Jan. 30, 1940. E. WOCHINGER 2,188,520

PARTY LINE TELEPHONE SYSTEM

Filed May 25, 1936 4 Sheets-Sheet 1

FIG. 2

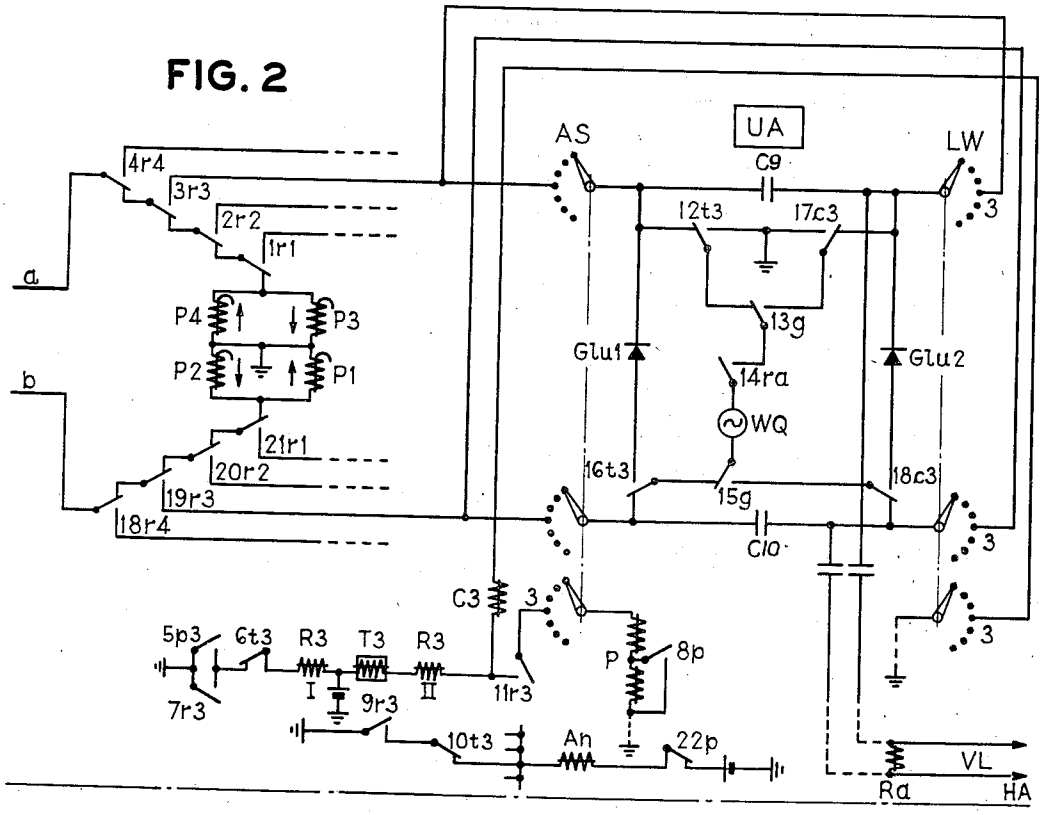
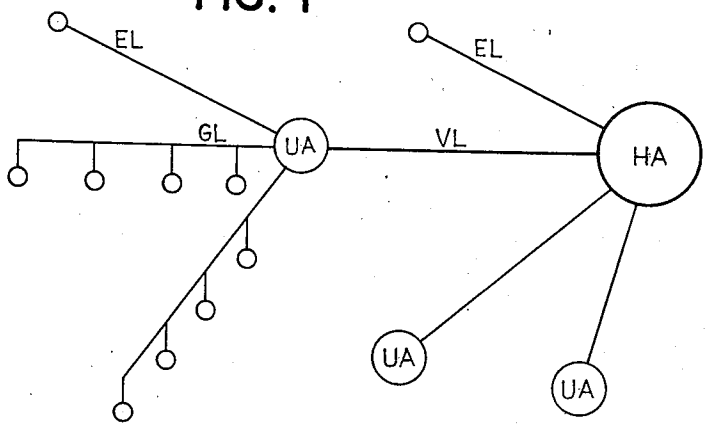


