

June 2, 1925.

1,539,920

D. M. TAGGART

SIGNALING SYSTEM

Filed Dec. 12, 1922

2 Sheets-Sheet 1

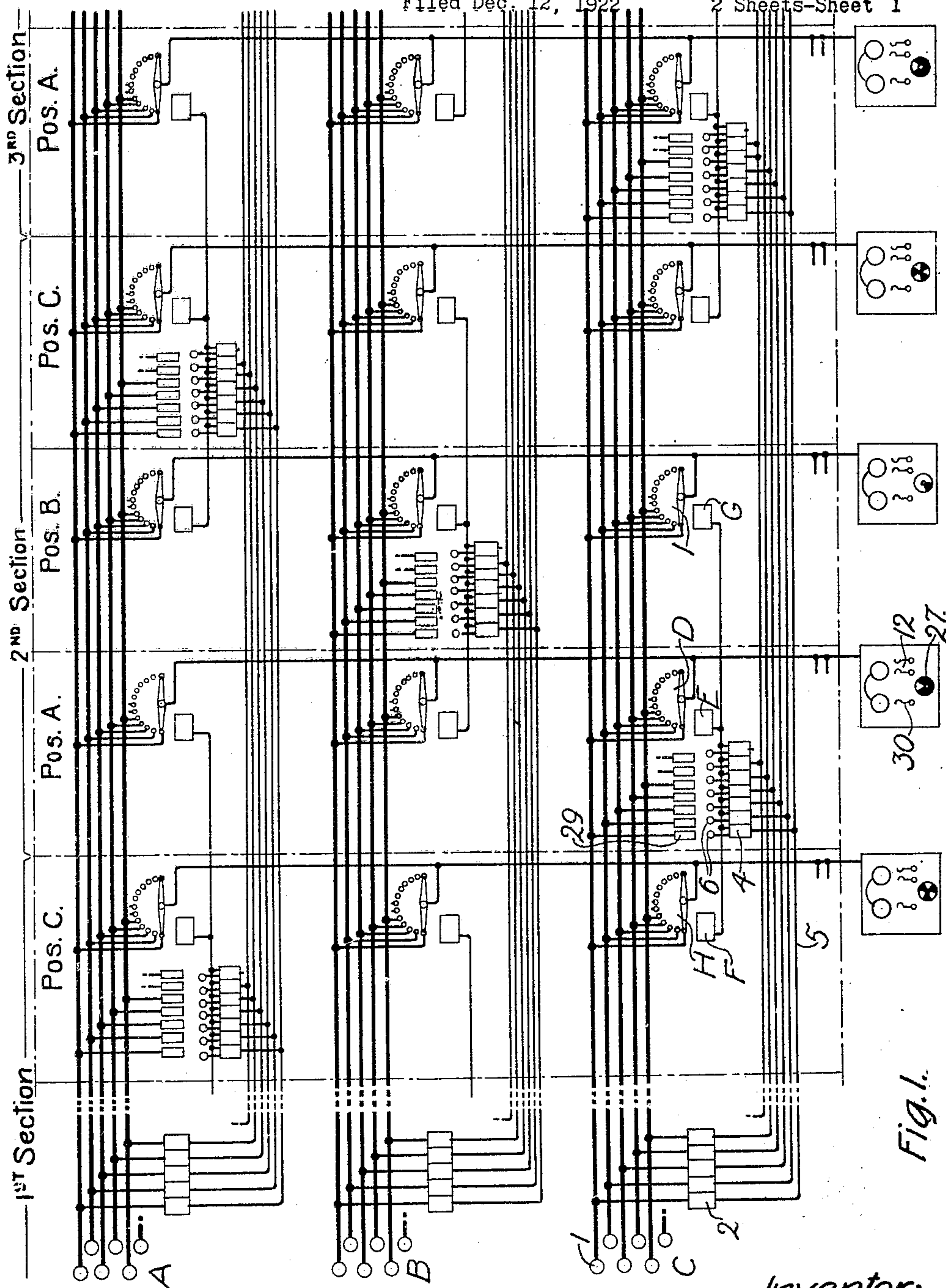


Fig. 1.

