Sept. 12, 1944. C. E. LOMAX 2,358,017

TELEPHONE SYSTEM

Filed Jan. 8, 1943 5 Sheets-Sheet 1

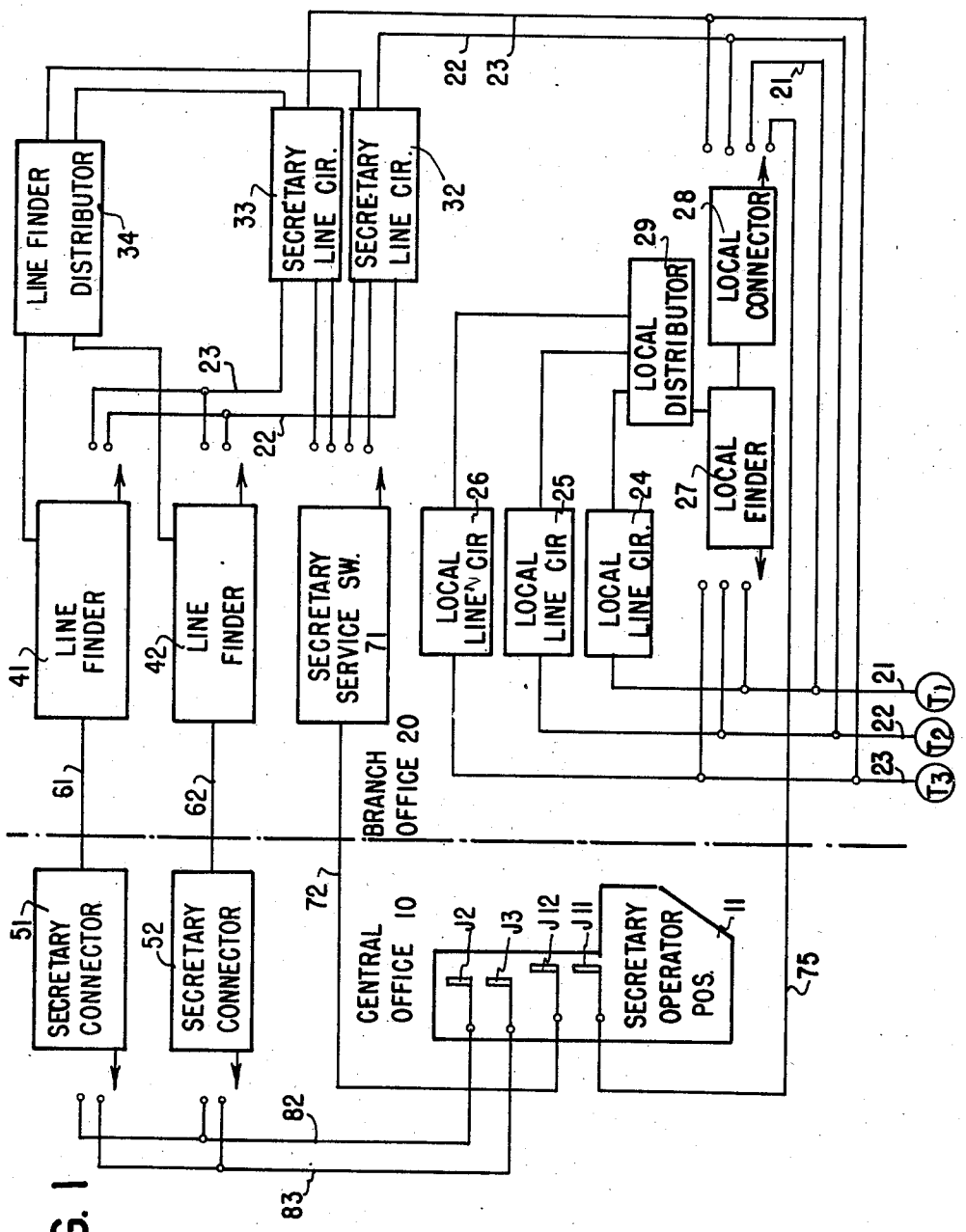

FIG. 1

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TELEPHONE SYSTEM

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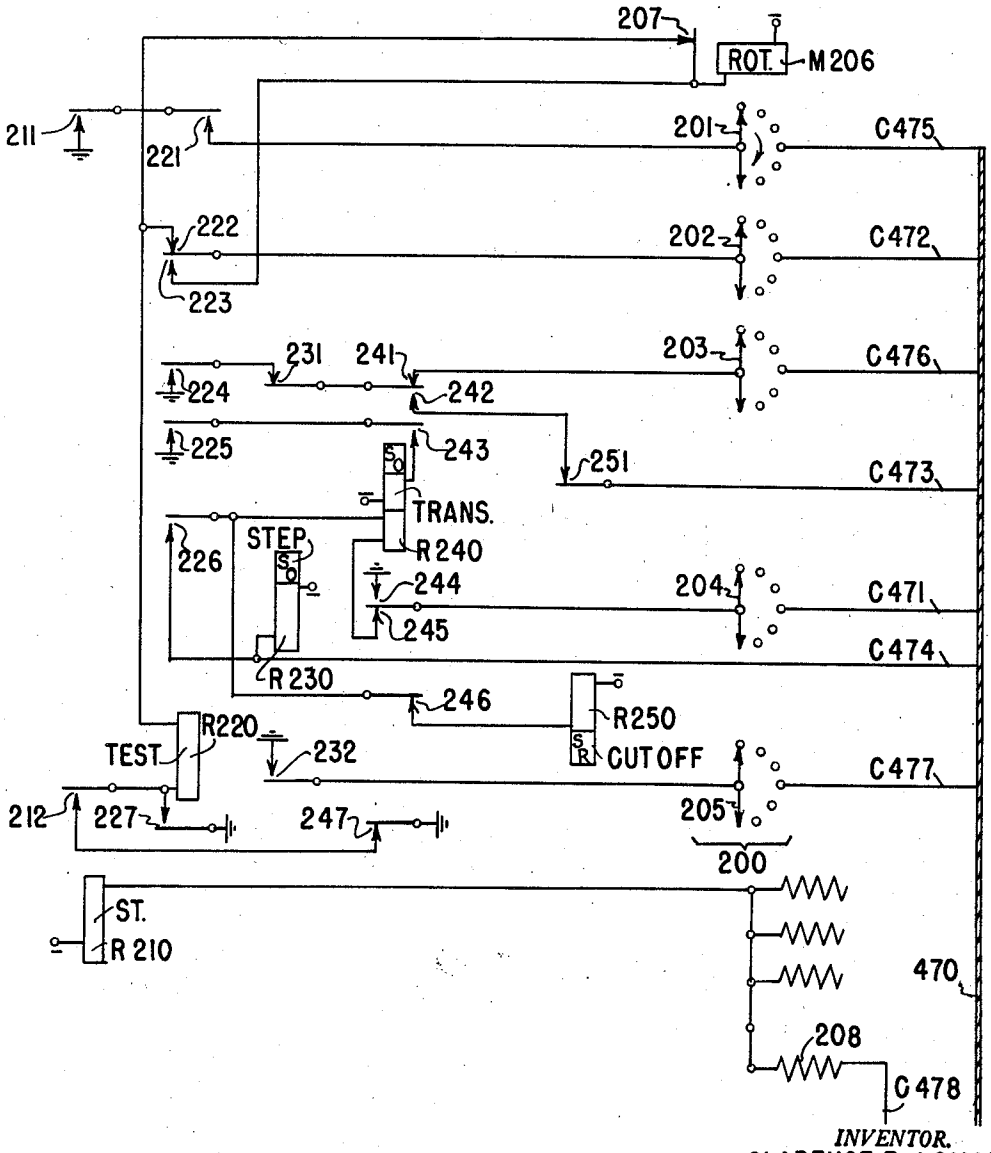
FIG. 2

LINE FINDER DISTRIBUTOR 34



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TELEPHONE SYSTEM

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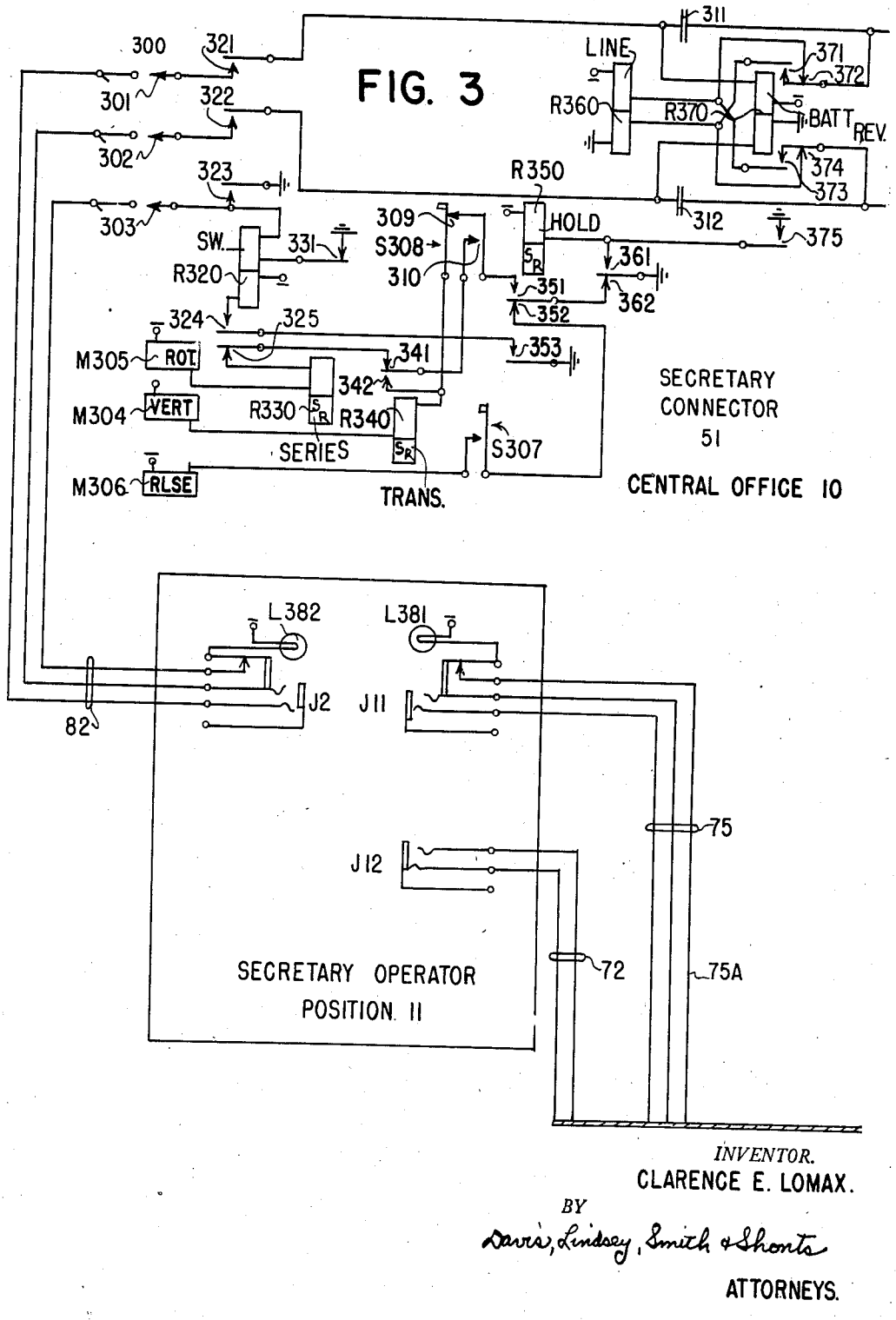
FIG. 3



