

March 31, 1942.

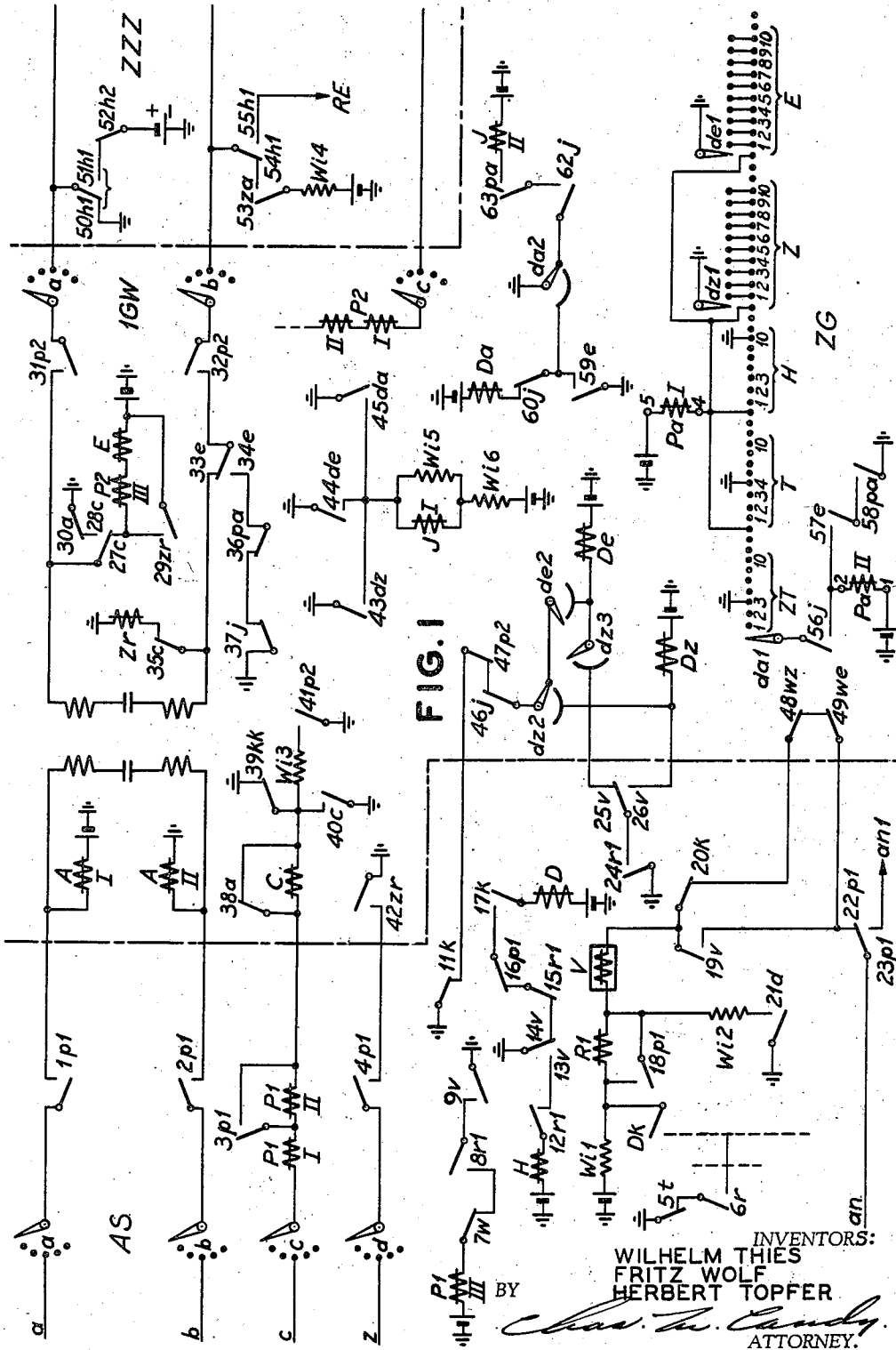
W. THIES ET AL

2,277,802

TELEPHONE SYSTEM

Filed Jan. 13, 1939

2 Sheets-Sheet 1



March 31, 1942.

