sequence cut-in circuit and will be automatically connected to a B operator's circuit just as soon as the previous call is disposed of. The arrangement for accomplishing this result is shown mainly in Fig. 2 which indicates the relays common to each position together with a relay 52 which is common to all positions.

It will be recalled that the switching relay 40 is energized for extending an incoming trunk circuit through primary and secondary trunks to the selected B cord circuit and that relays 43, 44 and 45 operate in sequence after the B trunk is selected. The application of ground potential to the terminal such as 39, as a result of the operation of the relay 40, immediately makes all of the idle trunks leading to this particular B operator's position busy. This takes place since the ground potential on the test terminal 39 applied by the switching relay 40, is extended through the lower armature and back contact of relay 45 to the common conductor 53 and thence through similar back contacts and armatures of relays such as 45 at this B operator's position to the corresponding terminals tested by any secondary selector test brush such as 38 so that all of these trunks will test busy. Before the relay 45 operates to open this common circuit including conductor 53, the relay 54 (lower right corner of Fig. 2) is energized in a circuit traceable from a ground, winding of this relay, conductor 55, inner back contact and armature of relay 45, holding brush 37, inner armature and front contact of switching relay 40, conductor 30, winding of relay 29 to grounded battery. Relay 54 is thus energized and at its upper armature and front contact also applies ground potential to the common conductor 53. As soon as relay 54 energizes, it effects the operation of slow releasing relay 56 in a circuit extending from grounded battery, lower winding of this relay, lower front contact and armature of relay 54 to ground. Relay 56, at its uppermost armature and front contact, also applies ground potential to the mentioned common conductor 53. As soon as relay 45 operates, it interrupts the energizing circuit of relay 54 causing it to release. But since the relay 56 is slow releasing, it holds ground potential on the common conductor 53 until the operator's cut-in circuit in the B cord circuit (not shown) functions and operates relay 57 as shown

in the mentioned patent. Relay 57 may operate in the same manner as relay 71 of the mentioned patent. As soon as the relay 57 is operated, it effects the energization of the make busy relay 58 in a circuit traceable from grounded battery, lower winding of this relay, armature and front contact of relay 57 to ground. Relay 58 also extends ground potential from the back contact and armature of the common relay 52, conductor 59, upper front contact and armature of relay 56, front contact and armature of relay 60, which is energized as long as the B operator is at her position, thence to the common conductor 53. Relay 57 maintains the position make busy relay 58 energized until the operator becomes idle, at which time the release of the relay 57 and in turn the release of the relay 58 removes the ground potential from the common conductor 53, which removes the busy condition from the B trunks associated therewith. This same operation is likewise effected for other circuits at other positions.

It will now be explained how this position busy circuit is operated and released when all positions are busy handling calls. With all positions busy, make busy relays such as 58, 58a, 58b, etc. are energized which indicates that a call is being handled at each position, a chain circuit is completed for energizing the common relay 52. This chain circuit, which is not effective until the relay such as 56 at each position is released, is traceable from grounded battery, winding of the common relay 52 and through the front contacts and armatures of the position make busy relays 58 of the group and through the back contacts and armatures of the relays 56 of the group to the ground at the last relay 56 of the series. When the common relay 52 is energized, it is locked in this condition from grounded battery, its winding, front contact and armature and thence through the front contacts and armatures of all relays such as 58 of the series to ground at the last relay 58 of the series. With the common relay 52 energized, a relay such as 56, which operated and then released to establish the all position busy condition, is energized again on the receipt of the next incoming call at the associated position in the same manner as previously described. The reason that the B positions are not made busy under the conditions just described, is that the ground potential connections for busying all trunks at each B operator's position are opened at the back contacts of the common relay 52, however, when the next call comes into a busy position and its relays such as 54 and 55 are operated as before, the relay 56 is locked operated over a circuit completed from ground at its uppermost armature and front contact, front contact and armature of the induction coil relay 60, front contact and armature of relay 58, conductor 59, armature and front contact of armature of common 52, inner upper armature and front contact and winding of relay 56 to grounded battery. It will thus be seen that a second call is permitted to be in waiting at each position when all positions are busy handling a call. A red lamp 62 is connected in multiple with the locking winding of each relay 56, which lamp when lighted serves as an indication to the B operator that a call is waiting at her position for the completion of the preceding call which she is handling. This red lamp indication then serves to speed up the operation during busy periods.

It will be understood that the ground potential

applied through the uppermost armature and front contact of relay 56 extends over the common wire 53 for making all trunks at the associated position busy when a call is awaiting attention at this position. Since this ground is not removed until the first call in the process of completion is disposed of, the associated B position is held busy as long as a second call is awaiting attention thereat. When the relay 57 of the B cord circuit in use in completing the first call, releases, it effects the deenergization of the relay 58. When this last relay releases, the chain circuit is opened to effect the release of the common relay 52. As a result of this, the waiting call is immediately permitted to cut into the sequence circuit for operating the operator's cut in circuit (not shown) at the B operator's circuit now in use. If at this time, all other positions are busy, then the chain circuit is again effective to operate the common relay 52 and another call can be received and await attention at this same position. It will thus be seen that it requires the release of the relay 57, which is energized during the completion of the call at its B trunk circuit and a consequent release of its associated relay 58 in order to place the call awaiting feature in its normal condition.