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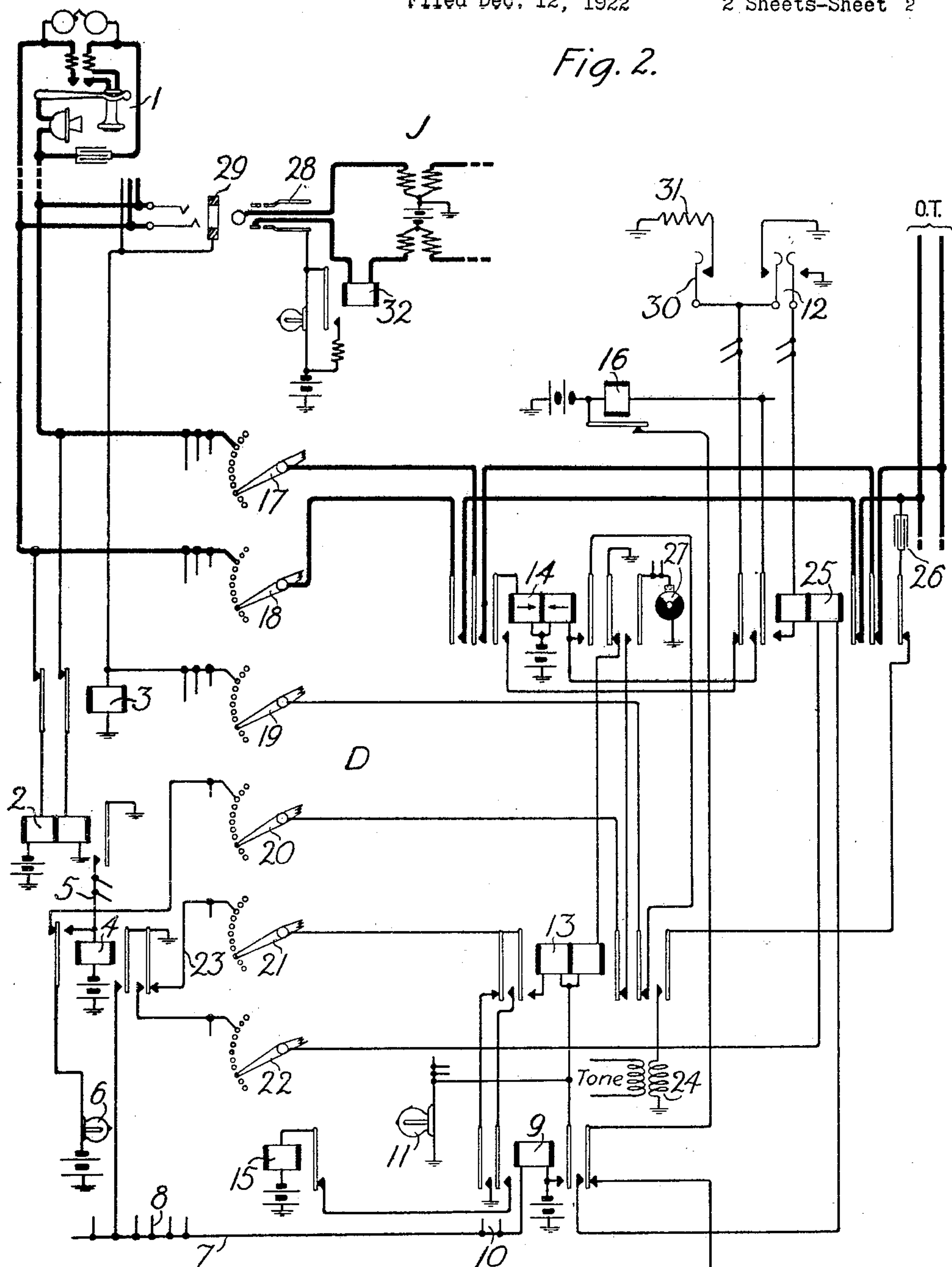
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2 Sheets-Sheet 2

Fig. 2.



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1,539,920

UNITED STATES PATENT OFFICE.

DAWSON M. TAGGART, OF SEATTLE, WASHINGTON, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SIGNALING SYSTEM.

Application filed December 12, 1922. Serial No. 606,514.

To all whom it may concern:

Be it known that I, DAWSON M. TAGGART, residing at Seattle, in the county of King and State of Washington, have invented certain Improvements in Signaling Systems, of which the following is a specification.

This invention relates to improvements in signaling systems and has particular reference to a telephone exchange system in which a plurality of subscribers' lines terminate before a plurality of operators' positions.

Objects of the invention are to connect any one of a plurality of positions to a calling line through automatic switches and to control line signals for said line in such manner as to indicate which one of a plurality of switches has been connected to said line.