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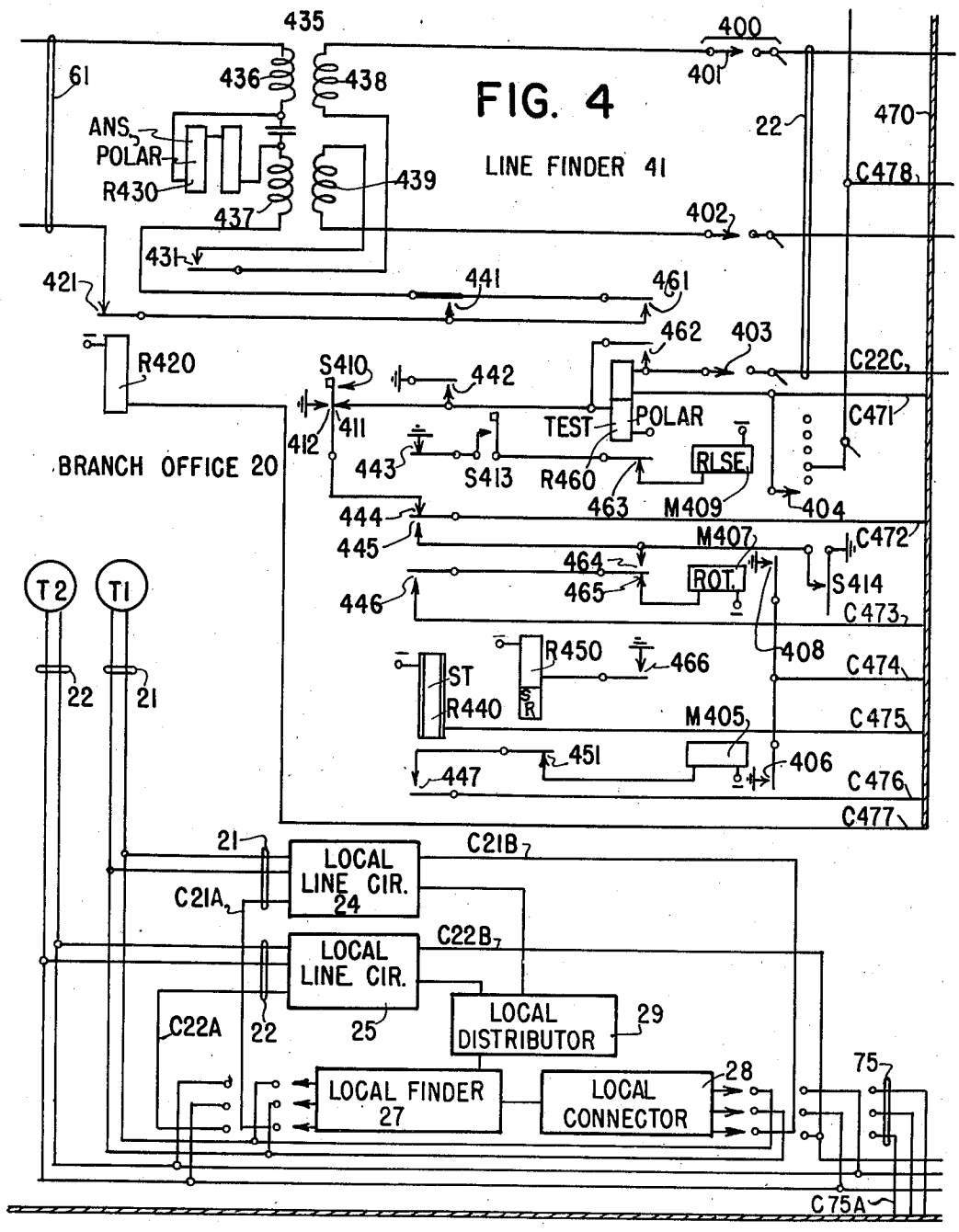
TELEPHONE SYSTEM

Filed Jan. 8, 1943 5 Sheets-Sheet 4



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TELEPHONE SYSTEM

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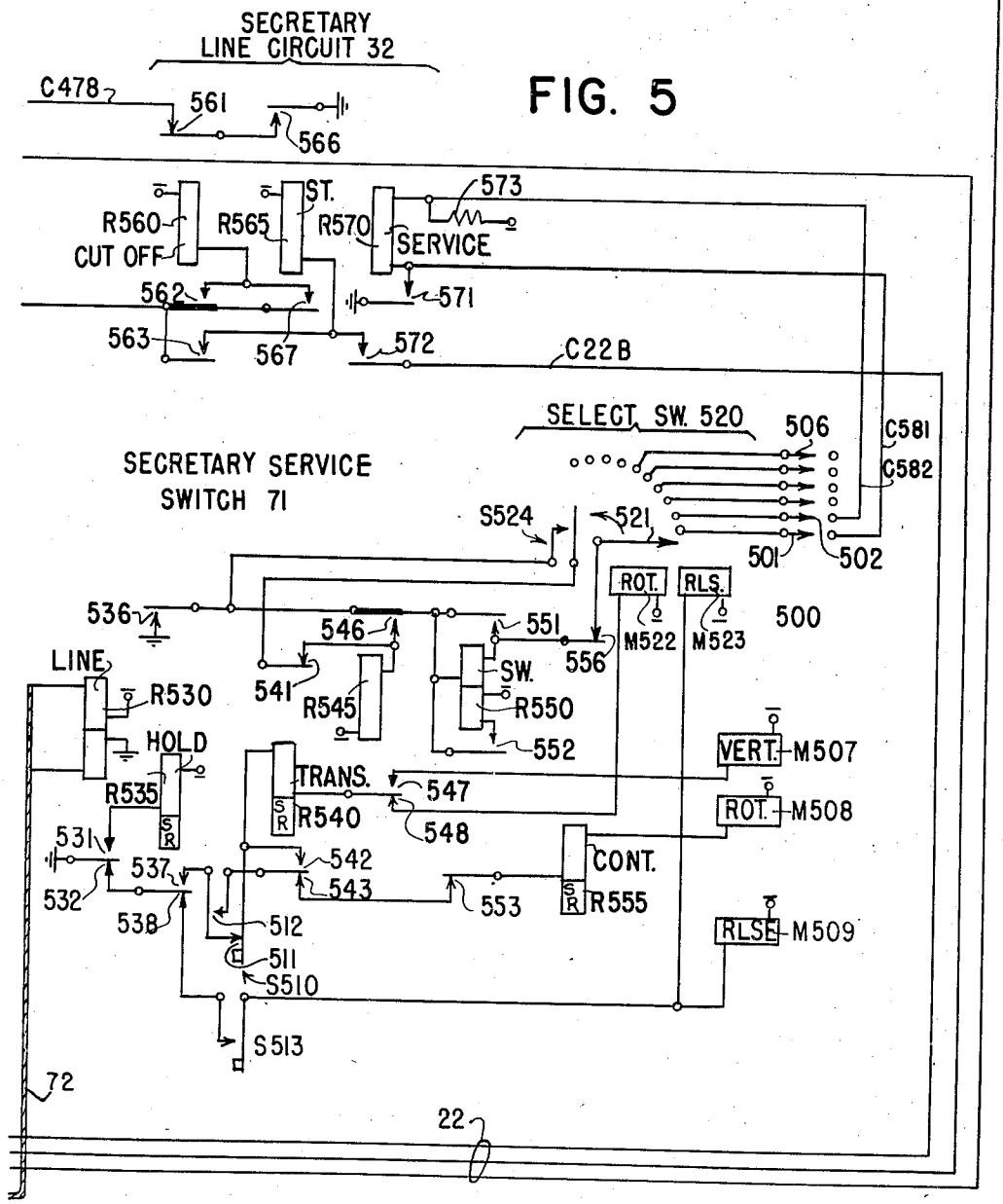
FIG. 5



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Patented Sept. 12, 1944 2,358,017

UNITED STATES PATENT OFFICE

2,358,017

TELEPHONE SYSTEM

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Application January 8, 1943, Serial No. 471,683

23 Claims. (Cl. 179—27)

The present invention relates to telephone systems and more particularly to such systems arranged to render secretarial service to certain subscriber substations served thereby.

In a conventional telephone system, agencies independent of the telephone operating company provide a type of service known as secretarial service, whereby certain subscribers, such as doctors, salesmen and others who do not have secretaries and whose duties require that they be absent from their offices for considerable periods of time, may have calls directed to their substations intercepted and forwarded to the agencies mentioned. A call thus intercepted is answered by a secretary at the agency; and, after the secretary makes inquiry and learns the desired called subscriber, she gives the calling subscriber certain information in accordance with the prior instructions of the called subscriber.

In a telephone system of the type noted the telephone operating company has no supervision over the agencies and the apparatus usually employed therein is not well designed to render highly satisfactory secretarial service.

Accordingly, it is an object of the present invention to provide a telephone system incorporating an improved arrangement including an operator switchboard under the supervision of the telephone operating company for rendering secretarial service to certain subscriber substations served thereby.

Another object of the invention is to provide in a telephone system comprising a number of offices, an improved arrangement for rendering from an operator position in the central office secretarial service to certain subscriber substations in the various branch offices.

Another object of the invention is to provide improved automatic switching apparatus for rendering interceptor service to certain subscriber substations served thereby.

A further object of the invention is to provide in a telephone system improved automatic switching apparatus selectively controllable to institute and to discontinue interceptor service at certain subscriber substations served thereby.

A further object of the invention is to provide in a telephone system an improved intercepting arrangement, whereby calls extended both to and from subscriber substations at which interceptor service is enforced are routed to an operator position.

Further features of the invention pertain to the particular arrangement of the circuit elements of the system, whereby the above-outlined and additional operating advantages are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which Figure 1 illustrates the general arrangement of a telephone system embodying the present invention; and Figs. 2 to 5, inclusive, taken together, illustrate the details of a system having incorporated therein the features of the invention as briefly outlined above.

Description of the apparatus incorporated in the system

Referring now more particularly to Fig. 1 of the drawings, the telephone system there illustrated comprises a central office 10 of any suitable type and a branch office 20 of the automatic type. The central office 10 includes a secretary operator switchboard or position 11 of the manual type; and the branch office 20 serves a group of automatic subscriber substations, including the subscriber substations T1, T2, T3 etc. The subscriber substations in the branch office 20 are divided into a first subgroup, including the subscriber substation T1, which is rendered ordinary automatic subscriber substation service, and a second subgroup, including the subscriber substations T2 and T3, which is rendered secretarial automatic subscriber substation service.

Each of the subscriber substations T1, T2, T3 etc. is provided with automatic subscriber substation apparatus including a telephone instrument, a calling device or dial, and a ringer. Subscriber lines extend to each of the subscriber substations and terminate in the branch office 20, the subscriber lines 21, 22 and 23 respectively extending to the subscriber substations T1, T2 and T3. Each of the subscriber lines is provided with a local line circuit individual thereto, the local line circuits 24, 25 and 26 being individual to the respective subscriber lines 21, 22 and 23 respectively extending to the subscriber substations T1, T2 and T3. Also each of the subscriber lines which is rendered secretarial service is provided with a secretary line circuit individual thereto, the secretary line circuits 32 and 33 being individual to the subscriber lines 22 and 23 extending to the subscriber substations T2 and T3 which are rendered secretarial service. Also the branch exchange 20 comprises local automatic switching apparatus including a number of local links, one of the local links being illustrated as

comprising a local finder 27 and a local connector 28. A local distributor 29 is operatively associated with the local links for the purpose of assigning an idle local link to the use of a calling subscriber line, the local distributor 29 also being operatively associated with the local line circuits 24, 25, 26 etc. Both the local finders 27 etc. and the local connectors 28 etc. have access to the subscriber lines extending to the subscriber substations T1, T2, T3 etc.; and the local connectors 28 etc. also have access to a trunk 75 extending between the branch office 20 and the central office 10 and terminating in a jack J11 at the secretary operator position 11.

Further the branch office 20 comprises a number of line finders 41, 42 etc. having access to the subscriber lines 22, 23 etc. extending to the subscriber substations T2, T3 etc. which are rendered secretarial service. A line finder distributor 34 is operatively associated with the line finders 41, 42 etc. for the purpose of assigning an idle line finder for the use of either a calling or called subscriber line extending to a subscriber substation which is rendered secretarial service, the line finder distributor 34 also being operatively associated with the secretary line circuits 32, 33 etc. Finally the branch office 20 comprises a secretary service switch 71 operatively connected to a trunk 72 extending between the branch office 20 and the central office 10 and terminating in a jack J12 at the secretary operator position 11. The secretary service switch 71 has access to the various secretary line circuits 32, 33 etc. individually associated with the subscriber lines 22, 23 etc. extending to the subscriber substations T2, T3 etc. which are rendered secretarial service.