It will be noted that a barring key 63 is illustrated at the righthand side of Fig. 1, which key is associated with each B trunk circuit so that individual trunk circuits at the B position can be made busy as desired. In addition, there is illustrated in the upper righthand corner of Fig. 2, an induction coil relay 60. This relay is energized as long as the operator's head set is plugged in, and is for the purpose of automatically rendering a B operator's position busy when her telephone set is disconnected.

In the lower portion of Fig. 1, there are illustrated alarm relays 24 and 34 which are effective to give an alarm when the primary or secondary selector switch magnets, such as 32 or 41, fail to operate properly. The dash pot relays 64 and 65 respectively associated with the alarm relays 24 and 34 are slow to energize so that in the normal operation of these magnets, these dash pot relays fail to operate. If, however, there is a failure on the part of the magnets 32 or 41, its related dash pot relay will operate to give an alarm so that an attendant can correct the difficulty.

I claim:

1. In a call distributing system, a group of operator's positions, means including primary and secondary switches for distributing calls one at a time to said positions, said primary switches being greater in number than said secondary switches, a trunk leading to each primary switch, means for applying a busy indication to trunks not in use, when all of said secondary switches are taken for use, and means including said switching means for assigning a second call only to each of said positions when said group of positions are each engaged in extending a first call.
2. In a call-distributing system a group of operator's positions, each position having means to extend calls therefrom, means including primary and secondary switches for distributing calls to said positions, said primary switches being greater in number than said secondary switches, a trunk leading to each primary switch, means for normally rendering each position unselectable until a call distributed thereto has been extended, means for applying a busy indication to trunks not in use when all of said secondary

switches are taken for use, means for directing a second call to each of several of said positions while all of said positions are each engaged in extending a first call, and means for cutting-in the directed call at a given position when the first call thereat has been extended.

3. In a call-distributing system, a group of operator's positions, each position having means to extend calls therefrom, means including primary and secondary automatic switches for distributing calls to said positions, said primary switches being greater in number than said secondary switches, a trunk leading to each primary switch, means for normally rendering each position unselectable until a call distributed thereto has been extended, means for applying a busy indication to trunks not in use when all of said secondary switches are taken for use, means including means common to said positions for directing a second call to each of said positions, means at all of said positions operated in response to the operation of extending calls therefrom for jointly rendering said common means effective, and means for cutting-in a given directed call to the given position when the first call thereat has been extended.

4. In a call distributing system, a group of trunks terminating at each position, means including automatic switches for distributing calls to said trunks, test terminals in said switches for each of said trunks, a multi-branch circuit for temporarily applying a busy condition to all of said terminals of a group of trunks responsive to the selection of one of the trunks in said groups, a second multi-branch circuit including at least a position of said first circuit for maintaining the busy condition on said test terminals until said selected trunk is extended, a relay common to said groups of trunks for completing said second circuit, means including a chain circuit for controlling said common relay to open the second circuit whereby a second trunk in each group can be selected before a first selected trunk is extended, said chain circuit being completed responsive to the use of a trunk in each group in extending a

call, and means for cutting in a second selected trunk in a group when said first trunk in said last-mentioned group has been extended.

5. In a call distributing system, a group of operators' positions, each position having means to extend calls therefrom, means including automatic switches for distributing calls to said positions, means for normally rendering each position unselectable until a call distributed thereto has been extended, means including a relay common to all of said positions for directing a second call to each of said positions, a chain circuit for operating said relay, said chain circuit having a break point therein at each position, means responsive to the use of a given position in extending a call for closing the break point thereat, and means for cutting in a given directed call to the position to which it has been directed when the first call thereat has been extended.

6. In a call distributing system a group of operators' positions, a group of trunks terminating at each position, means for extending calls from said positions, means including automatic switches for distributing calls to said positions, test terminals in said switches for each of said trunks, a multi-branch circuit for temporarily applying a busy condition to all of said terminals of a group of trunks responsive to the selection of one of the trunks in said groups, a second multi-branch circuit including at least a position of said first circuit for maintaining the busy condition on said test terminals until said selected trunk is extended, a relay common to said positions for completing said second circuit, means including a chain circuit for controlling said common relay to open said second circuit whereby a second trunk at each position can be selected before a first selected trunk thereat is extended, said chain circuit being completed responsive to the use of a trunk at each position in extending a call, and means for cutting in a second selected trunk to the position at which it terminates when said first trunk thereat has been extended.

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