FIG. 1



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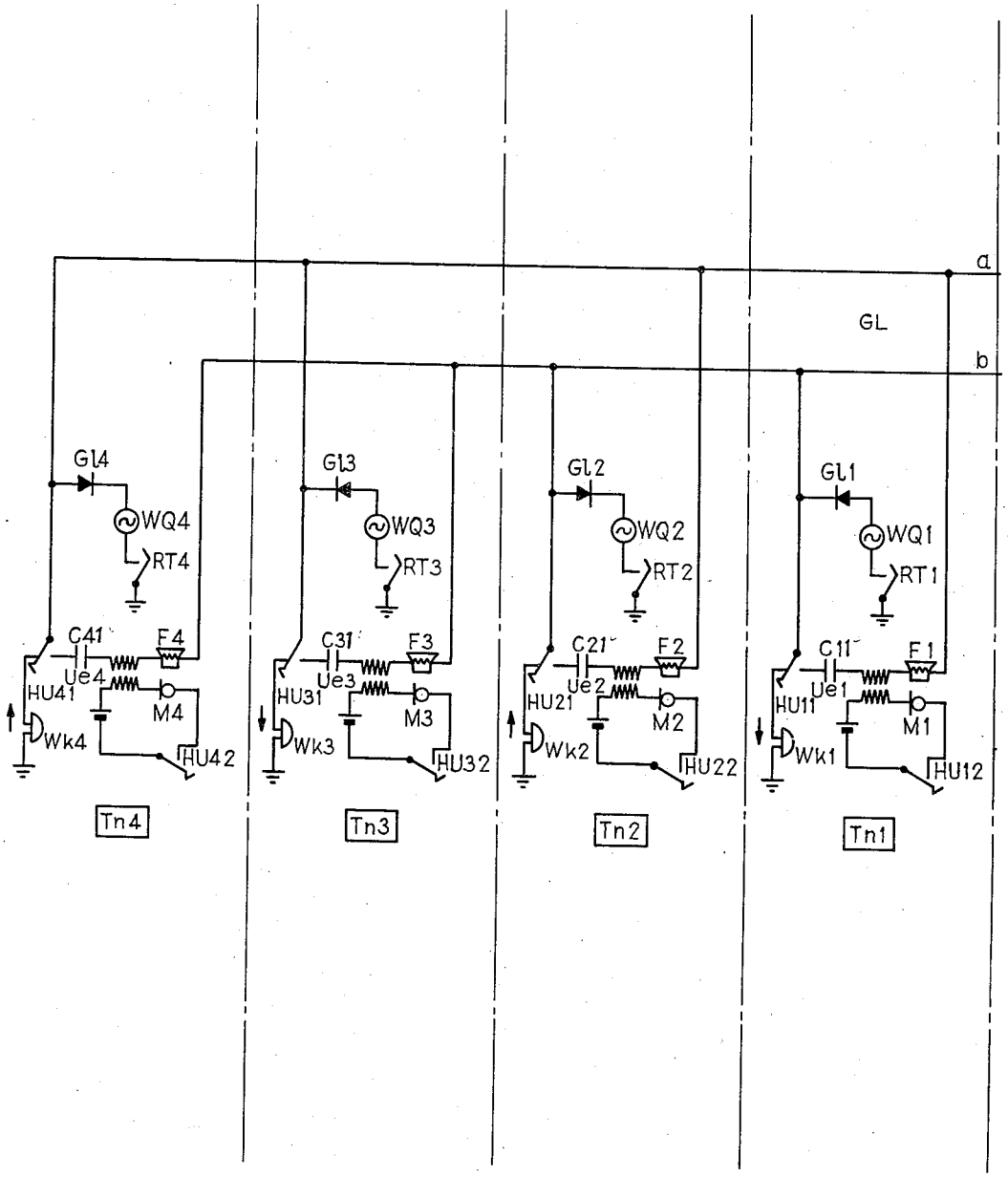
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PARTY LINE TELEPHONE SYSTEM