Other objects are to operate one of a plurality of line signals located at various operators' positions in a characteristic manner and to render the remaining signals inoperative when one of said operators' positions is connected to a calling line through an automatic switch.

The above and other objects will appear more clearly from the following detailed description when taken in connection with the accompanying drawings which illustrate a preferred embodiment of the inventive idea.

In the drawings, Figure 1 is a diagrammatic illustration of a switchboard showing the arrangement of the subscribers' lines terminating at the various operators' positions thereof, and the apparatus associated with said positions.

Fig. 2 illustrates the circuit arrangement of one of the automatic switches employed in connecting a subscriber's line to an operator's position.

The general arrangement of the switchboard, as illustrated in Fig. 1, contemplates the division of the switchboard into a number of sections, each of which includes three operators' positions. The subscribers' lines terminating at the switchboard are preferably divided into groups A, B, and C and the lines of each group appear in multiple before all of the operators' positions in the various sections of the switchboard. For each group of lines at each position there appears an automatic switch, such as

switches D, H, and I. Each subscriber's line in any particular group has a multiple line lamp appearing at one operator's position in each section. Each operator's position is provided with equipment such as the keys 12 and 30 and the interrupter 27 which are common to the subscribers' lines in the various groups which are multiplied at said position.

Briefly the operation of the system may be described as follows:

When a call is initiated on a line in any group the multiple line lamps for said line are lighted at corresponding positions in the various sections of the switchboard. The operators at the various positions who are not occupied in handling calls depress their listening keys 12 and thereby initiate the operation of switches such as D, H, and I, to hunt for the terminals of the calling line. The first of these switches to engage the terminals of the calling line stops thereon and creates a condition which prevents other switches from coming to rest upon said terminals. Due to the depression of the listening key, the switch which is brought to rest upon the terminals of the calling line then controls the connection of an interrupter device, peculiar to the particular operator's position whose switch has found the calling line, to the line lamp appearing in the section in which said switch is located and flashes said line lamp in a characteristic manner to indicate which one of the operators in said section is to handle the call. Said switch also controls the connection of said operator's headset to the calling subscriber's substation so that the operator may immediately converse with the calling subscriber and while securing the desired number may complete a permanent connection to said calling line through a multiple jack thereof. When the operator has completed the connection she may, by the actuation of her listening key 12, disconnect her equipment from the calling line and initiate the operation of the switch employed in completing said connection to establish another connection to a line upon which an unanswered call is awaiting attention. If the operator desires to vacate her position after attending to a call, she operates the key 30 which has the effect of disconnecting the switch employed in estab-

lishing the connection from the calling line and preventing said switch from seizing the terminals of some other line which is calling.

It is believed that the operation of this system will now be fully understood from the following detailed description.

Assuming that a subscriber whose line is located in group C and whose substation is indicated by numeral 1 should initiate a call, the removal of the receiver from its hook at the substation establishes an operating circuit for line relay 2, through the contacts of the cutoff relay 3, and the substation apparatus. When the line relay 2 operates, a circuit is established for energizing the relay 4 at position A in the second section and other similar relays which appear at the corresponding position in each of the other sections of the switchboard, said other relays being multiplied, as indicated, to the conductor 5 over which the relay 4 is energized. The energization of relay 4 and the other relays similar thereto causes the lighting of line lamps 6 at the various A positions in the different sections, the circuit for the line lamp 6 at position A of the second section extending from ground through the contact of line relay 2, the conductor 5, the left-hand alternate contact of relay 4 and the lamp 6 to grounded battery. The energization of relay 4 at position A in the second section also establishes a circuit extending from ground through the inner right-hand alternate contact of relay 4, the conductor 7 to which other lines of group C are multiplied, as indicated at 8, and the winding of relay 9 of the rotary switch generally indicated by D (Fig. 1) to grounded battery. The mechanism for controlling switch D is indicated in Fig. 1 at E and this mechanism is multiplied as indicated at 10 to mechanisms F and G which are employed for controlling, respectively, switches H and I located at position C in the first section and position B in the second section of the switchboard respectively. The relay 4 is utilized to control the operation of three switches located at operators' positions which may be in different sections of the switchboard as shown in connection with the group of lines C or which may be in the same section as shown in connection with the group of lines B. With other relays similar to relay 4 in other sections operated due to the multiple connections to the conductor 5, it will be obvious that the initiation of a call in group C, or in any of the other groups, will cause all of the switches similar to switch D serving that particular group to operate in a manner which will now be described specifically in connection with switch D.