W. THIES ET AL

2,277,802

TELEPHONE SYSTEM

Filed Jan. 13, 1939

2 Sheets-Sheet 2

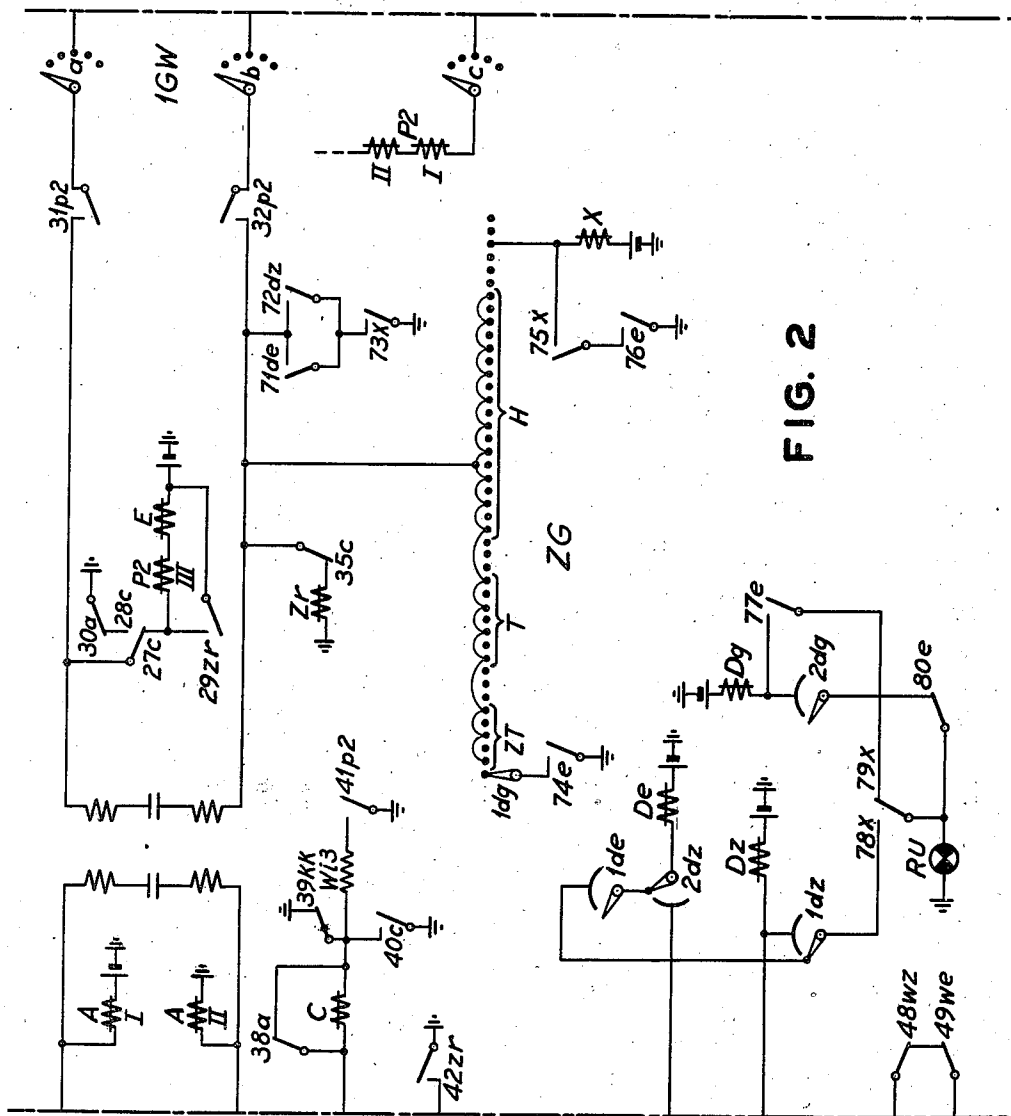


FIG. 2

INVENTORS:
WILHELM THIES
FRITZ WOLF
HERBERT TOPFER
BY *Chas. M. Candy*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,277,802

TELEPHONE SYSTEM

Wilhelm Thies, Falkenhain, near Finkenkrug,
Fritz Wolf, Birkenwerder, and Herbert Töpfer,
Berlin-Siemensstadt, Germany, assignors to
"Fides Gesellschaft für die Verwaltung und
Verwertung von gewerblichen Schutzrechten
mit beschränkter Haftung," Berlin, Germany, a
corporation of Germany

Application January 13, 1939, Serial No. 250,696
In Germany January 24, 1938

19 Claims. (Cl. 179—7.1)

The invention relates to a circuit arrangement for determining calling subscribers' sets in remote signalling, particularly telephone installations with finder switches.

Arrangements are already known in connection with finder switches for determining the callers' subscribers station in which additional wipers are provided on the finder switch which characterize particular positions in an impulse sender corresponding to the call number of the subscriber after the finder switch has been set on the calling subscriber.

In systems with normal finder switches (without special wipers for determining the subscriber) this arrangement is not required; also it is naturally not possible with known means to convert an already existing system with normal finder switches so that it can determine the calling subscriber without considerable alterations. The known arrangement has, however, the disadvantage that between the finder switch and the impulse sender complicated wiring is necessary.

The present invention provides a method for determining the number of the calling subscriber and indicating the same in a registering device without these disadvantages, and this is done by having the impulses for setting the finder switch on the calling junction line transmitted to switching devices which take up the position corresponding to the number of the calling subscriber and on the coming into effect of a registration signal for the call number send out corresponding impulse series over one conductor of a connection to a registering device.

In Figs. 1 and 2 embodiments of the invention are shown in which an up and around selector is used as a finder switch.