Filed May 25, 1936 4 Sheets-Sheet 2

FIG. 3



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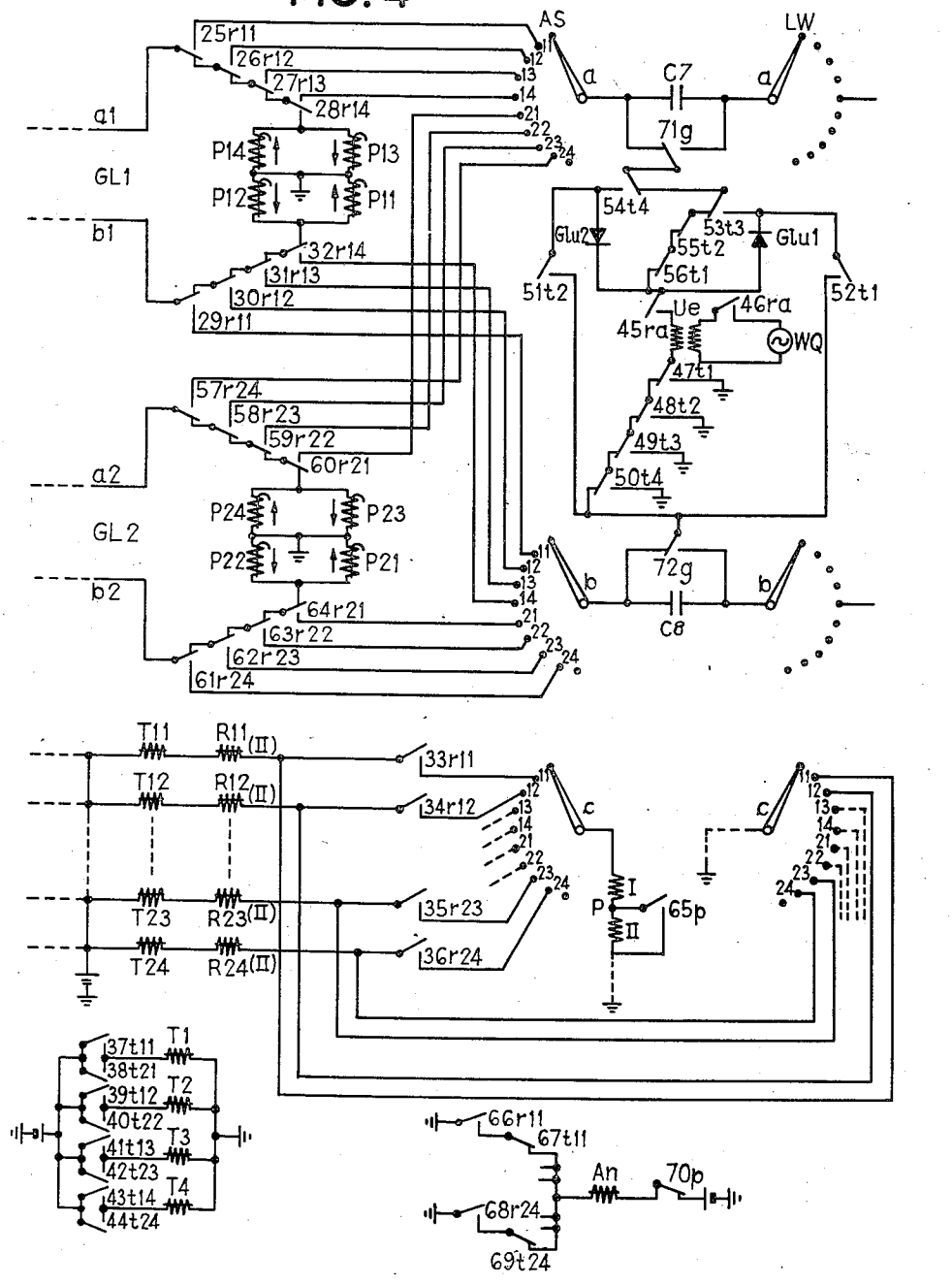
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PARTY LINE TELEPHONE SYSTEM

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FIG. 4



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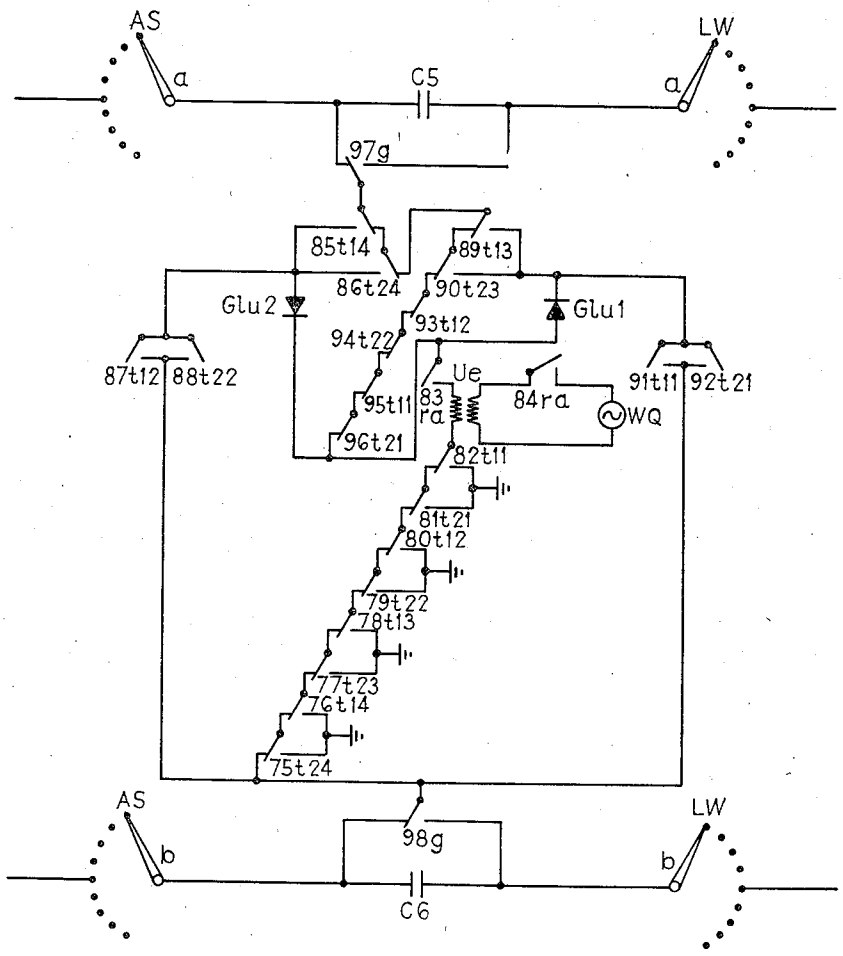
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PARTY LINE TELEPHONE SYSTEM