The central office 10 comprises, in addition to the secretary operator position 11, a number of secretary connectors 51, 52 etc. respectively corresponding to the line finders 41, 42 etc. and operatively connected thereto by means of a number of trunks 61, 62 etc. extending between the central office 10 and the branch office 20. Accordingly, the line finder 41 disposed in the branch office 20 and the secretary connector 51 disposed in the central office 10 are interconnected by the trunk 61 extending therebetween and constitute a link which is utilized for a purpose more fully explained hereinafter. Similarly, the line finder 42, the secretary connector 52 and the connecting trunk 62 constitute another link. The secretary connectors 51, 52 etc. have access to a number of trunks 82, 83 etc. which respectively terminate in jacks J2, J3 etc. at the secretary operator position 11. At this point it is noted that the trunks 82, 83 etc. respectively terminating in the jacks J2, J3 etc. at the secretary operator position 11 respectively correspond to the subscriber lines 22, 23 etc. in the branch office 20 respectively extending to the subscriber substations T2, T3 etc. which are rendered secretarial service.

The actual number of local finder-connector links provided in the branch office 20 is determined by the amount of local traffic therein; while the actual number of line finder-secretary connector links required between the branch office 20 and the central office 10 is determined by the peak amount of secretarial traffic between the branch office 20 and the central office 10. At this point it is noted that any subscriber substation rendered ordinary service may be converted, whereby it may be rendered secretarial service, merely by the provision of a secretary line circuit individual thereto in conjunction with the necessary circuit changes rendering the secretary line circuit thus provided accessible to the line finders 41, 42 etc. and the provision of an additional and corresponding trunk terminating in a corresponding jack at the secretary operator position 11 and accessible to the secretary connectors 51, 52 etc. In passing, it is noted that the actual number of line finder-secretary connector links required between the branch office 20 and the central office 10 will be only a minor fraction of the number of subscriber substations in the branch office 20 rendered secretarial service.

In the central office 10, the secretary operator position 11 comprises, as shown in Fig. 3, in addition to the jacks J2, J3, J11, J12 etc., position apparatus not shown; whereby the operator thereat may answer calls on the trunks 82, 83 etc. and the trunk 75 and may control, via the trunk 72, the secretary service switch 71 in the branch office 20. Also associated with the jacks J2 and J11 are signal lamps L382 and L381, respectively, which are utilized for a purpose more fully explained hereinafter.

Preferably, each of the secretary connectors in the central office 10 is identical to the secretary connector 51 which comprises, as shown in Fig. 3, a switching mechanism 300 of the Strowger type, including a wiper set provided with three wipers 301, 302 and 303 supported for both vertical and rotary movements, and an associated semicylindrical contact bank provided with ten vertically spaced-apart levels of contact sets arranged in circumferentially spaced-apart relation. Also the switching mechanism 300 includes a vertical magnet M304 for driving the wiper set step by step in the vertical direction away from its normal vertical position, a rotary magnet M305 for driving the wiper set step by step in the rotary direction away from its normal rotary position, and a release magnet M306 for releasing the wiper set and for causing it to be returned to its normal rotary and vertical positions. Also associated with the switching mechanism 300 are two sets of switch springs S307 and S308 which are actuated when the wiper set is driven in the vertical direction one step away from its normal vertical position. Further the secretary connector 51 comprises a relay group including a switch relay R320, a series relay R330, a transfer relay R340, a hold relay R350, a line relay R360 and a battery reverse relay R370; and a control network connected and arranged in a manner more fully described hereinafter.

Preferably, each of the line finders in the branch office 20 is identical to the line finder 41 which comprises, as shown in Fig. 4, a switching mechanism 400 of the Strowger type, including a wiper set provided with three wipers 401, 402 and 403 supported for both vertical and rotary movements, and an associated semicylindrical contact bank provided with ten vertically spaced-apart levels of contact sets arranged in circumferentially spaced-apart relation. Also the switching mechanism 400 includes a vertical control wiper 404 supported only for vertical movement, and an associated vertical control contact bank. Further the switching mechanism 400 includes a vertical magnet M405 for driving the wiper set and the vertical control wiper 404 step by step in the vertical direction away from their normal vertical positions, a rotary magnet M407 for driving the wiper set step by step in the rotary direction away from its normal rotary position,

and a release magnet M409 for releasing the wiper set and the vertical control wiper 404 and for causing the wiper set to be returned to its normal rotary and vertical positions and for causing the vertical control wiper 404 to be returned to its normal vertical position. Also associated with the switching mechanism 400 are two sets of switch springs S410 and S413 which are actuated when the wiper set is moved one step in the vertical direction away from its normal vertical position and a set of switch springs S414 which is actuated when the wiper set is moved eleven steps in the rotary direction away from its normal rotary position. Further the line finder 41 comprises a repeating coil 435; a relay group, including a pulse relay R420, an answer relay R430, a start relay R440, a cutoff relay R450 and a test relay R460; and a control network connected and arranged in a manner more fully described hereinafter.

In the branch office 20, the line finder distributor 34 comprises, as shown in Fig. 2, a switching mechanism 200 of the rotary type, including five wipers 201 to 205, inclusive, provided with individually associated contact banks, and a magnet M206 for driving the wipers noted in the clockwise direction; the switching mechanism 200 having access via the cable 470 to the various line finders 41, 42 etc. Also the line finder distributor 34 comprises a relay group, including a start relay R210, a test relay R220, a step relay R230, a transfer relay R240, and a cutoff relay R250; and a control network connected and arranged in a manner more fully described hereinafter.

Preferably, each of the secretary line circuits in the branch office 20 is identical to the secretary line circuit 32 individually associated with the subscriber line 22 extending to the subscriber substation T2 which is rendered secretarial service. The secretary line circuit 32 comprises, as shown in Fig. 5, a relay group, including a cutoff relay R560, a start relay R565 and a service relay R570; and a control network connected and arranged in a manner more fully described hereinafter. In the branch office 20, the local line circuits 24, 25 etc. are of conventional connection and arrangement and are of any suitable form. Also in the branch office 20 the local links are of any suitable type; however, it is preferable that both the local finders and the local connectors thereof be of conventional Strowger types of standard connections and arrangements. Moreover, in the branch office 20, the local distributor 29 is of any suitable form and may be quite similar in connection and arrangement to the line finder distributor 34 illustrated.

In the branch office 20, the secretary service switch 71 comprises, as shown in Fig. 5, switching mechanism 500 of the Strowger type, icluding a wiper set provided with six wipers 501 to 506, inclusive, supported for both vertical and rotary movements, and an associated semicylindrical contact bank provided with ten vertically spaced-apart levels of contact sets arranged in circumferentially spaced-apart relation. Also the switching mechanism 500 includes a vertical magnet M507 for driving the wiper set step by step in the vertical direction away from its normal vertical position, a rotary magnet M508 for driving the wiper set step by step in the rotary direction away from its normal rotary position, and a release magnet M509 for releasing the wiper set and for causing it to be returned to its normal rotary and vertical positions. Also associated with the switching mechanism 500 are two sets of switch springs S510 and S513 which are actuated when the wiper set is driven in the vertical direction one step away from its normal vertical position. Also the secretary service switch 71 comprises a select switch 520 of the minor type, including a single wiper 521, provided with an associated contact bank, a rotary magnet M522 for driving the wiper noted step by step in the counterclockwise direction away from its normal rotary position, and a release magnet M523 for releasing the wiper noted and for causing it to be returned in the clockwise direction back into its normal rotary position. Also associated with the select switch 520 is a set of switch springs S524 which is actuated when the wiper noted is driven in the counterclockwise direction one step away from its normal rotary position. Further the secretary service switch 71 comprises a relay group, including a line relay R530, a hold relay R535, two transfer relays R540 and R545, a switch relay R550, and a control relay R555; and a control network connected and arranged in a manner more fully described hereinafter.

A better understanding of the connection and arrangement of the system will be facilitated from a consideration of the detailed operation of the various pieces of apparatus incorporated therein incident to handling local traffic in the branch office 20 and secretarial traffic between the branch office 20 and the central office 10, as will appear hereinafter.

Instituting secretarial service at a subscriber substation in the branch office

When a subscriber at a subscriber substation in the branch office 20 which is rendered secretarial service desires to utilize this service, he first extends a call to the secretary operator position 11 in the central office 10 and advises the operator thereat concerning any information which is to be given to other subscribers calling the subscriber substation mentioned in his absence. More particularly, in order to institute secretarial service at the subscriber substation T2, the subscriber thereat removes the receiver from its associated switchhook; whereby the local line circuit 25 is controlled over the subscriber line 22. More specifically, the local line circuit 25 controls the local distributor 29, whereby an idle local link, such, for example, as the local link illustrated, is assigned and the local finder 27 thereof is operated to seize the subscriber line 22 extending to the calling subscriber substation T2. When the local finder 27 seizes the subscriber line 22, the subscriber line 22 is marked as busy via the control conductor C22B thereof to the local connectors having access thereto and the local connector 28 is conditioned to be operative in response to one or more digits received over the calling subscriber line 22. The subscriber at the calling subscriber substation T2 then dials one or more digits over the subscriber line 22, whereby the local connector 28 is operated to select the trunk 75 extending to the secretary operator position 11 in the central office 10. The local connector 28 tests the idle or busy condition of the selected trunk 75 causing busy tone current to be returned over the subscriber line 22 to the calling subscriber substation T2 in the event the trunk 75 is busy at this time. On the other hand, in the event the trunk 75 is idle at this time, the local connector 28 operates to seize the trunk 75, whereby ground potential is applied to the con-

trol conductor C75A thereof in order to mark the trunk 75 as busy to the other local connectors having access thereto and to complete an obvious circuit, including the contacts of the jack J11, for illuminating the signal lamp L381. The illumination of the signal lamp L381 indicates the presence of a call on the trunk 75; whereby the operator at the secretary operator position 11 answers the call by inserting the answer plug of the cord circuit into the jack J11 effecting the extinguishment of the signal lamp L381 and completing an obvious connection between the calling subscriber substation T2 and the telephone instrument at the secretary operator position 11. The subscriber at the calling subscriber substation T2 then passes to the operator at the secretary operator position 11 the information which is to be given to other subscribers calling the subscriber substation T2 in his absence. Subsequently, when both the subscriber at the calling subscriber substation T2 replaces the receiver upon its associated switchhook and the operator at the secretary operator position 11 withdraws the answer plug of the cord circuit from the jack J11, the local finder 27 and the local connector 28 are released, whereby both the subscriber line 22 extending to the subscriber substation T2 and the trunk 75 terminating in the jack J11 at the secretary operator position 11 are rendered idle to the local connectors having access thereto.

The operator at the secretary operator position 11 then inserts the call plug of the cord circuit into the jack J12 terminating the trunk 72 extending between the central office 10 and the branch office 20, whereby an obvious circuit is completed for energizing in series the upper and lower windings of the line relay R530 in the secretary service switch 71 in the branch office 20. When thus energized the line relay R530 operates to complete, at the contacts 531, an obvious circuit for energizing the winding of the hold relay R535 in order to cause the latter relay to operate. The operator at the secretary operator position 11 then dials three digits over the trunk 72, whereby the line relay R530 follows the three digits mentioned. The first digit dialed over the trunk 72 is effective to operate the select switch 520, thereby to indicate whether secretarial service is to be instituted or discontinued, as explained more fully hereinafter; while the second and third digits are effective to operate the switching mechanism 500, thereby to select the particular secretary line circuit associated with the subscriber line extending to the subscriber substation at which secretarial service is to be instituted or discontinued as the case may be. More particularly, in the present example, in order to institute secretarial service at the subscriber substation T2, the three digits dialed are 1, 2 and 2; the first digit 1 indicating that secretarial service is to be instituted at the subscriber substation T2 and the second and third digits 2 and 2, respectively, identifying the secretary line circuit 32 individual to the subscriber line 22 extending to the subscriber substation T2.

