July 26, 1938. H. ENGEL 2,124,913

TELEPHONE SYSTEM

Filed Nov. 13, 1935 2 Sheets-Sheet 1

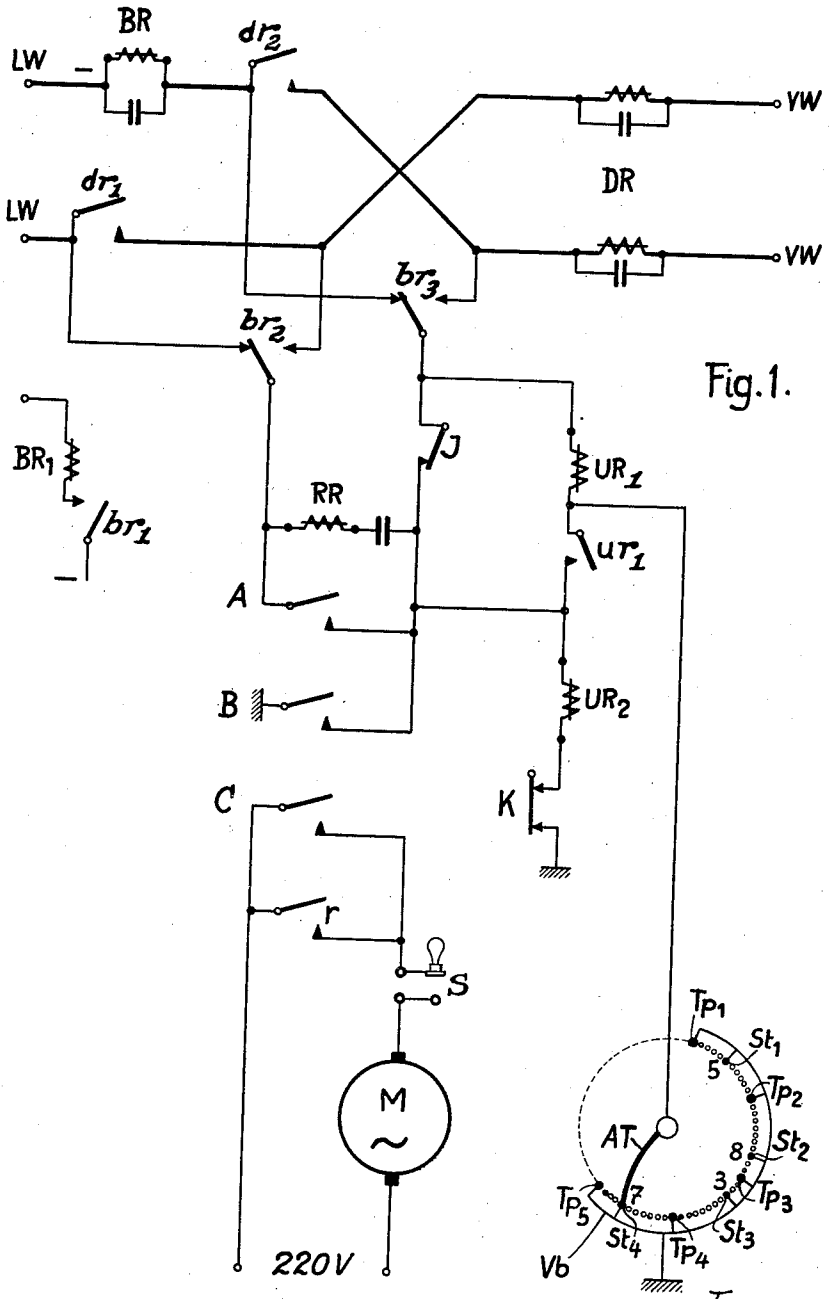


Fig. 1.