Filed May 25, 1936 4 Sheets-Sheet 4

FIG. 5



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Patented Jan. 30, 1940 2,188,520

UNITED STATES PATENT OFFICE

2,188,520

PARTY LINE TELEPHONE SYSTEM

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Application May 25, 1936, Serial No. 81,550
In Germany June 13, 1935

15 Claims. (Cl. 179—17)

For simplifying the service for subscribers in remote communication systems, and more especially in telephone systems, arrangements have been known which register a call proceeding from a subscriber's station in an exchange associated with this station in the event of connecting paths for establishing a desired connection not being available at the time. After a connecting path becomes free a revertive call is then set up to the calling station thereupon this can initiate the establishment of the desired connection in a manner corresponding to the particular remote control system.

The present invention aims at providing this simplification in service also for subscribers connected to party lines, while at the same time simplifying the construction of the connecting devices at the exchange. When the revertive call is set up to the calling station only the ringing device in the station in question must be operated, just as in the case of an incoming call to a party line, while the other subscribers of the party line must not be disturbed unnecessarily. This involves difficulties since when a connecting path becomes free and is connected to the party line from which a call has been sent out, the usual selection of ringing current occurring in the case of incoming calls under the influence of the station setting up this call, does not take place.

The selection of the ringing current for the revertive calling station is effected according to the invention in that switching means become operative under the influence of call initiating impulses transmitted by subscribers of the party lines which prepare the connection of the ringing current characterizing the calling station. The switching means are conveniently under the influence of the devices registering the call.

The arrangement according to the invention is applicable with special advantage to systems in which party lines are connected to small subsidiary exchanges which are connected to a main exchange over only one or a few connecting lines. If the traffic associated with the subscribers connected to the small subsidiary exchange is only dealt with by the cooperation of an operator in the main exchange no special supervision need be effected by the operator when using the arrangement according to the present invention, either in the case when the call which she receives, which possibly has been recorded for a certain time in the subsidiary exchange, proceeds from an individual subscriber's line or a party line. Thus it is not necessary to communicate to her a special signal characterizing the kind of station which is calling, the traffic over the connecting lines between the subsidiary and main exchanges being thus reduced. When she is ready to attend to the call the operator initiates the revertive call to the calling subscriber from the subsidiary exchange so that if the latter is connected to a party line the ringing current necessary is connected up automatically in dependence upon the ringing device associated individually with the subscriber's station at the subsidiary exchange.

In place of an operator in the main exchange the initiating impulse for transmitting ringing current from the subsidiary exchange can also be given automatically if the system is completely automatic, as soon as a group selector or impulse recording device, etc., arranged in the main exchange is ready to receive numerical impulses.

Embodiments of the invention are shown on the attached drawings but the invention is not to be considered to be limited to these embodiments.

Fig. 1 is a diagrammatic representation of the arrangement of the main exchange (HA) and the subsidiary exchanges (UA) with the individual subscriber's lines and the party lines.

Figs. 2 and 3 show the switching details of the party line and the devices provided for a station in the subsidiary exchange, while in Figs. 4 and 5 various embodiments of the devices needed for a plurality of party lines in one subsidiary exchange are shown.

In the arrangement shown in the embodiment, a plurality of branch stations Tn are connected to a common line GL and these stations can be called selectively from an exchange by current in different directions over different leads of the common line. Though only four subscribers are represented as being connected to the party line the invention is not limited to this number. It is also possible for example by the combination of various kinds of current transmission to call more than four subscribers. The party line is connected to an automatic subsidiary exchange UA to which further party lines and also individual subscribers' lines may be connected. The subsidiary exchange UA is connected over one or more connecting lines VL to a main exchange HA to which likewise several other subsidiary exchanges or individual subscribers' lines or party lines may be connected (see Fig. 1).