When a subscriber removes his receiver for the purpose of making a call, relay R, not shown, individually associated with the subscriber is energized. By the closing of contact 6r earth potential is connected to a particular decade contact of the finder switch (the tens group in which the calling subscriber is included is characterized by this decade contact). Further, by means of the contact of relay R, not shown, earth potential is connected to the starting up line so that the following circuit is completed: earth, potential, starting line an, contact 22pl, rotary off-normal contacts 49we, 48wz, off-normal contact 20k (opened as long as the finder switch is away from its normal position), winding of the relay V, winding of the relay R1, resistance W1l, battery, earth. In this circuit the relays R1 and V operate and the latter has a delayed release of its armature. By the closing of the two contacts 12r1 and 13v the following circuit is completed for the vertical magnet H of the finder switch AS: earth, contacts 13v, 12r1, vertical magnet

H, battery, earth. The finder switch is stepped on to the first contact bank. Simultaneously the relay P1 operates over earth, contacts 9v, 8r1, rotary off-normal contact 7w (opened at the first rotary step of the finder switch AS), winding III of relay P1, battery, earth. Relay P1 is a differential relay. It partially energizes in this circuit and operates all its contacts with the exception of contact 23pl, which is only closed in the second stage of the operation of the relay P1. At contact 18pl it short-circuits the relay R1, which thus releases after a short period and at the contacts 8r1 and 12r1 opens a circuit for the relay P1 and the vertical magnet H. When the contacts of the relay P1 have restored, then by the opening of the contact 18pl the short-circuit for the relay R1 is removed and this relay can operate again, and by closing the contacts 12r1 and 8r1 connect the relay P1 and the vertical magnet again. The interaction between the relays R1 and P1 and the vertical magnet H continues until the wiper DK which is moved vertically in the finder switch reaches the decade contact to which over contact 6r the coil relay, not shown, and contact 5t of the cut-off relay, earth potential is connected. When this is the case, then earth is connected directly to resistance W1l and the relays R1 and V are short-circuited. These relays restore. The following circuit is then completed for the rotary magnet D of the finder switch AS: earth, contacts 14v, 15r1, 16pl, off-normal contact 17k (closes as long as the finder switch is away from its normal position), rotary magnet D, battery, earth. The finder switch is rotated by one step in the decade on which it has been set. The decade contact is also opened at the wiper DK and the earth potential connected over contacts 6r and 5t is disconnected. The rotary magnet D has a contact 21d, which is now closed and the following circuit is completed for the relay R1: earth, contact 21d, resistance W12, winding of the relay R1, resistance W1l, battery, earth. Relay R1 operates in this circuit and opens its contact 15r1, whereby the rotary magnet is disconnected and sets back its contact 21d. In this way the relay R1 is disconnected and by the closing of the contact 15r1 the circuit for the rotary magnet D is completed again. The interaction between the rotary magnet D and the relay R1 continues until the wipers of the call finder AS reach the contact to which the calling subscriber is connected. Then the following test circuit is completed: battery potential not shown, test wiper c, wiper c of the finder switch AS, windings I and II of the relay P1, contact 38a, off-normal contact 39kk (closed as long as the first group selector 1GW is in its normal position), earth. In this circuit the test relay P1 operates completely. It switches through the talking conductors at the

contacts $1p1$ and $2p1$, short-circuits the high resistance winding II of the relay P1 at contact $3p1$ for the purpose of guarding the calling subscriber, switches through the metering conductor at contact $4p1$ and at contact $16p1$ interrupts the circuit for the rotary magnet D of the finder switch, so that it is stopped. By the opening of the contact $22p1$ the start conductor is disconnected from the finder switch and at contact $23p1$ is connected over the line $an1$ with the next finding switch.

The impulses for setting the finder switch AS are simultaneously transmitted to the devices (discriminators), which undertake the characterizing of the number corresponding to the calling subscriber. By using a rotary selector as a finder switch the setting of the discriminator results from an impulse series. In the case of the up and around finder switch shown here the discriminator device is set by means of two series of impulses.

In detail this takes place as follows:

The impulse relay for the vertical magnet H of the finder switch as well as for the rotary magnet D is provided by the relay R1. Thus during the setting of the finder switch on a particular decade and also during the vertical movement of the finder switch, the relay V is energized. The impulses affecting the vertical magnet H are thus transmitted to the selector Dz over the following circuit (characterizing selector for the tens digit of the number of the calling subscriber): earth, contacts $24r1$, $26v$, magnet Dz, battery, earth. Corresponding to the number of vertical steps the wipers of the switch mechanism are operated to a particular contact by means of the magnet Dz, so that the wiper $dz1$ connects a particular contact, in the tens contact series Z of the meter sending ZG, with earth potential. Directly after the stepping up of the finder switch its rotation takes place in the decade on which it has been set. As previously described during the rotary movement of the finder switch the relay V restores. The rotary steps of the finder switch are thus transmitted to the magnet De of the switch mechanism over the following circuit which characterizes the units digit of the number of the calling subscriber: earth, contacts $24r1$, $25v$, wiper $dz3$ in operative position, magnet De, battery, earth. Corresponding to the number of rotary steps of the finder switch the wipers of the switch mechanism are operated to a particular position by means of the magnet De, so that over wiper del a particular contact of the meter sender ZG in the unit contact bank E is connected with earth potential.