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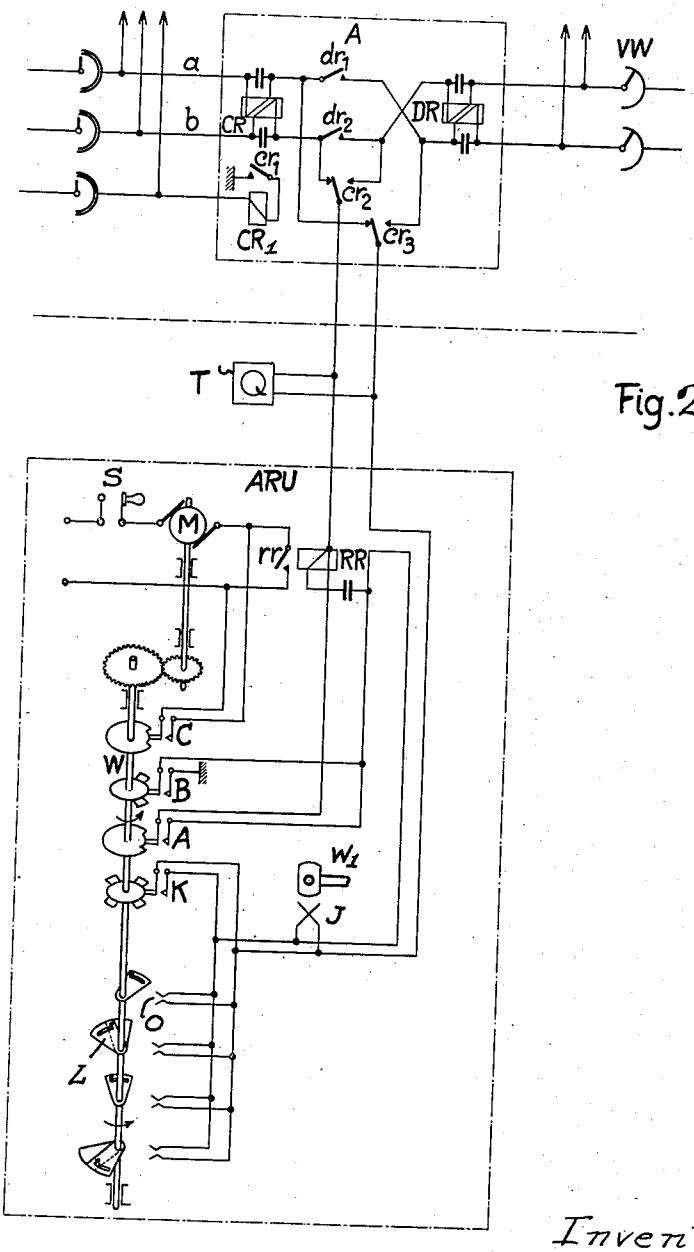


Fig. 2.

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TELEPHONE SYSTEM

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In Switzerland November 17, 1934

5 Claims. (Cl. 179—18)

The present invention relates to a telephone system with means for diverting a call from one receiving station to another.

Hitherto in manually operated telephone systems it was usual that a subscriber absenting himself from his place of residence would notify the exchange stating the length of time of his absence and where he would be otherwise available. But this cannot be done in automatic systems without a troublesome alteration in the technical apparatus at the exchange and will be admitted only in exceptional cases.

It is the object of the present invention to provide means enabling subscribers to divert calls during their absence without giving notice to the exchange. Accordingly the present invention consists in providing a device, the principal part of which is formed as an accessory part of a subscriber's station.

This device comprises means made operative by the primary call and effecting automatically, in addition to the series of impulses for the station to which the call shall be transferred, the connection of the calling station across an auxiliary connection with the selector of the exchange.

Referring to the drawings,

Figure 1 shows one embodiment of the invention in which the device serving for diverting a call is equipped with an electric motor put into operation by the primary call to be diverted and actuating a device for sending out impulses corresponding to the number of the new station.

Figure 2 is another embodiment of the invention showing a similar arrangement as Figure 1, but comprising a device with adjustable levers adapted to bridge the impulse sender between two impulse series.

In the following, the station making the first call shall be called the "calling station" and the station receiving this call the "receiving station" and the station to which the call is to be transferred the "new station." The device comprises at the exchange a relay BR switched into the line of the subscriber's station. Said relay is connected to the negative pole of the battery of the exchange through the feeding choke coil. This relay possesses a holding coil BR_1 and three contacts br_1, br_2, br_3. At the exchange is also established a differential relay DR connected by an auxiliary connection to a preselector VW not shown. This relay controls the contacts dr_1, dr_2.

The subscriber possesses besides his regular apparatus a device containing a calling relay RR energized by the calling current and a small motor M, the shaft of which moves by means of cams the contacts A, B, C and K. On this shaft are also mounted an impulse producing contact arm J and a tapping arm AT. The device is completed by a relay with two coils UR_1 UR_2 where UR_1 controls the contact ur_1.