If a subscriber of the subsidiary exchange desires to set up a call he operates his magneto and thus transmits a calling signal to the sub-

sidiary exchange. As soon as the call reaches the operator in the main exchange she replies to the calling subscriber. Since, however, she is not in a position to know which subscriber has called, and since the other subscribers of the party line are not to be disturbed by the revertive call on the part of the operator, switching devices are provided in the subsidiary exchange which connect up ringing current corresponding to the calling subscriber when the operator makes the revertive call. When the calling subscriber replies the operator answers and sets up the desired call.

The subscribers' stations connected to the party line are constructed as simple local battery stations whose calling device (bell, indicating flap or the like) is normally connected between one lead of the party line and earth. The calling device is so arranged that it only responds to current in a particular direction. It can for example consist of an alternating current bell which is held in a particular rest position by a spring. Current sources WQ are provided as ringing devices and may, for example, be magnetos. In order to generate direct current alternating current magnetos may be used from which either direct current can be taken off by the application of a suitable commutator ring or to which rectifiers G1 can be connected which rectify both half waves of the alternating current or which suppress one half of the waves.

The switching operation will be explained in so far as is necessary for understanding the invention by reference to the embodiments in Figs. 2, 3, and 4.

Outgoing calls

If the subscriber T*n*3 for example wishes to set up a call he takes up his receiver, listens to find out whether the common line is already in use, and in the event of the line being free operates his calling key RT3. This key can for example be connected with the magneto in the known way and be automatically brought into the working position when the magneto is operated. The alternating current source WQ3 is thereby connected up and pulsating direct current flows over the rectifier G13 on the one hand over the bells W*k*3 and W*k*4 to earth, whereby on account of the particular current direction only the bell W*k*3 is operated, and on the other hand over the *a*-lead of the party line to the subsidiary exchange (Fig. 2) and there over contacts 4*r*4, 3*r*3, 2*r*2, 1*r*1 and the two polarized relays P3 and P4 in parallel to earth. On account of the particular direction of the calling current only the calling relay P3 of the two polarized relays in the subsidiary exchange energizes. This switches over its contact 5*p*3 whereby relay R3 (winding I) is connected over the contacts 6*t*3 in the rest position. This relay locks up over its contact 7*r*3 independently of relay P3. In addition by the switching over of contacts 3*r*3 and 19*r*3 the calling relays (P1 to P4) in the subsidiary exchange are disconnected from the party line so that calls on the part of further subscribers cannot operate the same party line in the subsidiary exchange. Relay P3 also releases. Furthermore in order to definitely prevent further calls and thus to avoid the possible faulty operation of subsequently arranged connecting devices a busy signal is connected to the party line in dependence upon the energizing of relay R3 (in a manner not shown), which indicates to all subscribers who remove their receivers that the line is already engaged. This buzzer can be disconnected as soon as the connection is established. In the subsidiary exchange (UA) only those switching devices are represented in Fig. 2 which are necessary for the establishment of a connection on the part of subscriber of station T*n*3. Thus Figs. 2 and 3 give no complete picture of the devices provided in the subsidiary exchange, these are rather to be seen from Figs. 4 and 5.

The call of subscriber T*n*3 is now stored in the subsidiary exchange UA by the operation of relay R3 and is transmitted to the main exchange as soon as a connecting line to the main exchange becomes free. On account of the energizing of relay R3 a circuit for the starting relay A*n* of the call finder in the subsidiary exchange is set up over contacts 9*r*3, 10*t*3 and 22*p*, so that the call finder AS as soon as it is free is set in motion. When it tests on the calling line characterized by the contact 11*r*3 it is brought to rest by the energizing of relay T3; earth, battery, relay T3, relay R3 (winding II), contact 11*r*3, wiper of the call finder on contact 3, relay P (windings I and II) and earth. Through the energizing of relay T3, winding I of relay R3 is disconnected. Relay R3, however, remains energized in the calling circuit of the call finder over its winding II.

The calling signal of the calling subscriber is now transmitted over the connecting line VL to the main exchange in the known manner (not represented) and there effects the switching on of a call signal. When the operator in the main exchange answers the calling subscriber does not reply since after transmitting his call signal he has replaced his receiver. The operator of the main exchange therefore transmits ringing current over the connecting line which energizes relay R*a*. This operates and switches on the alternating current source WQ in the subsidiary exchange. Since relay T3 is energized the following circuit is now established: earth, contact 12*t*3, contact 13*g*, contact 14*ra*, alternating current source WQ, contact 15*g*, contact 16*t*3 in the working position, rectifier G*lu*1, wiper of call finder AS, contact 3*r*3 in the working position, contact 4*r*4 in the rest position, *a*-lead of the party line, switchhook contact HU31, bell W*k*3 and earth. The ringing current also flows over the bell W*k*4 of the subscriber's station T*n*4; on account of the particular direction of the ringing current only the bell W*k*3 of the calling station is, however, operated. Subscriber T*n*3 replies and informs the operator in the main exchange of the number of the connection desired. The further establishment of the call takes place in the known manner.