After the setting of the finder switch and switching through of the talking conductors by the contacts $1p1$ and $2p1$ of the test relay P1, the following circuit is completed for the relay A in the first group selector: earth, winding II of relay A, lower talking conductor b , contact $2p1$, wiper b of the finder switch, subscriber's loop, upper talking conductor a , wiper a of the finder switch contact $1p1$, winding I of relay A, battery, earth. The relay A operates and by removing the short-circuit at contact $38a$ connects the seizing relay C of the group selector. Relay C closes its contact $40c$ and locks up independently of the off-normal contact $39kk$.

The subscriber now sets up the desired connection by sending out dial impulses. The setting of the first group selector is not important for the invention and is therefore not shown. After the setting of the group selector in known

manner, here not described in detail, the test relay P2 is energized over its windings I and II and over the test wiper c of the group selector. By the closing of contacts $31p2$ and $32p2$ the talking conductors are switched through. The dial impulse series which follow are transmitted to succeeding connecting devices over contacts $30a$, $28c$, $31p2$, wiper a of the group selector.

Further operations for setting up the connection are not essential for the subject of the invention. When the required subscriber replies an indication is given in known manner to the repeater ZZZ (only indicated here) for the time zone metering by which the device is set to determine the fee and therefore the number of metering impulses to be sent out. The transmitting of the metering impulse results in known manner only at the termination of the connection.

When the calling subscriber replaces his receiver after the conversation is over the relay A in the group selector restores and by closing its contact $38a$ short-circuits the relay C again and causes it to restore. The release of the connection is prevented, however, in that the following locking circuit is closed: earth, battery, winding of relay E, winding III of relay P2, contacts $27c$, $31p2$, wiper a of the group selector IGW, contact $50h1$ of a relay H1 arranged in the repeater for time-zone metering but not shown, earth. In this circuit the energizing of the relay P2 is further maintained while the relay E however cannot operate. In spite of the opening of contact $40c$ the locking conductor is further connected with earth potential over resistance and contact $41p2$ so that the release of the line to the subscriber is in the first place prevented. The repeater ZZZ for the time zone metering now sends out the number of metering impulses which has been determined. This takes place by the repeated energizing of metering impulse relay Za. By means of contact $53za$ the metering impulses are transmitted to the metering relay Zr in the group selector over the following circuit: earth, battery, resistance $Wi4$, contacts $53za$, $54h1$, lower talking conductor, wiper b of the group selector, contacts $32p2$, $33e$, $35c$, winding of the metering relay Zr, earth. The relay Zr by means of contact $42zr$ transmits the metering impulses over the metering conductor z , contact $4p1$, wiper d of the finder switch to the meter of the calling subscriber, not shown, which is now stepped according to the time and the zone. At the end of the metering the relay H1, not shown, in the repeater ZZZ is energized and by opening the contact $54h1$ disconnects the metering battery from the lower talking conductor and over contact $55h1$ connects the registering device RE to this device which is only partly shown and indicates the appropriate data which have been determined. The registering device can be controlled by the dial impulses sent out and thus the registering elements are displaced which make possible the recording of the desired number. Further other registering elements can be controlled by the metering impulse relay, so that the number of metering periods to be reckoned can be indicated. Further the registering device indicates the number of the calling subscriber.

The latter operation takes place in the following manner: by the closing of the contact $51h1$, relay H2 not shown in the repeater ZZZ connects an additional potential to the upper talking conductor over contact $52h2$ by which the relay E is energized, while the relay P naturally remains

energized over its winding III. By the closing of contact 34e the first impulse is sent out to the registering device over the lower talking conductor. By the closing of the contact 59e the magnet Da of the meter sender ZG is connected, in whose contact bank various contact positions are characterized by the connection of earth potential. The energizing circuit for the magnet Da extends as follows: earth, contacts 59e, 60j, magnet Da, battery, earth. The wiper of the meter sender is operated to the first contact so that the wiper da1 stands on the first contact of the tens sending contact group ZT. The magnet Da operates its contact 45da and thereby connects the slow relay J as follows: earth, contact 45da, winding I of relay J (parallel to the resistance Wi5), resistance Wi6, battery, earth. Relay J opens a point in the circuit indicated above the magnet Da at contact 60j. The magnet Da is thus deenergized and opens contact 45da, so that relay J is disconnected. This further closes the contact 60j and completes the energizing circuit for the magnet Da again. The wipers of the meter sender are thus moved to the next contact. These operations continue until the wipers of the meter sender have executed a complete rotation. The relay J which is energized and deenergized for each step of the wiper of the meter sender, by closing its contact 37j sends a definite number of impulses to the registering impulse over the following circuit: earth, contacts 37j, 36pa, 34e, 32p2, wiper b of the group selector, contact 55h1 in the repeater ZZZ, registering device RE.