Assuming that all of the switches are idle when the call is initiated from substation 1 and when relay 9 operates over the circuit

described therefor, a circuit is established from grounded battery through the inner right-hand contact of relay 9 and pilot lamp 11 located before the operator at position A in the second section to ground. The operation of other relays similar to relay 9 at the other switches will also close their circuits to light the pilot lamps before the operators at the other positions in the various sections and the lighting of these pilot lamps indicates to the operators that a call is awaiting attention. The operators then depress their master listening keys 12 and await the proper signal which indicates which of the operators is to get the call. It will be assumed that the operator at position A of the second section was the first to depress her listening key 12 and the arms of the various switches occupy such positions that the call will be routed through this position. When the inner right hand contact of relay 9 is closed a circuit is also established extending from grounded battery through said contact, the right hand winding of test relay 13, and the normal contact of the differentially wound relay 14 to ground. The test relay 13 energizes in this circuit to establish a self interrupting circuit for the stepping magnet 15 of switch D, which circuit will presently be traced in detail. The opening of the normal contact of relay 9 disconnects battery at the relay 16 from the normal contacts of relays, similar to relay 9, located at the switches succeeding switch D at position A in the second section of the switchboard so as to prevent these succeeding switches from responding to calls in other groups of lines as long as relay 9 of switch D remains energized thus giving lines in group C preference over lines in the other groups appearing at the various positions A.

The circuit for the stepping magnet 15 which controls the stepping of the wipers 17 to 22 inclusive of switch D extends from grounded battery through the winding and contact of magnet 15, the inner left hand contact of relay 9, the outer left hand alternate contact of test relay 13, the wiper 21 and contact engaged thereby and from thence through the right hand normal contacts of relays similar to relay 4 which have not been operated by the initiation of the call at substation 1. This circuit for the stepping magnet 15 is thus maintained until the wiper 21 of switch D engages the terminal to which the conductor 23 is connected. Inasmuch as relay 4 is now energized, no ground will be connected to conductor 23, and therefore, when engagement of wiper 21 with the terminal to which conductor 23 is effected, the operating circuit for stepping magnet 15 is permanently opened and the wipers of switch D come to rest upon the terminals individual to the

calling subscriber's line. This action takes place under the assumption that the wipers of switch D are the first to engage terminals of the calling line. During the operation of switch D in hunting for the calling line and while the test relay 13 is operated a tone is connected to the operator's telephone indicated at O. T. from the source 24 through the right hand alternate contact of relay 13, the outer right hand normal contact of relay 25, condenser 26 and from thence to the operator's headset. This tone indicates to the operator who has depressed her listening key that the switch is still operating and has not stopped upon the terminals of the calling line.

When the wipers of the switch D engage the terminals of the calling line, relay 13 does not immediately release, due to its original operating circuit being still closed but a circuit is established for relay 25 extending from grounded battery through the contact of relay 16, the outer right hand alternate contact of relay 9, the right hand winding of relay 25, the wiper 22, and terminal engaged thereby, and the outer right hand alternate contact of relay 4 to ground. Relay 25 energizes and in opening its outer right hand normal contact disconnects the apparatus 24 from the operator's telephone set and thereby indicates to the operator that switch D has been connected to the terminals and the calling line. With the listening key 12 depressed at this time, a holding circuit for relay 25 is established extending from ground through the right hand contact of key 12, the left hand winding and inner left hand alternate contact of relay 25 and the winding of relay 16 to grounded battery. Relay 16 energizes in its circuit and thereby disconnects battery through its normal contact from the right hand winding of relay 25, thus breaking the original energizing circuit for the latter relay. The operation of relay 25 also establishes a circuit for the differential relay 14 which circuit may be traced from grounded battery, through the right hand winding of relay 14, the outer left hand alternate contact of relay 25 and the left hand contact of the listening key 12 to ground. Relay 14 energizes in this circuit and in opening its normal contact disconnects ground from the right hand winding of test relay 13 thereby permitting this relay to release. The closure of the left hand normal contact of relay 13 connects ground at the outer left hand alternate contact of relay 9 to the terminal engaged by the wiper 21 so that when the test wipers of other switches similar to switch D engage the terminal corresponding to that now engaged by the wiper 21 the stepping magnets of said other switches will continue to operate and thus prevent the wipers of these switches from coming to rest