Incoming calls

When the subscriber T*n*3 is called by the main exchange the final selector LW in the subsidiary exchange is set on the contact of this subscriber in the known manner which will not be described in detail. Thereupon the circuit is first set up for relay C3: earth, battery, relay T3, relay R3 (winding II), relay C3, wiper of the final selector on contact 3 and earth. In this circuit relays T3 and R3 also energize. In addition relay R*a* is energized by the ringing current transmitted from the main exchange and thus the source WQ of alternating current in the subsidiary exchange is switched on. Since an incoming call is in question the contacts 13*g* and 15*g* are switched over. The following circuit is thus set up: earth, contact 17*c*3 in the working position, contacts 13*g* and 14*ra*, alternating cur-

rent source WQ, contact 15*g* in the working position, contact 18*c*3 in the working position, rectifier G*lu*2, wiper of final selector on contact 3, contact 3*r*3 in the working position, contact 4*r*4 in the rest position, *a*-lead of the party line, switchhook contact HU31, bell W*k*3, and in parallel switchhook contact HU41 and bell W*k*4, and earth. On account of the particular current direction the bell W*k*3 now rings. When the called subscriber replies conversation can take place.

The establishment of calls from and to the other subscribers connected to the party line is effected in a corresponding manner. For the sake of clearness the switching devices (R3, T3, C3) associated with the subscriber T*n*3 in the subsidiary exchange are represented; corresponding switching devices (R1, R2, R4, T1, T2, T4, C1, C2, C4) are provided for the other subscribers. Only one alternating current source is provided, however, which can be connected in a suitable manner, over the contacts of the particular relays (T1 to T4 or C1 to C4) and the particular rectifier (G*lu*1 or G*lu*2) taken into use, to the party line.

In order to give an idea of the appearance of the arrangements in the subsidiary exchange when several party lines are connected to the latter, two party lines (GL1 and GL2) with their appropriate devices are represented in Fig. 4. As in Fig. 3 for example four subscribers' stations (T*n*11 to T*n*14 and T*n*21 to T*n*24) are connected to each of the party lines. Individual contacts are provided for subscribers at the call finder and final selector. It is unnecessary, however, to provide a special source of ringing current in the subsidiary exchange for each party line. The switching devices of the subsidiary exchange are considerably simplified if only a single source WQ of ringing current is provided for all the subscribers (individual and party lines). The particular current in a definite direction which is necessary can then be supplied over contacts of only four ringing current connecting relays (T1 to T4) which are common to all the party lines and over common rectifiers (G*lu*1 and G*lu*2) since for each of the party lines always the same kind of ringing current (positive or negative current) over the *a*- or *b*-lead) is necessary. The common ringing current connecting relays are then controlled by the relays (T11 to T14, T21 to T24) individual to the calling or called station. Such an arrangement is particularly of advantage when a large number of party lines are connected to the subsidiary exchange since in this way a large number of contacts of the individual relays connected in the ringing circuit is avoided.

The switching operations are as follows: If subscriber T*n*11, for example, calls, relay P11 is energized in the subsidiary exchange UA over the lead *b*1 of the party line GL1, contacts 29*r*11, 30*r*12, 31*r*13, 32*r*14, relay P11 and earth. Relay P11 energizes and energizes relay R11 in the same manner as described with reference to Fig. 2 (the details being omitted for the sake of clearness). The circuit for the starting relay A*n* of the call finder is completed over contact 66*r*11 and 67*t*11, so that this is set in operation if the connecting devices of the subsidiary exchange are free. When the call finder tests on the calling line relay P energizes and short circuits its high resistance winding II over contact 65*p* and also by opening contact 70*p* disconnects the starting relay A*n*. Furthermore relay T11 energizes in the following circuit: earth, battery, relay T11, relay R11 (winding II) contact 33*r*11, wiper *c* of the call finder on contact 11, relay P (winding I) contact 65*p* and earth. The ringing-circuit-connecting-relay T1 is energized over contact 37*t*11 and prepares the ringing current over contact 47*t*1 and 52*t*1.

The call received in the subsidiary exchange is transmitted to the main exchange in the manner already described with reference to Fig. 2. When the operator answers she recalls the subsidiary exchange whereby contacts 45*ra* and 46*ra* are closed so that the source of ringing current is switched on. Ringing current therefore passes through the calling station T*n*11 over earth, contact 47*t*1, repeater U*e*, contact 45*ra*, rectifier G*lu*1, contacts 52*t*1 and 72*g*, wiper *b* of the call finder on contact 11, contact 29*r*11, lead *b*1 of the party line, bell W*k*11 of the calling station and earth. The bell rings and the calling subscriber replies.