More particularly, the line relay R530 follows the single impulse of the first digit 1 restoring and then reoperating. Upon restoring, the line relay R530 interrupts, at the contacts 531, the previously mentioned circuit for energizing the winding of the hold relay R535, and completes, at the contacts 532, a circuit, including the contacts 537, the contacts 511 of the set of switch springs S510 and the contacts 548, for energizing the winding of the transfer relay R540 in series with the rotary magnet M522 of the select switch 520; whereby the transfer relay R540 operates and the rotary magnet M522 operates in order to drive the wiper 521 of the select switch 520 one step in the counterclockwise direction away from its normal rotary position. Upon reoperating, the line relay R530 recompletes, at the contacts 531, the previously mentioned circuit for energizing the winding of the hold relay R535, and interrupts, at the contacts 532, the previously traced circuit for energizing the winding of the transfer relay R540 in series with the rotary magnet M522. The hold relay R535 and the transfer relay R540 are of the slow-to-release type; whereby the relays mentioned do not restore during impulsing. At this time the rotary magnet M522 restores and the wiper 521 of the select switch 520 engages the first contact in the associated contact bank connected to the wiper 501 of the wiper set of the switching mechanism 500, for a purpose more fully explained hereinafter. Also when the wiper 521 of the select switch 520 is driven one step in the counterclockwise direction away from its normal rotary position, the set of switch springs S524 is actuated into engagement, thereby to prepare a circuit traced hereinafter for energizing the winding of the transfer relay R545. Shortly following the conclusion of the first digit 1 the transfer relay R540 restores, thereby to complete, at the contacts 541, the previously mentioned circuit including the contacts 536 and the set of switch springs S524, for energizing the winding of the transfer relay R545. When thus energized the transfer relay R545 operates to complete, at the contacts 546, an obvious holding circuit, including the contacts 536, for energizing the winding thereof. Also the transfer relay R545 interrupts, at the contacts 548, a further point in the previously traced circuit for energizing the winding of the transfer relay R540 in series with the rotary magnet M522 of the select switch 520, and prepares, at the contacts 547, a circuit traced hereinafter for energizing the winding of the transfer relay R540 in series with the vertical magnet M507 of the switching mechanism 500.

The line relay R530 then follows the second digit 2, thereby to complete, at the contacts 532, the first time it restores, the previously mentioned circuit, including the contacts 537, the contacts 511 of the set of switch springs S510 and the contacts 547, for energizing the winding of the transfer relay R540 in series with the vertical magnet M507; whereby the transfer relay R540 reoperates and the vertical magnet M507 operates to drive the wiper set of the switching mechanism 500 one step in the vertical direction away from its normal vertical position. When the wiper set of the switching mechanism 500 is driven one step in the vertical direction away from its normal vertical position, the sets of switch springs S510 and S513 are actuated. More particularly, the set of switch springs S510 is actuated, thereby to interrupt, at the contacts 511 thereof, a further point in the previously traced circuit for energizing the winding of the transfer relay R540 in series with the vertical magnet M507 and to prepare, at the contacts 512 thereof, an alternative circuit traced hereinafter for energizing the winding of the transfer relay R540 in series with the vertical magnet M507. The set of switch springs S513 is actuated into engagement, thereby to prepare multiple circuits traced hereinafter for energizing the release mag-

nets M523 and M509 of the select switch 520 and the switching mechanism 500, respectively. The next time the line relay R530 restores it completes, at the contacts 532, the previously mentioned alternative circuit, including the contacts 537, the contacts 512 of the set of switch springs S510, the contacts 542 and the contacts 547, for energizing the winding of the transfer relay R540 in series with the vertical magnet M507. Accordingly, at this time, the line relay R530 follows the impulses of the second digit 2, whereby the hold relay R535 and the transfer relay R540 remain operated during impulsing and the wiper set of the switching mechanism 500 is driven two steps in the vertical direction away from its normal vertical position. Shortly following the conclusion of the second digit 2 the transfer relay R540 restores, thereby to interrupt, at the contacts 542, a further point in the previously traced alternative circuit for energizing in series the winding of the transfer relay R540 and the vertical magnet M507. Also the transfer relay R540 prepares, at the contacts 543, a circuit traced hereinafter for energizing in series the winding of the control relay R555 and the rotary magnet M508 of the switching mechanism 500.

The line relay R530 then follows the impulses of the third digit 2, thereby to complete each time it restores, at the contacts 532, the previously mentioned circuit, including the contacts 537, the contacts 512 of the set of switch springs S510 and the contacts 543 and 553, for energizing the winding of the control relay R555 in series with the rotary magnet M508, whereby the control relay R555 operates and the rotary magnet M505 operates and restores twice in order to drive the wiper set of the switching mechanism 500 two steps in the rotary direction away from its normal rotary position. At this point it is noted that the control relay R555 is of the slow-to-release type, whereby the latter relay and the hold relay R535 remain operated during impulsing. At the conclusion of the third digit 2, the line relay R530 remains operated and, shortly thereafter, the control relay R555 restores. At this time the wiper set of the switching mechanism 500 engages the 2 up 2 in contact set in the associated contact bank. Upon restoring, the control relay R555 completes, at the contacts 556, a circuit, including the contacts 536, the wiper 521 of the select switch 520 and the engaged first contact in the associated contack bank, the wiper 501 of the wiper set of the switching mechanism 500 and the engaged contact in the associated contact bank, the conductor C581 and the resistor 573, for energizing the upper winding of the switch relay R550 in series with the winding of the service relay R570, the service relay R570 being in the secretary line circuit 32 individual to the subscriber line 22 extending to the subscriber substation T2. When this series circuit is completed the switch relay R550 operates to complete, at the contacts 552, an obvious holding circuit, including the contacts 536, for energizing the lower winding thereof. Also the switch relay R550 interrupts, at the contacts 553, a further point in the previously traced circuit for energizing the winding of the control relay R555 in series with the rotary magnet M508, thereby positively to prevent further operation of the switching mechanism 500 at this time. Further the switch relay R550 completes, at the contacts 551, an obvious path for short-circuiting the upper winding thereof, whereby a low resistance circuit substantially identical to that traced above is completed for energizing the winding of the service relay R570 in the secretary line circuit 32.

When thus energized the service relay R570 operates to complete, at the contacts 571, an obvious holding circuit, including the resistor 573, for energizing the winding thereof. Also the service relay R570 completes, at the contacts 572, an obvious connection between the winding of the start relay R565 in the secretary line circuit 32 and the control conductor C22B of the subscriber line 22 extending to the subscriber substation T2, for a purpose more fully explained hereinafter. At this time, secretarial service has been instituted at the subscriber substation T2 in the branch office 20 by the operator at the secretary operator position 11 in the central office 10 over the trunk 12 by the operation of the secretary service switch 71 above described. After the operator at the secretary operator position 11 has thus instituted secretarial service at the subscriber substation T2 she withdraws the call plug of the cord circuit from the jack J12, thereby to interrupt the previously traced circuit for energizing in series the upper and lower windings of the line relay R530 in the secretary service switch 71 over the trunk 12, whereby the latter relay restores. Upon restoring, the line relay R530 interrupts, at the contacts 531, the previously mentioned circuit for energizing the winding of the hold relay R535, thereby to cause the latter relay to restore shortly thereafter. Upon restoring, the hold relay R535 interrupts, at the contacts 536, the previously traced multiple holding circuits for energizing the winding of the transfer relay R545 and the lower winding of the switch relay R550, thereby to cause the relays mentioned to restore. Also the hold relay R535 completes, at the contacts 538, the previously mentioned multiple circuits, including the contacts 532 and the set of switch springs S513, for energizing the release magnets M523 and M509. When thus energized the release magnet M523 operates, thereby to release the wiper 521 of the select switch 520 and to cause it to be returned in the clockwise direction back into its normal rotary position. When thus energized the release magnet M509 operates, thereby to release the wiper set of the switching mechanism 500 and to cause it to be returned to its normal rotary and vertical positions. When the switching mechanism 500 is thus released the sets of switch springs S510 and S513 are actuated. More particularly, the set of switch springs S513 is actuated into disengagement, thereby to interrupt the previously traced multiple circuits for energizing the release magnets M523 and M509 in order to cause these release magnets to restore. At this time the secretary service switch 71 is completely released.

Rendering secretarial service to a subscriber substation in the branch office

Considering now the manner in which secretarial service is rendered a subscriber substation, such, for example, as the subscriber substation T2 in the branch office 20, after secretarial service thereat has been instituted in the manner previously explained, it is again noted that, in the secretary line circuit 32 individual to the subscriber line 22 extending to the subscriber subscriber T2, the service relay R570 occupies its operated position and the winding of the start relay R565 is connected to the control conductor

C22B of the subscriber line 22. At this time a call may be initiated at any calling subscriber substation in the branch office 20, such, for example, as the subscriber substation T1, and extended to the called subscriber substation T2; whereby secretarial service is rendered, as explained more fully below. More particularly, the subscriber at the calling subscriber substation T1 removes the receiver from its associated switchhook; whereby the local line circuit 24 is controlled over the subscriber line 21. More specifically, the local line circuit 24 controls the local distributor 29, whereby an idle local link, such, for example, as the local link illustrated, is assigned and the local finder 27 thereof is operated to seize the subscriber line 21 extending to the calling subscriber substation T1. When the local finder 27 seizes the subscriber line 21, the subscriber line 21 is marked as busy via the control conductor C21B thereof to the local connectors having access thereto and the local connector 28 is conditioned to be operative in response to two digits received over the calling subscriber line 21. The subscriber at the calling subscriber substation T1 then dails two digits over the subscriber line 21, whereby the local connector 28 is operated to select the subscriber line 22 extending to the called subscriber substation T2. The local connector 28 tests the idle or busy condition of the selected subscriber line 22, causing busy tone current to be returned over the subscriber line 21 to the calling subscriber substation T1 in the event the called subscriber substation T2 is busy at this time. On the other hand, in the event the called subscriber substation T2 is idle at this time, the local connector 28 operates to seize the subscriber line 22, whereby ground potential is applied to the control conductor C22B thereof in order to mark the subscriber line 22 as busy to the other local connectors having access thereto and to cause ringing current to be projected over the line conductors of the subscriber line 22 extending to the called subscriber substation T2, whereby the ringer thereat is operated. However, in the present example, the subscriber at the called subscriber substation T2 is absent and the call thereto is not answered at the called subscriber substation T2; rather, the call is answered at the secretary operator position 11 in the central office 10, as explained more fully below.

The application of ground potential to the control conductor C22B of the subscriber line 22 extending to the called subscriber substation T2 also completes an obvious circuit, including the contacts 572, for energizing the winding of the start relay R565 in the secretary line circuit 32, due to the operated position of the service relay R570 therein, secretarial service being enforced at the called subscriber substation T2 at this time. When thus energized the start relay R565 operates to complete, at the contacts 566, an obvious path, including the contacts 561, for applying ground potential to the mark conductor C478 extending both to the line finder distributor 34 and to the vertical control contact banks of the various line finders 41, 42, etc. Also the start relay R565 completes, at the contacts 567, an obvious path for applying battery potential by way of the winding of the cutoff relay R560 in the secretary line circuit 32 to the control conductor C22C of the subscriber line 22 appearing in the contact banks of the various line finders 41, 42 etc. The application of ground potential to the mark conductor C478 and the application of battery potential to the control conductor C22C of the subscriber line 22 respectively mark the vertical and rotary positions of the various contact sets in the line finders 41, 42, etc. terminating the subscriber line 22 extending to the called subscriber substation T2. Also the application of ground potential to the mark conductor C478 completes a circuit, including the resistor 208, for energizing the winding of the start relay R210 in the link finder distributor 34, thereby to cause the latter relay to operate.