thereupon. The closure of the inner right hand alternate contact of relay 14 establishes an energizing circuit for cutoff relay 3 of the line 1 and a locking circuit for relay 14, said circuit being traceable from grounded battery through the right hand winding and inner right hand alternate contact of relay 14, the outer right hand normal contact of relay 13, the wiper 19 and terminal engaged thereby, and the winding of cut off relay 3 to ground. The energization of relay 3 in this circuit opens the energizing circuit for line relay 2 which thereupon releases and in turn causes the release of relay 4 and other relays similar thereto. When relay 4 releases a circuit is established extending from ground through the conducting segment of the interrupter 27, the outer right hand alternate contact of relay 14, the inner right hand normal contact of relay 13, the wiper 20 and terminal engaged thereby, the left hand normal contact of relay 4 and the lamp 6 to grounded battery. The lamp 6 now starts flashing under control of the interrupter 27. Inasmuch as the conducting segments of the interrupters at the various positions are differently arranged, as indicated in Fig. 1, it will be apparent that each operator's position will receive a characteristic flashing of the line lamp. Since the wipers of switch D are the only ones that are now engaged with the terminals of the calling line, it will be apparent that the release of all the other relays similar to relay 4 will cause the extinguishment of all the line lamps with the exception of the lamp 6 which will now be flashed in its characteristic manner under the control of the interrupter 27 to indicate to the operator at position A in section 2 that her switch is the one engaged with the calling line and that she is to handle the call. She immediately releases the listening key 12 and thereby causes the release of relays 16 and 25, the latter remaining in its released condition due to the fact that the original energizing circuit through its right hand winding is no longer closed since the relay 4 is now released. The closure of the two innermost right hand contacts of relay 25 now connects the operator's telephone set through these contacts, the two outermost left hand contacts of relay 14, which is, at this time, energized, the wipers 17 and 18 and the terminals engaged thereby and from thence over the line conductors to the calling subscriber's substation 1. The operator may now converse with the calling subscriber to ascertain the number desired and at the same time may insert the plug 28 of the cord circuit J into the jack 29 of the calling subscriber preparatory to completing the connection to the called subscriber over said cord circuit, only, a portion of which is shown, it being understood that this cord

circuit may be of any desired type well known in the art.

If at the time that the relay 4 and other similar relays release there are no other calls awaiting attention, the ground is removed from the conductor 7 and relay 9 releases to extinguish pilot lamp 11. When the operator has completed the call and is prepared to take care of another unanswered call, she again depresses the listening key 12 which establishes a circuit extending from ground through the left hand contact of key 12, left hand normal contact of relay 25, the inner left hand contact and left hand differential winding of relay 14 to grounded battery. The closure of this circuit causes the release of relay 14 and consequent disconnection of the interrupter 27 from the lamp 6 thereby permanently extinguishing said lamp. With another call awaiting attention, relays 4 and 9 are operated and upon the release of relay 14, the original energizing circuit for test relay 13 is again established and this relay operates to again close the operating circuit for the stepping magnet 15 of switch D and the wipers of said switch are again stepped as before described until said wipers engage the terminals of the calling line. This is true of other switches similar to switch D and as before explained the first switch which reaches the terminals of the calling line has its wipers stopped thereon and a busy condition is placed upon the test terminal of said line by the switch which stops thereon to cause all other switches to pass over said terminals when the wipers of said switches engage the same.

If the operator after completing the connection for line 1, desires to vacate her position, she depresses the listening-out key 30 instead of the key 12. The operation of the key 30 now connects ground through a high resistance 31 to the contact of key 30 and from thence through the left hand normal contact of relay 25 and the innermost left hand contact and left hand winding of relay 14 to grounded battery. The closure of this circuit causes relay 14 to release with the same results as before described. Now, if there is an unanswered call awaiting attention, the release of relay 14 will cause the switch D to hunt for the terminals of the calling line by reason of the operation of the test relay 13, but when this line is found by the switch D, although relay 25 will operate, the relay 14 will fail to energize through its right hand winding due to the high resistance 31 thus maintaining the original energizing circuit for the test relay 13 and preventing this relay from releasing with the result that although switch D will stop upon terminals of the calling line, no busy condition will be placed upon the test terminal of this line through the left hand normal contact of relay 13 with the result

that some other switch similar to switch D will not be prevented from also engaging and coming to rest upon the terminals of said line. When the operator again assumes her position at the switchboard, the listening-out key 30 is released and upon the lighting of her lamp 11, the operator may again proceed to take care of the calls in a manner now believed to be well understood.