Corresponding switching operations occur when another subscriber of the party line GL1 sets up a call. Thus for example in the case of a call from subscriber T*n*14 relay P14 is energized and causes the operation of relays R14 and T14 and thus of the ringing relay T4.

If a subscriber of the party line GL2, for example TN24, sets up a call, relay P24 is energized and causes the call finder to be set in operation over relay R24. When this tests on the calling line line relay T24 is operated and over contact 44*t*24 connects up relay T4. This prepares the connection of the corresponding ringing current over contacts 50*t*4 and 54*t*4. When the revertive call is received from the operator of the main exchange the contacts 45*ra* and 46*ra* are again brought to the working position and connect up the source WQ of alternating current. Ringing current then passes over the following circuit: earth, contact 50*t*4, contacts 49*t*3, 48*t*2 and 47*t*1, repeater U*e*, contact 45*ra*, rectifier G*lu*2, contacts 54*t*4, 71*g*, wiper *a* of the call finder on contact 24, contact 57*r*24, *a*2-lead of the party line GL2, bell W*k*24 of the calling station and earth. The bell rings and the calling subscriber replies.

In the case of an incoming exchange call the final selector LW is set on the contact of the desired subscriber, for example T*n*23. Relays R23 and T23 are then energized over the *c*-lead of the final selector, so that relay T3 is switched over on contact 42*t*23. In addition since the call is an incoming call the contacts 71*g* and 72*g* are brought into the operating position in a manner not described. When now the source WQ of ringing current is connected up over contacts 45*ra* and 46*ra*, ringing current passes over the following circuit: earth, contacts 49*t*3, 48*t*2, 47*t*1, repeater U*e*, contact 45*ra*, rectifier G*lu*1, contact 53*t*3 in the working position, contact 71*g* in the working position, *a*-wiper of the final selector on contact 23, contact 58*r*23 in the working position, contact 57*r*24 in the rest position, A2-lead of the party line GL2, bell W*k*23 of the station to be called, and earth. The bell rings and the called subscriber replies.

If an individual subscriber of the subsidiary exchange is called, ringing current flows over the two leads of the subscriber's line, i. e., over the *a*-wiper of the final selector on the contact of the desired individual subscriber, contacts 71*g*, 54*t*4, 53*t*3, 55*t*2, 56*t*1, 45*ra*, repeater U*e*, contacts 47*t*1, 48*t*2, 49*t*3, 50*t*4, 72*g* and *b*-wiper of the final selector on the contact of the desired subscriber, since none of the relays T1 to T4 is energized.

If only a few party lines are connected to a subsidiary exchange, it may be simpler to omit the common ringing current connecting relays T1 to T4 and to effect the connection of ringing current directly over contacts of the individual subscribers' relays (T11 to T14, T21 to T 24). Such an arrangement is shown in Fig. 5, all non-relevant details being omitted.

If for example, subscriber Tn24 calls, the following ringing circuit is closed when the revertive call is received from the main exchange: earth, contact 75t24 in the working position, contacts 76t14, 77t23, 78t13, 19t22, 80t12, 81t21, 82t11, repeater Ue, contact 83ra, rectifier Glu2, contact 86t24, 85t14, 97g, a-wiper of the call finder on contact 24 and then in the manner already shown in Figs. 2 and 4 to the calling subscriber. Corresponding switching operations take place when calls are set up by other subscribers.

What is claimed is:

1. In a telephone system, party lines terminating in an exchange, means in said exchange individual to each station on said lines operated in response to the initiation of a call for storing said call, an individual ringing circuit in said exchange for each station on said lines for selectively signalling the corresponding station, an automatic switch for finding and connecting with said stored call, and switching means responsive to said connection for preparing the ringing circuit individual to the calling station and for terminating the storage of said call.

2. In a party line telephone system as claimed in claim 1 wherein said switching means are individual to each subscriber's station.

3. In a telephone system, a local exchange, party lines terminating in said local exchange, a main exchange, a trunk line connecting said exchanges, an individual ringing circuit for each station on said lines in said local exchange, switching means in said local exchange operated responsive to a party on one of said lines initiating a call for preparing the ringing circuit individual to the party initiating the call, and means in said local exchange controlled over said trunk line from the main exchange for completing said prepared circuit to selectively signal the calling party.