At this point it is noted that the magnet M206 of the switching mechanism 200 incorporated in the line finder distributor 34 is normally connected via the contacts 207 and 222 to the wiper 202 of the rotary switching mechanism 200, which wiper normally engages a contact in the associated contact bank in view of the fact that the switching mechanism 200 is of the nonhoming type. The guard conductors C472 etc. extending to the various line finders 41 etc. are terminated in the contact bank associated with the wiper 202 of the switching mechanism 200; which guard conductors have battery potential or ground potential connected thereto when the associated line finder is respectively idle or busy. Thus it will be understood that, when a line finder 41 etc. is rendered busy, ground potential is applied to the associated guard conductor C472 etc. and consequently to the wiper 202 of the switching mechanism 200 in the event the wiper mentioned engages the contact in the associated contact bank terminating the guard conductor mentioned. In this event, ground potential applied to the wiper 202 of the switching mechanism 200 completes an obvious circuit, including the contacts 222 and 207, for energizing the magnet M206, whereby the latter magnet operates to interrupt, at the contacts 207, the previously traced circuit for energizing the magnet M206 and to condition the wipers noted of the switching mechanism 200 to be driven one step in the clockwise direction. The magnet M206 then restores, whereby the wipers noted of the switching mechanism 200 are driven one step in the counterclockwise direction and the magnet M206 is reconnected, at the contacts 207, to the wiper 202 of the switching mechanism 200; whereby the next line finder 41, 42 etc. selected by the switching mechanism 200 at this time is tested in order to determine the idle or busy condition thereof. Accordingly, the switching mechanism 200 operates automatically to preselect an idle line finder prior to initiation of the operation of the line finder distributor 34. Now assuming that the line finder 41 is idle at this time and that the switching mechanism 200 incorporated in the line finder distributor 34 has operated to select the conductors extending thereto, battery potential is applied by way of the lower winding of the test relay R460 in the line finder 41, the contacts 411 of the set of switch springs S410 and the contacts 444 to the guard conductor C472 of the line finder 41 in the cable 470. This application of battery potential to the guard conductor C472 of the line finder 41 in the cable 470 completes a path substantially identical to that previously traced, including the contacts 207 and 222 and the wiper 202 of the switching mechanism 200 and the engaged contact in the associated contact bank, for short-circuiting in series the magnet M206 of the switching mechanism 200 and the lower winding of the test relay R460 in the line finder 41; whereby further operation of the switching mechanism 200 is arrested and

the line finder 41 is preselected thereby for use at this time.

Upon operating, the start relay R210 completes, at the contacts 212, an obvious circuit, including the contacts 247 and 207, for energizing the winding of the test relay R220 in series with the magnet M206, whereby the test relay R220 operates. However, the magnet M206 does not operate due to the high series resistance of the winding of the test relay R220. Upon operating, the test relay R220 completes, at the contacts 227, an obvious holding circuit substantially identical to that previously traced for energizing the winding thereof in series with the magnet M206. Also the test relay R220 interrupts, at the contacts 222, the previously traced original connection between the magnet M206 and the wiper 202 of the switching mechanism 200, and completes, at the contacts 223, an obvious alternative connection between the magnet M206 and the wiper 202. Also the test relay R220 completes, at the contacts 221, an obvious path, including the contacts 211 and the wiper 201 and the engaged contact in the associated contact bank, for applying ground potential to the start conductor C475 in the cable 470, thereby to complete an obvious circuit for energizing the winding of the start relay R440 in the preselected line finder 41, whereupon the latter relay operates. Further the test relay R220 completes, at the contacts 224, a path, including the contacts 231 and 241 and the wiper 203 of the switching mechanism 200 and the engaged contact in the associated contact bank, for applying ground potential to the vertical conductor C476 in the cable 470; and completes, at the contacts 226, a connection, including the contacts 246, between the winding of the cutoff relay R250 and the winding of the step relay R230, the winding of the step relay R230 being connected to the interrupter conductor C474 in the cable 470.

Upon operating, the start relay R440 in the line finder 41 completes, at the contacts 441, a circuit for energizing in series the windings of the answer relay R430 in the line finder 41 and the windings of the line relay R360 in the secretary connector 51 via the trunk 61. The above-mentioned circuit extends from ground by way of the lower winding of the line relay R360, the contacts 374, one of the line conductors of the trunk 61, the contacts 421 and 441, the winding 437 of the repeating coil 435, the windings of the answer relay R430, the winding 436 of the repeating coil 435, the other line conductor of the trunk 61, the contacts 372 and the upper winding of the line relay R360 to battery. When this series loop circuit is completed the line relay R360 in the secretary connector 51 operates; however, the answer relay R430 in the line finder 41 does not operate as the latter relay is of the polarized type. Also the start relay R440 completes, at the contacts 442, an obvious circuit for energizing the lower winding of the test relay R460, thereby to render the latter relay exceedingly fast to operate when the upper winding thereof is subsequently energized, the test relay R460 being of the polarized type. Further the start relay R440 completes, at the contacts 447, an obvious path, including the contacts 451, between the vertical magnet M405 of the switching mechanism 400 and the vertical conductor C476 in the cable 470, whereby the vertical magnet M405 is energized and operates. Upon operating, the vertical magnet M405 drives the wiper set of the switching mechanism 400 one step in the vertical direction away from its normal vertical position, and completes, at the contacts 406, an obvious path for applying ground potential to the interrupter conductor C474 in the cable 470. When the wiper set of the switching mechanism 400 is driven one step in the vertical direction away from its normal vertical position, the sets of switch springs S410 and S413 are actuated for a purpose more fully explained hereinafter.

The application of ground potential to the interrupter conductor C474 in the cable 470 completes the previously traced circuit for energizing in multiple the windings of the step relay R230 and the cutoff relay R250 in the line finder distributor 34, whereby the cutoff relay R250 operates immediately and the step relay R230 operates shortly thereafter, the step relay R230 being of the slow-to-operate type. Upon operating, the step relay R230 interrupts, at the contacts 231, the previously traced path for applying ground potential to the vertical conductor C476 in the cable 470, thereby to interrupt the previously traced circuit for energizing the vertical magnet M405, whereupon the latter magnet restores, thereby to interrupt, at the contacts 406, the previously mentioned path for applying ground potential to the interrupter conductor C474 in the cable 470. When ground potential is removed from the interrupter conductor C474 the previously traced circuits for energizing in multiple the windings of the step relay R230 and the cutoff relay R250 are interrupted, whereby the step relay R230 restores. However, the cutoff relay R250 does not restore immediately as it is of the slow-to-release type Upon restoring, the step relay R230 recompletes, at the contacts 231, the previously traced circuit for energizing the vertical magnet M405, whereby the latter magnet reoperates, thereby to drive the wiper set of the switching mechanism 400 an additional step in the vertical direction away from its normal vertical position. Also, upon reoperating, the vertical magnet M405 recompletes, at the contacts 406, the previously traced circuits for energizing in multiple the windings of the step relay R230 and the cutoff relay R250, whereby the step relay R230 reoperates shortly thereafter and the cutoff relay R250 is retained in its operated position as it is of the slow-to-release type. Accordingly, it will be understood that the vertical magnet M405 and the step relay R230 interact in the manner described above, whereby the cutoff relay R250 is retained in its operated position and the vertical magnet M405 and the step relay R230 operate and restore alternately; whereby the wiper set of the switching mechanism 400 is driven step by step in the vertical direction away from its normal vertical position.

More particularly, the wiper set and the vertical control wiper 404 of the switching mechanism 400 are driven step by step in the vertical direction two stepss, in the present example; whereupon the vertical control wiper 404 engages the second contact in the associated vertical control contact bank terminating the mark conductor C478 having ground potential thereon; whereby ground potential on the mark conductor C478 is applied to the test conductor C471 in the cable 470. This application of ground potential to the test conductor C471 in the cable 470 completes a circuit, including the wiper 204 of the switching mechanism 200 and the engaged contact in the associated contact bank, the contacts 245 and 226,

and the grounded interrupter conductor C474 in the cable 470, for short-circuiting the lower winding of the transfer relay R240 prior to the complete restoration of the vertical magnet M405 to remove ground potential at the contacts 406 from the interrupter conductor C474. However, when the vertical magnet M405 restores to interrupt, at the contacts 406, the application of ground potential to the interrupter conductor C474 in the cable 470, the above-traced path for short-circuiting the lower winding of the transfer relay R240 is interrupted; whereupon a circuit is completed for energizing the lower winding of the transfer relay R240 in series with the lower winding of the step relay R230. The above-mentioned circuit extends from the grounded test conductor C471 in the cable 470 by way of the wiper 204 of the switching mechanism 200 and the engaged contact in the associated contact bank, the contacts 245, the lower winding of R240, the contacts 226 and the winding of R230 to battery. Also a multiple holding circuit is completed for energizing the lower winding of the transfer relay R240 in series with the winding of the cutoff relay R250; the last-mentioned circuit including the contacts 246 and 245 and the wiper 204 of the switching mechanism 200 and the engaged contact in the associated contact bank and the grounded test conductor C471 in the cable 470. When the lower winding of the transfer relay R240 is thus energized the latter relay operates shortly thereafter, the transfer relay R240 being of the slow-to-operate type. Upon operating, the transfer relay R240 completes, at the contacts 243, an obvious holding circuit, including the contacts 225, for energizing the upper winding thereof. Also the transfer relay R240 interrupts, at the contacts 241, a further point in the previously traced path for applying ground potential to the vertical conductor C476 in the cable 470, and prepares, at the contacts 242, a point in a path traced hereinafter for applying ground potential to the rotary conductor C473 in the cable 470. Also the transfer relay R240 interrupts, at the contacts 245, the previously traced circuits for energizing the lower winding of the transfer relay R240 in series multiple relation with respect to the windings of the step relay R230 and the cutoff relay R250, interrupts, at the contacts 246, a further point in the previously traced circuit for energizing the winding of the cutoff relay R250, and interrupts, at the contacts 247, the previously traced original circuit for energizing the winding of the test relay R220 in series with the magnet M206. The step relay R230 then restores; and, shortly thereafter, the cutoff relay R250 restores, the cutoff relay R250 being of the slow-to-release type.

Upon restoring, the cutoff relay R250 completes, at the contacts 251, the previously mentioned path, including the contacts 224, 231 and 242, for applying ground potential to the rotary conductor C473 in the cable 470, thereby to complete an obvious circuit, including the contacts 446 and 465, for energizing the rotary magnet M407. When thus energized the rotary magnet M407 operates, thereby to drive the wiper set of the switching mechanism 400 one step in the rotary direction away from its normal rotary position; and completes, at the contacts 408, an obvious alternative path for applying ground potential to the interrupter conductor C474 in the cable 470. This application of ground potential to the interrupter conductor C474 completes the previously traced circuit for energizing the winding of the step relay R230, thereby to cause the latter relay to operate shortly thereafter; however, the previously traced circuit for energizing the winding of the cutoff relay R250 is not completed due to the operated position of the transfer relay R240. Upon operating, the step relay R230 interrupts, at the contacts 231, the previously traced path for applying ground potential to the rotary conductor C473 in the cable 470, thereby to interrupt the previously traced circuit for energizing the rotary magnet M407. The rotary magnet M407 then restores, thereby to interrupt, at the contacts 408, the previously traced circuit for energizing the winding of the step relay R230 in order to cause the latter relay to restore. Upon restoring, the step relay R230 recompletes, at the contacts 231, the previously traced circuit for energizing the rotary magnet M407, thereby to cause the latter magnet to reoperate and drive the wiper set of the switching mechanism 400 an additional step in the rotary direction away from its normal rotary position. Thus it will be understood that the rotary magnet M407 and the step relay R230 interact in the manner described above, whereby the wiper set of the switching mechanism 400 is driven step by step in the rotary direction away from its normal rotary position. In the present example, the wiper set of the switching mechanism 400 is driven two steps in the rotary direction away from its normal rotary position, whereupon the wipers noted thereof engage the contact set in the associated contact bank terminating the conducors of the subscriber line 22 extending to the called subscriber substation T2.

When the wiper set of the switching mechanism 400 engages the contact set in the associated contact bank terminating the conductors of the subscriber line 22, a series circuit is completed for energizing the winding of the cutoff relay R560 in the secretary line circuit 32 individual to the subscriber line 22 and the upper winding of the test relay R460 in the line finder 41. This circuit extends from the grounded test conductor C471 in the cable 470 by way of the upper winding of R460, the wiper 403 of the wiper set of the switching mechanism 400 and the engaged contact in the associated contact bank, the control conductor C22C of the subscriber line 22, the contacts 567 and the winding of R560 to battery. When this series circuit is completed the test relay R460 operates exceedingly fast, as it is of the polarized type, to complete, at the contacts 462, an obvious path, including the contacts 442 and the grounded test conductor C471 in the cable 470, for short-circuiting the upper winding thereof, and an obvious path, including the contacts 442, for applying direct ground potential to the wiper 403 of the wiper set of the switching mechanism 400 and consequently to the control conductor C22C of the subscriber line 22, whereby a low resistance circuit substantially identical to that previously traced is completed for energizing the winding of the cutoff relay R560 in the secretary line circuit 32. When thus energized the cutoff relay R560 operates to complete, at the contacts 562 and 563, a holding circuit, including the contacts 572 and the grounded control conductor C22B of the subscriber line 22, for energizing the winding thereof. Also the cutoff relay R560 completes, at the contacts 563, an obvious path, including the contacts 572, for connecting the grounded control conductor C22B of the subscriber line 22 to the control conductor C22C of the subscriber line 22; thereby to com-

plete an alternative holding circuit, including the wiper 403 of the wiper set of the switching mechanism 400 and the engaged contact in the associated contact bank and the contacts 462, for energizing the lower winding of the test relay R460 in order to retain the latter relay in its operated position subsequent to the restoration of the start relay R440, as explained more fully hereinafter. Also the cutoff relay R560 interrupts, at the contacts 561, the previously traced path for applying ground potential to the mark conductor C478, thereby to interrupt the previously traced circuit for energizing the winding of the start relay R210 in the line finder distributor 34 in order to cause the latter relay to restore.