Since for the above embodiment a meter sender is provided for every hundred subscribers, the digits of the call number of the last two positions are characterized by the connection of calling potential. It is assumed that the meter sender shown is associated with the 340th of a hundred group. In the ten thousands contact groups of the meter sender, the contact 3 is thus characterized by the connection of earth potential, in the thousands group contact 4, and in the hundreds group contact 10.

It will be assumed that the calling subscriber has the number "34057." When in the course of the impulse sending the wiper da1 reaches the contact 3 of the tens sending group ZT, i. e., three impulses are sent out to the registering device RE by means of contact 37i, so that after the operation of the relay J the following circuit is closed for the relay Pa: earth, contact 3 of the tens sending group ZT, wiper da1, contact 56j, winding II of relay Pa, battery, earth. The relay Pa connects itself in the following holding circuit: earth, contacts 58pa, 57e, winding II of relay Pa, battery, earth. As a result of this the contact 36pa is opened and remains open in the first place so that by the succeeding operations of contact 37j no impulses are sent out to the registering device RE. The wiper da1 is thus connected over the succeeding contacts without the contact steps being registered. When the wiper da1 reaches the contact immediately in front of the thousandth-contact group T the wiper da1 connects with the winding I of relay Pa so that after the operation of the relay J the following circuit is completed: earth, contacts 58pa, 57e, 56j, wiper da1, winding I of relay Pa, battery, earth. The winding I of relay Pa is wound in the opposite direction to winding II as is clear from the drawings, since the winding II connects positive to the upper soldering pin 2 and the negative to the lower pin 1 while the winding I connects the positive to the lower pin 4 and negative to the higher pin 5.

Relay Pa is therefore released and thus interrupts the holding circuit of contact 58pa. The contact 36pa is again closed and the sending of impulses to the registering device begins again on the release of relay J and closing of contact 37j.

Corresponding to this second characterizing digit "4" of the call number, four impulses are now sent out to the registering device RE. When the wiper da1 reaches the contact 4 of the thousands-contact group T, after the sending out of these impulses, then at the operation of the relay J a circuit is completed for the winding II of relay Pa: earth, contact 4 of the thousands-group T, wiper da1, contact 56j, winding II of relay Pa, battery, earth. The circuit of the registering device is again interrupted at contact 36pa, and remains interrupted during the resulting stepping on of the wipers of the meter sender since the relay Pa locks up over contact 58pa. When the wiper da1 reaches the contact immediately in front of the hundreds-contact group H the wiper da1 is again in contact with the reverse winding I of the relay Pa so that this relay restores, and by closing contact 36pa makes it possible to send out impulses from the registering device again.

Corresponding to the third digit "0" of the subscriber's number, ten impulses are transmitted to the registering device. When the wiper da1 reaches the contact 10 of the hundreds contact group H, after the sending out of this impulse series a circuit is completed again for the winding II of the relay Pa and it is maintained energized by means of the holding contact 58pa. The circuit for the registering device is again interrupted at contact 36pa. When the wiper da1 reaches the contact directly preceding the tens-contact group Z in the course of its further motion the relay Pa is again restored by means of the reverse winding I and the sending out of impulses to the registering device is prepared by the closing of contact 36pa. The next, the penultimate digit of the connecting number, may be taken as "5." It is therefore assumed that the finder switch which is connected in order to come to rest on a decade on which the calling subscriber is connected, has executed 5 vertical steps. These 5 vertical steps will be repeated as previously described to the magnet Dz whose wiper dz1 has connected earth potential to the contact 5 of the tens-contact group Z. When the wiper da1, in the course of its movement and after the transmitting of the 5 impulses to the registering device RE, reaches the contact 5 of the tens-group Z the relay Pa is energized in the following circuit: earth, battery, winding II of relay Pa, contact 56j, wiper da1, contact 5 in the tens-contact group Z, wiper dz1, earth. By the opening of the contact 36pa the circuit for the registering device is broken. The relay Pa locks up again by closing its contact 58pa. The wiper da1 is stepped on but no impulses are sent out to the registering device. Only when the wiper da1 in the course of its further movement, reaches the contact directly preceding the units-contact group E is relay Pa restored again by the action of the reverse winding I of relay Pa, and by the closing of contact 36pa prepares the further sending out of impulses to the registering device. If it is assumed that the last digit of the number of the calling subscriber is "7" the wiper da1 by means of the 7 rotary steps for the finder switch, is set on the contact 7 of the units-group E in order to reach the calling subscriber. Finally, 7 impulses are sent out to the registering device. When the wiper da1 reaches

the contact 7 in the units-group E a circuit is completed for the relay Pa once more: earth, battery, winding II of relay Pa, contact 56j, wiper da1, contact 7 in the units-contact group E, wiper del, earth. The relay Pa locks up again by closing its contact 58pa. By the opening of contact 36pa the circuit for the registering device is interrupted so that by the further stepping on of the register sender the registering device is not influenced. The wipers of the register sender are stepped on to the home position where the following circuit is completed for the relay J over winding II: earth, wiper da2 in rest position, contacts 62j, 63pa, winding II of relay J, battery, earth. Relay J remains energized in this circuit until the relay Pa is restored so that the magnet Da of the meter sender ZG can receive no further impulses. The release of the relay Pa results by action of the registering device. Thus if 5 impulses are recorded in the registering device for characterizing the number of the calling subscriber, then by some operation (for example mechanical) the contact 52h2 in the repeater ZZZ is opened. Thus the seizing circuit in which the relays E and P2 were energized is interrupted. After the release of the relay E, the contact 57e is opened and thus the holding circuit for the relay Pa is finally broken. By the opening of the contact 63pa the circuit for the winding II of relay J is also interrupted.