At the time that the operator completed the connection for the call originating at substation 1, it will be recalled that she depressed her listening key and caused the release of the differentially wound relay 14 which, in opening its inner right hand alternate contact, opened the original energizing circuit for the cutoff relay 3, but this relay is now maintained over a different circuit extending through the sleeve contacts of plug 28 and jack 29 and the supervisory lamp and the contact of the supervisory relay 32 of the cord circuit J, in parallel, to grounded battery. The cutoff relay in this manner is prevented from releasing until the termination of the call at which time the operator, upon receiving the proper signal withdraws the plug 28 from jack 29 whereupon the cutoff of relay 3 releases and line 1 is in condition to again initiate a call.

What is claimed is:

1. In a signaling system, a line, operators' positions, a signal for said line at each of said positions, means responsive to a call initiated on said line for connecting said line to one of said positions, and means controlled thereby for flashing one of said signals in a characteristic manner.

2. In a signaling system, a plurality of subscribers' lines, operators' positions, a signal for each of said lines at said positions, automatic switches responsive to calls initiated on said lines for connecting said lines to said positions, and means operable when one of said switches is connected to a calling line for operating one of said signals in a characteristic manner and for rendering the remaining signals inoperative.

3. In a signaling system, a calling subscriber's line, an operator's position, a signal for said line at said position, means operable in response to the initiation of a call on said line to connect to terminals thereof, and means under the control of the operator at said position for causing said signal to flash in a characteristic manner and for connecting said position to said line through the first named means.

4. In a signaling system, a calling subscriber's line, operators' positions, a signal for said line at each position, switches operable to hunt for the terminals of said line when a call is initiated thereon and means under the control of the operator at only one of said positions for operating the signal at said positions in a characteristic man-

ner, connecting said position to said line through one of said switches and rendering inoperative the signals at the other positions.

5. in a signaling system, groups of subscribers' lines, an operator's position at which said groups of lines terminate, a signal at said position for each line of one of said groups, a key at said position common to said groups of lines, an automatic switch at said position for each group of lines operable to connect said position to any calling line in said group under the control of said key, and means operable to actuate the signal for said calling line in a characteristic manner when the switch associated with said one group of lines connects said operator's position to the calling line in said group.

6. In a signaling system, groups of subscriber's lines, a plurality of operators' positions, a switch at each operator's position for each group of lines, means controlled by the initiation of a call in one of said groups for operating the switches associated with said group at the various positions to hunt for the calling line, means for stopping one of said switches on terminals of the calling line, operator controlled means for preventing other switches from stopping upon said terminals of the calling line and for connecting said calling line through said switch to the operator's position at which said switch appears.

7. In a signaling system, groups of subscribers' lines, a plurality of operators' positions, a switch at each operator's position for each group of lines, means controlled by the initiation of a call in one of said groups for operating the switches associated with said group at the various positions to hunt for the calling line, a signal for said calling line, means for stopping one of said switches on terminals of the calling line, and means thereupon operable to actuate said signal in a characteristic manner and to connect said calling line through said switch to the operator's position at which said switch appears.

8. In a signaling system, groups of subscribers' lines, a plurality of operators' po-

sitions, a switch at each operator's position for each group of lines, means controlled by the initiation of a call on a line in one of said groups for operating the switches associated with said group at the various operators' positions, a signal for said calling line, means for stopping one of said switches on terminals of the calling line, means for preventing other switches from stopping upon said terminals, and means for actuating said signal in a characteristic manner when said switch stops upon the terminals of the calling line and for connecting said calling line through said switch to the operator's position at which said switch appears.

9. In a telephone exchange system, a plurality of subscribers' lines, a plurality of operators' positions, a switch at each of said positions, means controlled by the initiation of a call on one of said lines for operating said switches to hunt for the calling line; means for stopping one of said switches on terminals of the calling line, manually controlled means for thereupon connecting said calling line to the operator's position at which said one of the switches appears, and operator controlled means for permitting one other switch to stop on terminals of said calling line.

10. In a telephone exchange system, a plurality of subscribers' lines, a plurality of operators' positions, a switch at each of said positions, means controlled by the initiation of a call on one of said lines for operating said switches to hunt for the calling line, operator controlled means for stopping one of said switches on the terminals of the calling line and for connecting the calling line to the position at which said one switch appears, means controlled thereby for preventing other switches from stopping on terminals of the calling line, and operator controlled means for rendering said preventing means ineffective, whereby a plurality of switches stop on the terminals of the calling line.

In testimony whereof I have signed my name to this specification this 4th day of December, 1922.

DAWSON M. TAGGART.