Also, upon operating, the test relay R460 interrupts, at the contacts 465, a further point in the previously traced circuit for energizing the rotary magnet M407, thereby positively to prevent further operation of the latter magnet, whereby further operation of the wiper set of the switching mechanism 400 is positively prevented at this time. Also the test relay R460 completes, at the contacts 461, an obvious multiple point, around the contacts 442, in the previously traced loop circuit, including the trunk 61 and extending between the line finder 41 and the secretary connector 51. Further the test relay R460 completes, at the contacts 466, an obvious circuit for energizing the winding of the cutoff relay R450, thereby to cause the latter relay to operate and interrupt, at the contacts 451, a further point in the previously traced circuit for energizing the vertical magnet M405. Finally, the test relay R460 completes, at the contacts 464, a connection, including the contacts 445 and 446, between the guard conductor C472 and the rotary conductor C473 in the cable 470, thereby to complete a circuit, including the contacts 224, 231, 242, 251 and 223, and the wiper 202 of the switching mechanism 200 and the engaged contact in the associated contact bank, for energizing the magnet M206. When thus energized the magnet M206 operates, thereby to condition the wipers noted of the switching mechanism 200 to be driven an additional step in the clockwise direction.

Also when the grounded rotary conductor C473 is thus connected to the guard conductor C472 in the line finder 41 as explained above, a path, including the wiper 202 of the switching mechanism 200 and the engaged contact in the associated contact bank, and the contacts 223, 207 and 227, is completed for short-circuiting the winding of the test relay R220, thereby to cause the latter relay to restore. Upon restoring, the test relay R220 interrupts, at the contacts 227, a point in the previously traced path for short-circuiting the winding thereof, and interrupts, at the contacts 221, the previously traced path for applying ground potential to the start conductor C475 in the cable 470, thereby to interrupt the previously traced circuit for energizing the winding of the start relay R440 in the line finder 41 in order to cause the latter relay to restore shortly thereafter, the start relay R440 being of the slow-to-release type. Also, upon restoring, the test relay R220 interrupts, at the contacts 223, the previously traced circuit for energizing the magnet M206, thereby to cause the latter magnet to restore and drive the wipers noted of the switching mechanism 200 an additional step in the clockwise direction in order to disengage the conductors in the cable 470 extending to the line finder 41. Further the test relay R220 interrupts, at the contacts 225, the previously traced holding circuit for energizing the upper winding of the transfer relay R240, thereby to cause the latter relay to restore. At this time the line finder distributor 34 is completely released and is available for further use.

Upon restoring, the start relay R440 in the line finder 41 interrupts, at the contacts 442, the previously traced original circuit for energizing the lower winding of the test relay R460; however, the latter relay remains in its operated position due to the previously traced completed holding circuit for energizing the lower winding thereof, including the grounded control conductor C22C of the subscriber line 22. Also the start relay R440 interrupts, at the contacts 441, a multiple point in the loop circuit extending between the line finder 41 and the secretary connector 51, including the trunk 61, and completes, at the contacts 444, an obvious path, including the contacts 412 of the set of switch springs S410, for applying ground potential to the guard conductor C472 in the cable 470. The application of ground potential in the line finder 41 to the guard conductor C472 in the cable 470 marks the line finder 41 as busy to the line finder distributor 34, as previously noted. Accordingly, at this time, the wiper set of the switching mechanism 400 in the line finder 41 occupies its 2 up 2 in position engaging the contact set in the associated contact bank terminating the subscriber line 22 extending to the called subscriber substation T2. Further it is noted that the 2 up 2 in position of the wiper set of the switching mechanism 200 corresponds to the digits 2 and 2 representing the directory number of the called subscriber substation T2.

Reconsidering now the operation of the line finder 41 in conjunction with the line finder distributor 34, it is noted that each time the step relay R230 in the line finder distributor 34 operates and then restores it completes and then interrupts, at the contacts 232, an obvious path, including the wiper 205 of the switching mechanism 200 and the engaged contact in the associated contact bank, for applying ground potential to the pulse conductor C477 in the cable 470, thereby to complete and then to interrupt an obvious circuit for energizing the winding of the pulse relay R420 in the line finder 41, whereby the latter relay operates and then restores. Each time the pulse relay R420 in the line finder 41 operates and then restores it interrupts and then recompletes, at the contacts 421, the previously traced loop circuit extending between the line finder 41 and the secretary connector 51, including the trunk 61; whereby the line relay R360 in the secretary connector 51 follows the pulse relay R420 in the line finder 41. In view of the foregoing explanation of the mode of operation of the line finder 41 in conjunction with the line finder distributor 34, it will be understood that the step relay R230 first controls the vertical motion of the wiper set of the switching mechanism 400, whereby the wiper set is operated two steps in the vertical direction, in the present example, and a corresponding number of impulses comprising the digit 2 are transmitted by the step relay R230 to the pulse relay R420 and repeated thereby over the trunk 61 to the line relay R360. Then the step relay R230 controls the rotary motion of the wiper set of the switching mechanism 400, whereby the wiper set is operated two steps in the rotary direction, in

the present example, and a corresponding number of impulses comprising the digit 2 are transmitted by the step relay R230 to the pulse relay R420 and repeated thereby over the trunk 61 to the line relay R360. Hence, the line finder distributor 34 is operative to control the line finder 41 to select the called subscriber line 22 and to repeat over the trunk 61 to the line relay R360 in the secretary connector 51 the two digits 2 and 2 corresponding to the directory number of the called subscriber line 22.

The line relay R360 in the secretary connector 51 follows the first digit 2 in an obvious manner. When the line relay R360 operated it completed, at the contacts 361, an obvious circuit for energizing the winding of the hold relay R350, whereby the latter relay operated. The first time the line relay R360 restores it interrupts, at the contacts 361, the previously mentioned circuit for energizing the winding of the hold relay R350, and completes, at the contacts 362, a circuit, including the contacts 351 and the contacts 309 of the set of switch springs S308, for energizing the winding of the transfer relay R340 in series with the vertical magnet M304, whereby the transfer relay R340 and the vertical magnet M304 operate. Upon operating, the vertical magnet M304 drives the wiper set of the switching mechanism 300 one step in the vertical direction away from its normal vertical position. When the wiper set of the switching mechanism 300 is driven one step in the vertical direction away from its normal vertical position, the sets of switch springs S307 and S308 are actuated. More particularly, the set of switch springs S307 is actuated into engagement, thereby to prepare a circuit traced hereinafter for energizing the release magnet M306. The set of switch springs S308 is actuated, whereby there is interrupted, at the contacts 309 thereof, the previously traced original circuit for energizing the winding of the transfer relay R340 in series with the vertical magnet M304 and there is completed, at the contacts 310 thereof, an alternative circuit, including the contacts 362, 351 and 342, for energizing the winding of the transfer relay R340 in series with the vertical magnet M304. The first time the line relay R360 reoperates it recompletes, at the contacts 361, the previously mentioned circuit for energizing the winding of the hold relay R350, and interrupts, at the contacts 362, the previously traced alternative circuit for energizing the winding of the transfer relay R340 in series with the vertical magnet M304. The line relay R360 restores and then reoperates twice, in the present example, in response to the two impulses of the first digit 2 transmitted over the trunk 61, whereby the vertical magnet M304 is operated and restored twice in order to drive the wiper set of the switching mechanism 300 two steps in the vertical direction. The hold relay R350 and the transfer relay R340, being of the slow-to-release type, remain operated during impulsing. At the conclusion of the first digit 2, the line relay R360 remains operated in order to retain the hold relay R350 in its operated position, whereby the transfer relay R340 restores shortly thereafter. Upon restoring, the transfer relay R340 interrupts, at the contacts 342, a further point in the previously traced circuit for energizing the winding thereof in series with the vertical magnet M304, and prepares, at the contacts 341, a circuit traced hereinafter for energizing the winding of the series relay R330 in series with the rotary magnet M305.

The line relay R360 then follows the two impulses of the second digit 2. Each time the line relay R360 restores it interrupts, at the contacts 361, the previously mentioned circuit for energizing the winding of the hold relay R350, and completes, at the contacts 362, the previously mentioned circuit, including the contacts 351, the contacts 310 of the set of switch springs S308, and the contacts 341 and 325, for energizing the winding of the series relay R330 in series with the rotary magnet M305. When thus energized the series relay R330 operates; and the rotary magnet M305 operates, thereby to drive the wiper set of the switching mechanism 300 one step in the rotary direction away from its normal rotary position. Each time the line relay R360 reoperates it recompletes, at the contacts 361, the previously mentioned circuit for energizing the winding of the hold relay R350, and interrupts, at the contacts 362, the previously traced circuit for energizing in series the winding of the series relay R330 and the rotary magnet M305. The hold relay R350 and the series relay R330 are of the slow-to-release type and remain operated during impulsing. At the conclusion of the second digit 2 transmitted over the trunk 61 the line relay R360 remains in its operated position, thereby to retain operated the hold relay R350; and, shortly thereafter, the series relay R330 restores. At this time the wiper set of the switching mechanism 300 engages the 2 up 2 in contact set in the associated contact bank terminating the trunk 82 which is terminated by the jack J2 at the secretary operator position 11, the trunk 82 and the terminating jack J2 corresponding to the subscriber line 22 extending to the called subscriber substation T2 in the branch office 20, as previously noted. Upon restoring, the series relay R330 completes, at the contacts 331, a circuit, including the wiper 303 of the wiper set of the switching mechanism 300 and the engaged contact in the associated contact bank, the control conductor of the trunk 82 and the contacts of the jack J2, for energizing in series the upper winding of the switch relay R320 and the signal lamp L382. When this series circuit is completed the switch relay R320 operates to complete, at the contacts 324, an obvious holding circuit, including the contacts 353, for energizing the lower winding thereof. Also the switch relay R320 interrupts, at the contacts 325, a further point in the previously traced circuit for energizing the winding of the series relay R330 in series with the rotary magnet M305, and completes, at the contacts 323, an obvious path, including the contacts 331, for short-circuiting the upper winding of the switch relay R320. Also the switch relay R320 completes, at the contacts 323, an obvious path for applying direct ground potential to the wiper 303 of the wiper set of the switching mechanism 300, thereby to complete a low resistance circuit substantially identical to that previously traced for illuminating the signal lamp L382. Finally the switch relay R320 completes, at the contacts 321 and 322, an obvious connection, including the wipers 301 and 302 of the wiper set of the switching mechanism 300, between the upper and lower windings of the battery reverse relay R370 and the line conductors of the trunk 82 terminating in the jack J2, with which the illuminated signal lamp L382 is associated. The illumination of the signal lamp L382 indicates to the operator at the secretary operator position 11 that there is a call on the

trunk 82 waiting to be answered and that, consequently, a call has been extended to or initiated at the called subscriber substation T2 in the branch office 20.