In the registering device after all the data for the recording of the information had been received the registering operation, for example the printing operation, is carried out in known manner.

By the setting up of the seizing circuit the relay P2 is also restored. By the opening of contact 41p2 earth potential is removed from the locking conductor so that the test relay P1 of the finder switch is released. By the closing of contact 16p1 the rotary magnet of the finder switch is connected: earth, contacts 14v, 15r1, 16p1, off-normal contact 17k, rotary magnet D, battery, earth. By the closing of contact 21d the relay R1 is connected in the manner already described, and interrupts the circuit for the rotary magnet at 15r1. By means of the contact 21d of the rotary magnet the relay R1 is disconnected again so that the circuit for the rotary magnet D is again closed. The alternate play between the rotary magnet D and relay R1 continues until the finder switch has reached its normal position.

When this has happened the off-normal contact 11k of the finder switch is closed and accordingly the following circuit is completed: earth, contacts 11k, 47p2, 46j, wiper dz2 in the operating position, magnet Dz, battery, earth. The wipers of the magnet Dz are then stepped on. The magnet Dz has a contact 43dz which connects the relay J so that at contact 46j the circuit indicated above for the magnet Dz is interrupted. By the opening of contact 43dz the relay J is disconnected and the circuit for the magnet Dz is completed at the contact 46j. The alternate play between the magnet Dz and relay J continues until the wipers of the magnet Dz have reached their home positions.

Then the following circuit is completed for magnet De: earth, contacts 11k, 47p2, 46j, wiper dz2 in home position, wiper de2 in operating position, magnet De, battery, earth. Also the magnet De has a contact 44de which connects the relay J and the latter interrupts the circuit for the magnet De at contact 46j. By means of the interaction between the magnet De and

the relay J the wipers of the magnet De stepped on until they have reached their home positions. Thus all the devices are restored to their normal positions.

In the above a connection is described over the repeaters ZZZ i. e. a high valued connection. When it is required to register the call number for a local connection it is only necessary to bring about the connection of an additional potential on the reply of the called set from the final selector onwards by means of which the relay E affecting the registering is energized.

Fig. 2 shows a further embodiment of the subject of the invention which is so arranged that in contrast to the arrangement according to Fig. 1 the operations for repeating the number of the calling subscriber in the registering device and the switching devices, are simplified. In Fig. 2 only parts of the first group selector are shown i. e., the part which in Fig. 1 is connected between the two dotted separate lines. The finder switch AS situated in front of the group selector and the repeater ZZZ situated behind it correspond accurately to the corresponding organ of Fig. 1 with the exception that contact 11k in the finder switch is dispensed with in the arrangement according to Fig. 2.

In precisely the same way as in the arrangement according to Fig. 1 the impulses for setting the finder switch in the two impulse trains, i. e. for setting up the finder switch to a definite contact bank, and then rotating the switch on to the calling subscriber, are repeated to both switch mechanisms by means of magnets Dz and De. In contrast to the arrangement according to Fig. 1 special wires of these switch mechanisms for characterizing the tens and units positions of the calling subscriber in the contact bank of the meter sender ZG are not necessary. For this reason, the meter sender ZG can be simplified as it only serves to repeat the group characterization, i. e. the first three digits of the call number.

The operations so far as they are different from the arrangement according to Fig. 1 take place as follows: when the calling subscriber hangs up his receiver at the termination of the connection the seizing relay C of the group selector is released at the contact 38a, in the manner described. At contact 27c the seizing circuit is set up at which only relay P2, the test relay of the group selector, is maintained energized while the relay E is not yet operated. When the metering impulses have been repeated an additional potential is connected in the repeater ZZZ which also brings up the relay E. The magnet Dg of the meter sender ZG is disconnected in the following manner: earth, relay interrupter RU, contacts 79x, 77e, magnet Dg, battery, earth. Under the influence of the relay interrupter the wipers of the meter sender are not stepped on. In this way the wiper 1dg serves to repeat the impulse series for the registering device RE in the repeater ZZZ by which the group characterization comprising the first three digits of the number of the calling subscriber (ten thousands, thousands, hundreds) is indicated. Each time when the wiper 1dg reaches the contact which is connected up, an impulse is sent out for registering over the following path: earth, contact 14e, wiper 1dg of the meter sender ZG lower talking conductor, contact 32p2, wiper b of the group selector and further to the registering device RE in the repeater ZZZ (in Fig. 1). As is clear from Fig. 2 by itself, three impulses are sent out in the first place by means of the wiper 1dg and thus