4. In a telephone system, party lines terminating in an exchange, an individual ringing circuit in said exchange for each station on said lines, a plurality of ring controlling means in said exchange, each ring controlling means being common to all the stations on said lines having the same ringing characteristics for selectively ringing such stations, individual switching means for each station on said lines, and means responsive to the initiation of a call from a station on one of said lines for operating the corresponding individual switching means and the corresponding common ring controlling means to prepare the ringing circuit individual to the calling station.

5. In a telephone system, party lines terminating in an exchange, an individual ringing circuit for each station on said lines, rectifiers in said exchange for inclusion in said ringing circuits, switching means in said exchange automatically operated responsive to the initiation of a call from a station on one of said lines for preparing the ringing circuit individual to the calling station by connecting one of said rectifiers in said ringing circuit, and means for thereafter completing the prepared circuit to signal said calling station.

6. In a telephone system, party lines terminating in an exchange, an individual ringing circuit for each station on said line, rectifiers in said exchange for inclusion in said ringing circuits, and switching means in said exchange operated in response to a station on one of said lines being called for preparing the ringing circuit individual to the called station by automatically connecting one of said rectifiers in said individual ringing circuit.

7. In a telephone system, a party line comprising two line conductors terminating in an exchange, an individual ringing circuit for each station on said line, a pair of rectifiers in said exchange poled in opposite directions for inclusion in said ringing circuits, and automatic switching means in said exchange for each station on said line, operative responsive to a call to prepare the individual ringing circuit of a particular station on said line by connecting said ringing circuit to either line conductor of said line in series with either rectifier.

8. In a telephone system, a party line terminating in an exchange, a plurality of line relays in said exchange connected to said line, each line relay being individual to a station on said line, means at each station for transmitting ringing current over said line to said exchange to operate only the corresponding line relay, an individual ringing circuit for each station on said line, and means responsive to the operation of said line relay for preparing the corresponding individual ringing circuit to selectively signal the calling station.

9. In a telephone system, a party line terminating in an exchange, a plurality of line relays in said exchange connected to said line, each line relay being individual to a station on said line, means at each station for transmitting ringing current over said line to said exchange to operate only the corresponding line relay, an individual ringing circuit for each station on said line, means responsive to the operation of said line relay for preparing the corresponding individual ringing circuit to selectively signal the calling station, and means controlled by said last means for preventing subsequent operation of corresponding line relays in case other stations on said line transmit ringing current to said exchange over said line.

10. In a telephone system, a party line terminating in an exchange, a plurality of stations on said line, a line relay in said exchange individual to each station, connecting means individual to each station normally connecting said relays to the conductors of said line, means operative by a calling subscriber initiating a call for operating only the line relay corresponding to the calling station, and means operated responsive to the operation of said line relay for disconnecting said line relays from said line.

11. In a telephone system, a party line terminating in an exchange, a plurality of stations on said line, a magneto and a rectifier at each station, the magnetos and rectifiers at a plurality of said stations connected in series to one of the line conductors of said line and the magnetos and rectifiers at the other stations connected in series to the other line conductor of said line, the said rectifiers connected to the same line conductors being poled differently to transmit different kinds of current over said line conductors in response to the operation of said magnetos, and means individual to each station connected to said line at the exchange selec-

tively operated in accordance with said transmission for marking the calling station at said exchange.

12. In a telephone system, a party line terminating in an exchange, a plurality of stations on said line, means at each station for transmitting a particular kind of current over a particular one of the line conductors of said line in response to the initiation of a call, and means individual to each station connected to said line at the exchange selectively operated in accordance with the particular line conductor and kind of current transmitted for marking the calling station at said exchange.

13. In a telephone system wherein subscribers on a party line initiate calls by means of hand generators, a party line, a local exchange terminating said party line, a plurality of switching means at said exchange, each of said switching means individual to one subscriber on said line and operated responsive to the initiation of a call to prepare a signalling circuit for the call initiating subscriber, switching equipment in the exchange for further extension of a call, and means for transmitting ringing current to signal the call initiating subscriber only when the switching equipment is in condition for extending the call.

14. In a telephone system, an exchange, a party line terminating therein, means in said exchange individual to each station on said party line operable from its associated calling station only, call storing means in said exchange individual to each station on said line, a signalling circuit for each station on said line, one of said first mentioned means operated responsive to the initiation of a call by a subscriber on said line to operate the call storing means individual to that subscriber to store the call and to disconnect all of the other of said first mentioned means from said line, and means controlled by said call storing means for preparing the signalling circuit individual to the calling station to permit the transmission of signalling current to signal only the station initiating the call.

15. In a telephone system, an exchange, a party line terminating in said exchange, an individual ringing circuit for each party on said line, switching means in said exchange automatically operated responsive to the initiation of a call by any one of said subscribers, and means controlled by the operation of said switching means for storing said call and for preparing a ringing circuit to selectively signal only the subscriber initiating the call.

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