The operator at the secretary operator position 11 answers the call by inserting the answer plug of the cord circuit into the jack J2, whereby the contacts of the jack J2 are operated in order to interrupt the previously traced circuit for illuminating the signal lamp L382, whereby the last-mentioned lamp is extinguished. Also an operative connection is completed between the telephone instrument in the cord circuit at the secretary operator position 11 and the line conductors of the trunk 82, whereby an obvious loop circuit is completed for energizing in series the upper and lower windings of the battery reverse relay R370. When thus energized the battery reverse relay R370 operates to interrupt at the contacts 372 and 374, the previously traced original loop circuit extending between the line relay R360 in the secretary selector 51 and the answer relay R430 in the line finder 41 and to complete, at the contacts 371 and 373, an obvious alternative loop circuit between the line relay R360 and the answer relay R430; whereby the direction of current flow over the loop circuit mentioned is reversed. When the direction of current flow through the windings of the answer relay R430 in the line finder 41 is thus reversed the latter relay operates as it is of the polarized type. Upon operating, the answer relay R430 completes, at the contacts 431, a connection including the windings 438 and 439 of the repeating coil 435 between the wipers 401 and 402 of the wiper set of the switching mechanism 400, whereby the windings 438 and 439 are operatively connected to the line conductors of the subscriber line 22 extending to the called subscriber substation T2. Accordingly, at this time, the calling subscriber substation T1 is operatively connected via the subscriber line 21, the local finder 27, the local connector 28, and the subscriber line 22 to the called subscriber substation T2; and the subscriber line 22 extending to the called subscriber substation T2 is operatively connected via the line finder 41, the trunk 61, the secretary connector 51, the trunk 82, the jack J2 and the cord circuit to the telephone instrument at the secretary operator position 11, whereby the subscriber at the calling subscriber substation T1 in the branch office 20 may converse with the operator at the secretary operator position 11 in the central office 10. More particularly, the operator at the secretary operator position 11 answers the call on the trunk 82 and gives the subscriber at the calling subscriber substation T1 the information which is to be given to calling subscriber substations in the absence of the subscriber at the called subscriber substation T2, which is rendered secretarial service at this time.

After the subscriber at the calling subscriber substation T1 in the branch office 20 has received the information mentioned from the operator at the secertary operator position 11 in the central office 10, he replaces the receiver upon its associated switchhook; however, the local finder 27 and the local connector 28 remain in their operated positions due to the operated position of the answer relay R430, completing, at the contacts 431, the previously traced loop circuit between the windings 438 and 439 of the repeating coil 435 and the local connector 28 via the subscriber line 22 and the operated wiper set of the switching mechanism 400. The operator at the secretary operator position 11 then withdraws the answer plug of the cord circuit from the jack J2, thereby to interrupt the previously traced loop circuit for energizing in series the upper and lower windings of the battery reverse relay R370 in the secretary connector 51, whereby the latter relay restores. Upon restoring, the battery reverse relay R370 in the secretary connector 51 interrupts, at the contacts 375, a previously completed multiple holding circuit for energizing the winding of the hold relay R350, interrupts, at the contacts 371 and 373, the previously traced alternative loop circuit extending between the answer relay R430 in the line finder 41 and the line relay R360 in the secretary connector 51, and completes, at the contacts 372 and 374, the previously traced original loop circuit between the answer relay R430 and the line relay R360. Accordingly, the direction of current flow over the trunk 61 between the answer relay R430 in the line finder 41 and the line relay R360 in the secretary connector 51 is reversed, whereby the answer relay R430 restores as it is of the polarized type. Upon restoring, the answer relay R430 interrupts, at the contacts 431, the previously traced loop circuit between the windings 438 and 439 of the repeating coil 435 and the local connector 28, whereby the local finder 27 and the local connector 28 are released.

When the local finder 27 is thus reelased the subscriber line 21 extending to the subscriber substation T1 is marked as idle to the local connectors having access thereto; and when the local connector 28 is thus released the subscriber line 22 extending to the subscriber substation T2 is marked as idle to the local connectors having access thereto. More particularly, when the local connector 28 is thus released, ground potential therein is removed from the control conductor C22B of the subscriber line 22, thereby to interrupt the previously traced original circuit for energizing the winding of the start relay R565, the previously traced holding circuit for energizing the winding of the cutoff relay R560 and the previously traced path for applying ground potential to the control conductor C22C of the subscriber line 22. The start relay R565 and the cutoff relay R560 in the secretary line circuit 32 restore; and the service relay R570 therein remains in its operated position, whereby secretarial service is maintained in force at the subscriber substation T2. When ground potential is removed from the control conductor C22C of the subscriber line 22 the previously traced holding circuit for energizing the lower winding of the test relay R460 in the line finder 41 is interrupted, thereby to cause the latter relay to restore. Upon restoring, the test relay R460 completes, at the contacts 463, a circuit, including the contacts 443 and the set of switch springs S413, for energizing the release magnet M409, whereby the latter magnet operates in order to release the wiper set and the vertical control wiper 404 of the switching mechanism 400, whereby the wiper set is returned to its normal rotary and vertical positions and the vertical control wiper 404 is returned to its normal vertical position. When the wiper set of the switching mechanism 400 is thus released the sets of switch springs S410 and S413 are actuated. More particularly, the set of switch springs S410 is actuated, whereby there is interrupted, at the contacts 412 thereof, the previously traced path for applying ground potential to the guard

conductor C472 in the cable 470 and there is completed, at the contacts 411 thereof, the previously traced path for applying battery potential by way of the lower winding of the test relay R460 to the guard conductor C472 in the cable 470. The removal of ground potential from and the application of battery potential to the guard conductor C472 in the cable 470 marks the line finder 41 as idle to the line finder distributor 34, whereby the line finder 41 may be preselected at this time by the line finder distributor 34 for further use. The set of switch springs S413 is actuated into disengagement, thereby to interrupt the previously traced circuit for energizing the release magnet M409, whereby the latter magnet restores.

Also, upon restoring, the test relay R460 interrupts, at the contacts 461, the previously traced loop circuit extending between the answer relay R430 in the line finder 41 and the line relay R360 in the secretary connector 51, whereby the line relay R360 restores, the answer relay R430 already occupying its restored position. Upon restoring, the line relay R360 in the secretary connector 51 interrupts, at the contacts 361, the previously mentioned circuit for energizing the winding of the hold relay R350, thereby to cause the latter relay to restore shortly thereafter, the hold relay R350 being of the slow-to-release type. Upon restoring, the hold relay R350 interrupts, at the contacts 353, the previously traced holding circuit for energizing the lower winding of the switch relay R320, thereby to cause the latter relay to restore. Also the hold relay R350 completes, at the contacts 352, a circuit, including the contacts 362 and the set of switch springs S307, for energizing the release magnet M306, thereby to cause the latter magnet to operate and release the wiper set of the switching mechanism 300, whereby the wiper set mentioned is returned to its normal rotary and vertical positions. When the wiper set of the switching mechanism 300 is thus released the set of switch springs S307 is actuated into disengagement, thereby to interrupt the previously traced circuit for energizing the release magnet C306 in order to cause the latter magnet to restore. At this time the secretary connector 51 is completely released and available for further use.

In view of the foregoing explanation it will be understood that the release of the local connector 28 is effected jointly by the subscriber at the calling subscriber substation T1 in the branch office 20 and by the operator at the answering secretary operator position 11 in the central office 10, whereby the local connector 28 is not released until both the subscriber at the calling subscriber substation T1 replaces the receiver upon its associated switchhook and the operator at the answering secretary operator position 11 withdraws the answer plug of the cord circuit from the jack J2. When the local connector 28 is thus released the line finder 21 and the secretary connector 51, connected together via the trunk 61 to form the link mentioned, are released, whereby the line finder 41 is marked as idle to the switching mechanism 200 in the line finder distributor 34.

In the foregoing explanation of the mode of operation of the line finder 41 to find the subscriber line 22 extending to the called subscriber substation T2 in response to the extension of the call thereto from the calling subscriber substation T1, it was assumed that the line finder 41 operated under the control of the line finder distributor 34, whereby the wiper set of the switching mechanism 400 found the contact set in the associated contact bank terminating the subscriber line 22. However, it may occur that for some reason the wiper set of the switching mechanism 400 in the line finder 41 fails to find the contact set in the associated contact bank terminating the subscriber line 22 extending to the called subscriber substation T2 during its operation in the rotary direction. In this case, the wiper set of the switching mechanism 400 is driven eleven steps in the rotary direction away from its normal rotary position without effecting operation of the test relay R460, in the manner previously explained. In this case, the set of switch springs S414 is actuated, whereby an obvious path, including the contacts 445, is completed for applying ground potential to the guard conductor C472 in the cable 470. This application of ground potential to the guard conductor C472 in the cable 470 completes a circuit, including the wiper 202 of the switching mechanism 200 and the engaged contact in the associated contact bank and the contacts 223, for energizing the magnet M206 and an obvious multiple path, including the contacts 207 and 227, for short-circuiting the winding of the test relay R220; whereby the magnet M206 operates and the test relay R220 restores. Upon restoring, the test relay R220 interrupts, at the contacts 223, the previously traced circuit for energizing the magnet M206, thereby to cause the latter magnet to restore and drive the wiper set of the switching mechanism 200 an additional step in the clockwise direction. Thus the wiper set of the switching mechanism 200 is operated to disengage the contacts in the associated contact bank terminating the conductors extending to the line finder 41 and to engage contacts in the associated contact bank terminating conductors extending to another line finder 42 etc., whereby operation of the last-mentioned line finder is initiated to hunt for the subscriber line 22 extending to the called subscriber substation T2, in the manner previously explained, and the start relay R440 in the line finder 41 restores in order to effect the release of this line finder in the manner previously explained. Thus it will be understood that, in the event any line finder preselected for use by the line finder distributor 34 is first operated to hunt for the subscriber line extending to a called subscriber substation rendered secretarial service and fails to find the subscriber line mentioned, the line finder distributor 34 operates in order to assign another idle line finder to hunt for the called subscriber line mentioned, and the previously selected line finder is released.

Discontinuing secretarial service at a subscriber substation in the branch office

When a subscriber at a subscriber substation in the branch office 20 wishes to have secretarial service discontinued he first initiates a call on the associated subscriber line. For example, in order to discontinue secretarial service at the subscriber substation T2, the subscriber thereat first initiates a call by removing the receiver from its associated switchhook; whereby the local line circuit 25 is controlled over the subscriber line 22. More particularly, the local line circuit 25 is controlled in order to cause ground potential to be applied to the control conductor C22B of the subscriber line 22 in order to mark the subscriber line 22 as busy to the local connectors having access thereto, as previously explained. This application of ground potential to the control conductor C22B of the

subscriber line 22 completes the previously traced circuit for energizing the winding of the start relay R565 in the secretary line circuit 32, whereby the latter relay operates. Upon operating, the start relay R565 initiates operation of the line finder distributor 34, whereby an idle line finder, such, for example, as the line finder 41, is assigned in the manner previously explained. The line finder 41 then operates in order to find the subscriber line 22 having a call thereon extending to the calling subscriber substation T2; whereby operation of the associated secretary connector 51 is controlled over the trunk 61 to seize the trunk 82 terminating in the jack J2 at the secretary operator position 11 in the central office 10, all in the manner previously explained. The operator at the secretary operator position 11 then answers the call on the trunk 82 and converses with the subscriber at the calling subscriber substation T2 in the branch office 20. The subscriber at the calling subscriber substation T2 then advises the operator at the secretary operator position 11 that the secretarial service being rendered the subscriber substation T2 is no longer required. The subscriber at the calling subscriber substation T2 then replaces the receiver upon its associated switchhook; and the operator at the secretary operator position 11 withdraws the answer plug of the cord circuit from the jack J2; whereby the established connection is released in the manner previously explained.

The operator at the secretary operator position 11 then inserts the call plug of the cord circuit into the jack J12 terminating the trunk 72 extending between the central office 10 and the branch office 20, the trunk 72 being terminated in the secretary service switch 71, as previously explained. The operator at the secretary operator position 11 then dials three digits over the trunk 72; the first digit being effective to operate the select switch 520 in order to indicate that secretarial service is to be discontinued. and the second and third digits being effective to operate the switching mechanism 500, thereby to select the secretary line circuit 32 associated with the subscriber line 22 extending to the subscriber substation T2. More particularly, in the present example, in order to discontinue secretarial service at the subscriber substation T2, the three digits 2, 2 and 2 are dialed; the first digit 2 indicating that secretarial service is to be discontinued at a subscriber substation and the second and third digits 2 and 2, respectively, identifying the secretary line circuit 32 individual to the subscriber line 22 extending to the subscriber substation T2.