indicate in the registering device that the ten thousands digit of the call number is a "3." Accordingly, there are three disengaged contacts in the contact bank. When the wiper *ldg* is stepping over these contacts a switching operation is undertaken in the registering device in known manner by which a registering element is prepared by the impulse series characterizing the thousands digit. The wiper *ldg* is then set over the thousands contact group T and sends four impulses to the registering device. There are now three disengaged contacts and there again follows a switching operation in the registering device which prepares a registering element to receive the hundreds digit. The wiper *ldg* is then connected over the hundreds contact group H and thus sends 10 impulses to the registering device. Thus of the five figure number, the three first digits "340" have been indicated in the registering device, and with the aid of the relay interrupter RU the meter sender is stepped on until its wiper *ldg* has reached the contact by which the relay X is connected. This relay then operates in the following circuit: earth, contact *74e*, wiper *ldg*, winding of relay X, battery, earth. The relay X locks up in the following circuit: earth, contacts *76e*, *75x*, winding of relay X, battery, earth. The relay X opens its contact *79x* and thus the impulse circuit for the magnets Dg, so that the meter sender ZG remains operated. By the closing of contact *78x* the relay interrupter RU is connected to the magnet D_z to which the vertical steps of the finder switch were repeated. The magnet D_z receives impulses from the relay interrupter RU over the following path: earth, relay interrupter RU, contact *78x*, wiper *ldz* in operating position, magnet D_z, battery, earth. The magnet D_z has a contact *72dz* which is closed each time the magnet is energized. In this way an impulse is transmitted to the registering device RE over the following path: earth, contacts *73x*, *72dz*, lower talking conductor, contact *32p2*, wiper *b* of the group selector and further to the registering device RE (in Fig. 1). The registering device therefore takes up as many impulses by means of the contact *72dz* as are necessary to step on the switch mechanism with the magnet D_z from its set position to its home position. Thus the complementary number is transmitted to the switch mechanism D_z over the registering device. The registering element which records the tens digit of the call number must therefore be provided with an inverted series of numbers. When the wipers *ldz* and *2dz* of the switch mechanism with the magnet D_z have reached their normal positions the magnet De to which the rotary steps of the finder switch have been transmitted, is under the control of the relay interrupter RU: earth, relay interrupter RU, contact *78x*, wiper *ldz* in its zero position, wiper *ldz* in operating position, wiper *2dz* in its zero position, magnet De, battery, earth. The magnet De also has a contact *71de* which is closed for every energization of the magnet and transmits impulses to the registering device RE in the repeater ZZZ over the following path: earth, contacts *73x*, *71de*, lower talking conductor, contact *32p2*, wiper *b* of the group selector and further to the registering device (Fig. 1). Also in this case the complementary numbers of the switch mechanism are transmitted to the registering device by means of the magnet De so that the meter series of the registering element must be inverted in order to record the units digit in the same manner as for recording the tens digit. When the wiper *ldz*

has reached its normal position the circuit for the magnet De is interrupted over this wiper.

When the registration of the call number is completed then as described, the relay E in the group selector is restored by means of the repeater ZZZ. The magnet Dg of the meter sender is then connected over the following path: earth, relay interrupter RU, contact *80e*, wiper *2dg* in operating position, magnet Dg, battery, earth. Under the influence of the relay interrupter the meter sender is stepped on to its home position where the above indicated circuit is disconnected at wiper *2dg*.

All remaining operations correspond to those previously described in connection with Fig. 1.

What is claimed is:

1. In a telephone system, a register, subscribers' lines, means responsive to the initiation of a call from one of said lines for registering in said register the number of the calling line, and means controlled by said register after the call has been completed for transmitting a code of impulses corresponding to the number of said calling line.

2. In a telephone system, a register, subscribers' lines, means for extending a connection from a calling one of said lines to a called one of said lines, means controlled during the extension of said connection for registering in said register the number of the calling line, means controlled by said register after the call has been completed for transmitting over said connection impulse trains corresponding to the number of said calling line, and means preventing the release of said connection until said impulse trains have been transmitted.

3. In a telephone system, subscribers' lines, a finder switch operated responsive to a call on one of said lines to search for and seize the calling line, means operated concurrently with said operation of the finder switch and controlled by said finder switch to register the number of the calling line, and means controlled by said means after the call has been completed to transmit a code of impulses corresponding to the number of the calling line.

4. A telephone system as claimed in claim 3, wherein said finder switch comprises a two-motion switch, and wherein said first means includes a first register switch operated during the vertical movement of said finder and a second register switch operated during the rotary movement of said finder.

5. In a telephone system, subscribers' lines, a finder switch operated responsive to a call on one of said lines to search for and seize the calling line, a register, means controlled by said finder switch during said operation thereof for transmitting to said register impulses characterizing said calling line, and means controlled by said register after a variable interval of time for transmitting impulses corresponding to the impulses received from said means thereby to identify the calling line.