More particularly, the secretary service switch 71 operates in response to the three digits 2, 2 and 2, in the manner previously explained, and, at the conclusion of the operation thereof, the control relay R555 restores, thereby to effect operation of the switch relay R550 in the manner previously explained. Upon operating, the switch relay R550 completes, at the contacts 552, the previously traced holding circuit for energizing the lower winding thereof and completes, at the contacts 551, the previously traced path for short-circuiting the upper winding thereof and for applying direct ground potential to the wiper 521 of the select switch 520, whereby ground potential is applied to the wiper 502 of the wiper set of the switching mechanism 500 and the engaged contact in the associated contact bank terminating the conductor C582. The application of ground potential to the conductor C582 completes an obvious path, including the contacts 571, for short-circuiting the winding of the service relay R570 in the secretary line circuit 32, thereby to cause the latter relay to restore. Upon restoring, the service relay R570 interrupts, at the contacts 571, a further point in the previously traced holding circuit for energizing the winding thereof, and interrupts, at the contacts 572, the previously traced connection between the winding of the start relay R565 and the control conductor C22B of the subscriber line 22. After the operator at the secretary operator position 11 has thus discontinued secretarial service at the subscriber substation T2, she withdraws the call plug of the cord circuit from the jack J12, thereby to effect the release of the secretary service switch 71, in the manner previously explained. At this time, secretarial service at the subscriber substation T2 is discontinued and this subscriber substation is rendered ordinary subscriber substation service at this time.

Local calls in the branch office

The setting up of local connections involving subscriber substation rendered ordinary subscriber substation service in the branch office 20 is entirely conventional. Similarly, the setting up of local connections involving subscriber substations rendered secretarial service, when such secretarial service is not in force, in the branch office 20, is entirely conventional. For example, when secretarial service at the subscriber substation T2 is not in force, the subscriber substation is rendered ordinary subscriber substation service in a conventional manner, in view of the fact that in the associated secretary line circuit 32 the service relay R570 occupies its restored position, whereby the winding of the start relay R565 therein is disconnected from the control conductor C22B of the subscriber line 22 extending to the subscriber substation T2.

Conclusions

In view of the foregoing it is apparent that a telephone system is provided which comprises a central office and a branch office; which system includes improved apparatus for rendering secretarial service to a relatively large group of subscriber substations in the branch office from a secretary operator position in the central office via a relatively small number of links or trunks extending between the branch office and the central office.

While one embodiment of the invention has been disclosed, it will be understood that various modifications may be made therein which are within the true spirit and scope of the invention.

What is claimed is:

1. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a link, an operator position, means controlled from said operator position for selecting any one of said lines and characterizing the selected line, line identity apparatus associated with said operator position, and means controlled by the extension of a call to any characterized one of said lines for setting up a connection from said one characterized line by way of said link to said operator position and for selectively operating said line identity apparatus to identify said one characterized line.

2. In a telephone system, a calling station, a

plurality of lines, means for extending a call from said calling station to any called one of said lines, a plurality of links fewer in number than said lines, an operator position, a numerical switch, means at said position for operating said switch directively thereby to characterize any desired one of said lines, line identity apparatus associated with said operator position, and means controlled by the extension of a call to any characterized one of said lines for setting up a connection from said one characterized line by way of an idle one of said links to said operator position and for selectively operating said line identity apparatus to identify said one characterized line.

3. In a telephone system, a calling station, a plurality of lines, automatic switching apparatus selectively controllable from said calling station to extend a call therefrom to any called one of said lines, an automatic switching link, an operator position, means controlled from said operator position for selecting any one of said lines and characterizing the selected line in either of two ways, line identity apparatus associated with said operator position, and means controlled by the extension of a call to any called one of said lines only if said called line is characterized in a particular one of said two ways for selectively operating said switching link to set up a connection from said one called line to said operator position and for selectively operating said line identity apparatus to identify said one called line.

4. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, an operator switchboard, a plurality of trunks accessible to said operator switchboard and individually corresponding to said lines, an automatic switch having access to said trunks, means controlled by the extension of a call to any called one of said lines for selectively operating said switch to select the one of said trunks corresponding to said one called line, thereby to initiate a call on said one trunk, means controllable from said operator switchboard for answering the call on said one trunk, and means for connecting said switch to said one called line.

5. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, an operator switchboard, a plurality of trunks accesible to said operator switchboard and individually corresponding to said lines, an automatic switch having access to said trunks, means controlled by the extension of a call to any called one of said lines for selectively operating said switch to select the one of said trunks corresponding to said one called line, thereby to initiate a call on said one trunk, means controllable from said operator switchboard for answering the call on said one trunk, and means controlled by the answering of the call on said one trunk for connecting said switch to said one called line.

6. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a first automatic switch having access to said lines, an operator switchboard, a plurality of trunks accessible to said operator switchboard and individually corresponding to said lines, a second automatic switch having access to said trunks, means controlled by the extension of a call to any called one of said lines for selectively operating operating said first switch to select said one called line and for selectively operating said second switch to select the one of said trunks corresponding to said one called line, thereby to initiate a call on said one trunk, means controllable from said operator switchboard for answering the call on said one trunk, and means for connecting together said first and second switches.

7. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a first automatic switch having access to said lines, an operator switchboard, a plurality of trunks accessible to said operator switchboard and individually corresponding to said lines, a second automatic switch having access to said trunks, means controlled by the extension of a call to any called one of said lines for selectively operating said first switch to select said one called line and for selectively operating said second switch to select the one of said trunks corresponding to said one called line, thereby to initiate a call on said trunk, means controllable from said operator switchboard for answering the call on said one trunk, and means controlled by the answering of the call on said one trunk for connecting together said first and second switches.

8. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a first automatic switch having access to said lines, an operator position, a second automatic switch, means controlled by the extension of a call to any called one of said lines for selectively operating said first switch to select said one called line and for selectively operating said second switch correspondingly, means controlled by the operation of said second switch for extending a call to said operator position and for identifying said one called line, means controllable from said operator position for answering the call extended thereto, and means for connecting together said first and second switches.

9. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a plurality of links, an operator position, means controlled by the extension of a call to any called one of said lines for extending a call from said one called line by way of an idle one of said links to said operator position, means controlled by the extension of a call over said one link for rendering it busy, means controllable from said operator position for answering the call on said one link, and means controlled jointly by the performance of a release operation at said calling station and by the performance of a release operation at said operator position for rendering said one link again idle.

10. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a link, an operator position, line identity apparatus associated with said operator position, means controlled by the extension of a call to any called one of said lines for extending a call over said link to said operator position and for selectively operating said line identity apparatus to identify said one called line, means controllable from said operator position for answering the call on said link, and means controlled by the answering of the call on said link for connecting said link to said one called line.

11. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a link, an operator position, line identity

apparatus associated with said operator position, means controlled by the extension of a call to any called one of said lines for extending a call over said link to said operator position and for transmitting a signal over said link individual to said one called line, means controlled by the signal transmitted over said link for selectively operating said line identity apparatus to identify said one called line, means controllable from said operator position for answering the call on said link, and means controlled by the answering of the call on said link for connecting said link to said one called line.

12. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines and for initiating the projection of ringing current thereover, a link, an operator position, line identity apparatus associated with said operator position, means controlled by the extension of a call to any called one of said lines for extending a call over said link to said operator position and for selectively operating said line identity apparatus to identify said one called line, means controllable from said operator position for answering the call on said link, means controlled by the answering of the call on said link for connecting said link to said one called line, and means controlled by the connection of said link to said one called line for arresting the projection of ringing current thereover.

13. In a telephone system, a calling station, a plurality of substations, automatic switching apparatus selectively controllable from said calling station to extend a call therefrom to any called one of said substations, an operator position provided with facilities for rendering secretarial service to said substations, apparatus temporarily operated under the control of said position to select any desired one of said substations, means controlled by said apparatus for characterizing the selected substation and maintaining it characterized after said apparatus has restored to normal at the end of its temporary operation, and means controlled by the extension of a call to any one of said substations so characterized for setting up a connection from said one characterized substation to said operator position.

14. In a telephone system, a first office including a calling station, a plurality of substations, and means for extending a call from said calling station to any called one of said substations; a second office including an operator position provided with facilities for rendering secretarial service to said substations; two trunks extending between said offices; means controllable over a particular one of said trunks but not over the other of said trunks for conditioning any one of said substations to receive secretarial service; and means controlled by the extension of a call to any one of said substations which is thus conditioned for setting up a connection from said one called substation by way of the other of said trunks to said operator position.

15. In a telephone system, a first office including a calling station, a plurality of substations, and means for extending a call from said calling station to any called one of said substations; a second office including an operator position provided with facilities for rendering secretarial service to said substations, and substation identity apparatus associated with said operator position; two trunks extending between said offices; means controllable over a particular one of said trunks but not over the other of said trunks for conditioning any one of said substations to receive secretarial service; and means controlled by the extension of a call to any called one of said substations which has been thus conditioned for setting up a connection from said one called substation by way of the other of said trunks to said operator position and for selectively controlling said substation identity apparatus over said other trunk to identify said one called substation.

16. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, an operator position, line identity apparatus associated with said operator position, a switch controllable from said operator position to select any one of said lines, means including said switch operated at times to institute interceptor service upon any selected one of said lines and operated at other times to discontinue interceptor service upon any selected one of said lines, and means controlled by the extension of a call to any called one of said lines upon which interceptor service is in force for setting up a connection from said one called line to said operator position and for selectively operating said line identity to identify said one called line.

17. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a plurality of relays individually associated with said lines, each of said relays including an operated position and a restored position and being provided with an operating circuit and a stick circuit and a path for shorting its stick circuit, means for selectively completing the operating circuits and the paths of said relays, means controlled when any one of said relays occupies its two positions respectively to institute and to discontinue interceptor service upon the associated line, an operator position, and means controlled by the extension of a call to any called one of said lines upon which interceptor service is in force for setting up a connection from said one called line to said operator position.

18. In a telephone system, a calling station, a plurality of lines, means for extending a call from said calling station to any called one of said lines, a plurality of relays individually associated with said lines, each of said relays including an operated position and a restored position and being provided with an operating circuit and a stick circuit and a path for shorting its stick circuit, an automatic switch operable selectively to complete the operating circuits and the paths of said relays, an operator position, means controllable from said operator position for selectively operating said switch, means controlled when any one of said relays occupies its two positions respectively to institute and to discontinue interceptor service upon the associated line, and means controlled by the extension of a call to any called one of said lines upon which interceptor service is in force for setting up a connection from said one called line to said operator position.

19. In a telephone system, a substation, means for extending a call to said substation, means for extending a call from said substation, means selectively controllable to institute and to discontinue interceptor service at said substation, an operator position, and means controlled by the extension of all calls either to or from said substation when interceptor service is in force there-

at for setting up a connection from said substation to said operator position.

20. In a telephone system, a plurality of substations, means for extending a call to any called one of said substations, means for extending a call from any calling one of said substations, means common to said substations selectively controllable to institute and to discontinue interceptor service at any one of said substations, an operator position, and means controlled by the extension of a call either to or from any one of said substations when interceptor service is in force thereat for setting up a connection from said one substation to said operator position.

21. In a telephone system, a plurality of substations, means for extending a call to any called one of said substations, means for extending a call from any calling one of said substations, means common to said substations selectively controllable to institute and to discontinue interceptor service at any one of said substations, an operator position, substation identity apparatus asociated with said operator position, and means controlled by the extension of a call either to or from any one of said substations when interceptor service is in force thereat for setting up a connection from said one substation to said operator position and for selectively operating said substation identity apparatus to identify said one substation.

22. In a telephone system, a substation, means for extending a call to said substation, means for initiating a call at said substation, means selectively controllable to institute and to discontinue interceptor service at said substation, an operator position, and means controlled either by extension of all calls to said substation and by the initiation of all calls at said substation when interceptor service is in force thereat for setting up a connection from said substation to said operator position.

23. In a telephone system, a substation, automatic switching apparatus, means for operating said switching apparatus to extend a call to said substation, whereby said substation is marked as busy to said switching apparatus, means controlled by the initiation of a call at said substation for marking said substation as busy to said switching apparatus, means selectively controllable to institute and to discontinue interceptor service at said substation, an operator position, and means controlled by the marking of said substation as busy to said switching apparatus when interceptor service is in force thereat for setting up a connection from said substation to said operator position.

CLARENCE E. LOMAX.

CERTIFICATE OF CORRECTION.

Patent No. 2,358,017. September 12, 1944.

CLARENCE E. LOMAX.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 14, first column, line 74, claim 6, strike out the word "operating" first occurrence; and second column, line 21, claim 7, before "trunk" insert --one--; page 15, second column, line 26, claim 16, after "identity" insert --apparatus--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of November, A. D. 1944.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)