6. In a telephone system, subscribers' lines, a finder switch operated responsive to a call on one of said lines to search for and seize the calling line, a register, means controlled by said finder switch during said operation thereof for transmitting to said register impulses characterizing said calling line, means thereafter operated at will to transmit a signal to said register, and means controlled by said register upon receipt of said signal for transmitting impulses corresponding to the impulses received from said means.

7. In a telephone system, subscribers' lines, a finder switch operated responsive to a call on one of said lines to search for and seize the calling line, a register, means controlled by said finder switch during said operation thereof for transmitting to said register impulses characterizing said calling line, means for extending a connection from the calling line to a called line, means effective at times upon termination of the call for maintaining said connection for an interval of time, and means controlled by said register during said interval for transmitting over said connection impulses identifying the calling line.

8. In a telephone system, subscribers' lines, a finder switch, a register switch, means effective upon the initiation of a call by one of said lines for operating said two switches synchronously thereby to connect said finder switch with the calling line and set said register switch in a position corresponding to the number of said calling line, and means controlled by said register switch after the call has been completed to transmit a code of impulses corresponding to the number of said calling line.

9. In a telephone system, subscribers' lines, a finder switch, a register switch, means effective upon the initiation of a call by one of said lines for operating said two switches synchronously thereby to connect said finder switch with the calling line and set said register switch in a position corresponding to the number of said calling line, and means controlled by said register switch a variable interval of time after said positioning thereof for transmitting a code of impulses corresponding to the number of said calling line.

10. In a telephone system, subscribers' lines, a switch having access to said lines, a register, two impulsing circuits, means responsive to a call on one of said lines for transmitting impulses concurrently over said two circuits, means responsive to the impulses transmitted over one of said circuits to operate said switch step by step in search for the calling line, means responsive to the impulses transmitted over the other of said circuits to operate said register, means responsive to said switch finding said calling line for halting the transmission of impulses over both of said circuits, and means controlled by said register after a variable interval of time to transmit impulses corresponding to the impulses received over said other circuit.

11. In a telephone system, subscribers' lines, a finder switch, a register switch having a normal position, means effective upon the initiation of a call from one of said lines for operating said two switches synchronously thereby to connect said finder switch with the calling line and move said register switch from its normal position a distance depending upon the number of the calling line, means subsequently operated at will to transmit a signal to said register switch, means controlled by signal for restoring said register switch step-by-step to said normal position, and means operated by said switch during said restoration thereof to normal for transmitting impulses to identify the calling line.

12. In a telephone system, subscribers' lines, a finder switch having access to said lines, means effective upon the initiation of a call from one of said lines to operate said finder switch step-by-step in search for the calling line, means for registering the number of steps taken by said switch in finding the calling line, and means controlled by said registering means after the

call has been completed for transmitting a train of impulses complementary in number to the number of steps taken by said finder switch.

13. In a telephone system, subscribers' lines, a two-directional finder switch having access to said lines, means effective upon initiation of a call from one of said lines to operate said switch step-by-step in search for the calling line, means for counting the number of steps taken in each of said two directions by said switch in finding the calling line, means controlled by said last means after the call has been completed for transmitting a plurality of trains of impulses, certain of said trains containing a predetermined number of impulses, and the number of impulses in two of said trains depending respectively upon the number of steps taken by said switch in said two directions.

14. A telephone system as claimed in claim 13, wherein the number of impulses in each of said two trains of impulses is complementary to the number of steps taken by said switch in a corresponding one of said two directions.

15. In a telephone system, subscribers' lines, means for extending a call from one of said lines to another thereof, a register, means for registering the identity of the calling line in said register before the termination of said call, and means controlled by said register responsive to the termination of said call for transmitting impulses corresponding to the identity of said calling line as registered in said register.

16. In a telephone system, subscribers' lines, a register, means responsive to the initiation of a call from one of said lines for registering in said register the identity of the calling line, and means controlled by said register after the call has been terminated for transmitting impulses corresponding to the registered identification of said calling line.

17. In a telephone system, subscribers' lines, a register, means responsive to the initiation of a call from one of said lines for registering in said register the identity of the calling line, and means controlled by said register after a variable interval of time for transmitting impulses corresponding to the registered identification of said calling line.

18. In a telephone system, a calling line, a called line, each of said lines having a designation individual thereto, a link including a register, means including an automatic switch operated to connect said calling line to said link, means controlled by said automatic switch and operated concurrently with said operation of said automatic switch for detecting the designation of said calling line and for registering the detected designation in said register, and means for connecting said link to said called line, thereby to complete a connection from said calling line by way of said link to said called line.

19. In a telephone system, subscribers' lines each having a designation individual to that line, a finder switch, a register switch, means effective upon the initiation of a call by one of said lines to operate said two switches synchronously thereby to cause said finder switch to seize the calling line and said register switch to register the designation of said calling line, and means then operated to complete a connection extending over said finder switch from said calling line to a desired other one of said subscriber's lines.

WILHELM THIES.
FRITZ WOLF.
HERBERT TÖPFER.