In the operating field of the tapping arm AT are provided circularly arranged contacts Tp_1 . . . Tp_5 having holes between them. By means of plugs St_1 . . . St_4 it is possible to establish communication between these holes and a grounded ring V_b encircling all the said contacts.

The arm AT is rotated positively along with the impulse producing arm J and passes from one hole to the other at each impulse produced by this arm. Therefore according to the position of the plugs in the different banks of holes the arm J will provoke as many impulses as there are free holes which the arm will pass before it is connected to the ground through one of the plugs itself. In consequence of a short circuit described hereinafter, the following impulses produced by the contact J are ineffective until the tapping arm AT meets the next contact T_p. The subscriber, by putting the plugs between the contacts T_p, may set up or compose the number of the station to which the call which was intended for himself must be transferred. In the example shown in Fig. 1, the number set up is 5837.

The arrangement works as follows:

It must be noted first that the cams fast to the shaft of the motor M which control the contacts A, B, C and K have not all the same profile. During one turn of the shaft the contact A is opened for a short while at the beginning and at the end. The contact B is briefly closed once at the beginning and at the end of the revolution of the shaft.

The contact C is opened only at the beginning and at the end of a revolution. The contact K is closed when the arm AT meets with a plug St and is opened when this arm meets with a spacing point Tp.

When the station is called, which is provided with the device for composing or setting up by means of the plugs St, the number of the subscriber to whom the call has to be transferred (here as stated the number 5837), the calling relay RR will be energized. The contact r of this relay will be closed and the motor M will begin to turn. The contact C closes and bridges the contact r during one revolution of the cam shaft.

The contact A closes the subscriber's loop whereby the call signal is stopped. The contact

B is only touched for a moment which suffices to energize the relay BR. This latter holds with its contact br_1 over its second winding BR_1 and connects by reversing its contacts br_2, br_3 the device of the called station through the differential relay DR with a preselector or with the register according to the system of the exchange to which the station belongs. This preselector or this register begins to run in a known manner and connects the called subscriber with the inlet devices of the exchange.

In the circuit which has been closed by these preselectors is also included besides the differential relay DR an impulse producing arm J, the operation of which begins immediately after the completing of the circuit. The relative position of the different members are chosen so that the first impulse takes place in the moment when the tapping arm AT passes over the first hole of the setting up device of the call. An impulse will be created at each hole and will be transmitted to the apparatus of the exchange to be used according to the devices provided there.

When the arm AT touches the first plug it will be grounded. The circuit includes earth, ring V_b, plug St_1, arm AT, relay UR_1, contact br_3, relay DR, preselector VW, feed choke, battery, earth. The relay UR_1 is then energized. The contact ur_1 short-circuits the arm J whereby further passage of the arm AT is inoperative to produce impulses and the relay UR_2 holds this contact closed until the contact K opens. At this moment the armature of the relay UR_1 drops and the second series of impulses may begin. This play will be repeated until all the series have passed one after the other. When the arm AT arrives at the last spacing point Tp_5 the contact B will be closed. The differential relay DR is energized and the contacts dr_1 and dr_2 are closed and the connection of the calling station is now established across the auxiliary connection with the new station. The relays BR and DR hold themselves in series until the calling party puts his receiver down. At this moment all assumes again its normal position of rest.

It must be noted that in this telephone system the line of the called station is used as the starting line for the new call.

In the working example shown in Fig. 2, the devices are about the same as in the Fig. 1. This arrangement differs however from the first in that the series of impulses sent under the control of the keys of the setting up device which serves to compose the number of the station to which the call is to be diverted are controlled by contacts which bridge directly the impulse device. These contacts are operated by a cam shaft provided with setting up levers for determining the duration of bridging.

The apparatus at the exchange is designated generally by A and the transferring apparatus by ARU, the station T being represented diagrammatically. At the exchange a differential relay CR is switched between the lines *a* and *b* of a subscriber, and controls the contacts cr_1, cr_2, cr_3. The differential relay is inserted into an auxiliary connection working a preselector VW of the exchange. The line of the station T is always in relation with the selector of the subscribers' lines of the exchange through the contacts cr_2 and cr_3.

The transfer device ARU comprises a motor M operating through a speed reducer and a cam shaft W, the cams of which actuate contacts A, B, C and K. The impulse contact I is operated by a cam shaft W_1 which is also driven by the motor M. The ratio of transmission between the motor M and the shaft W_1 is such that for one revolution of the shaft W the impulse contact I is opened ten times as many times as the telephone numbers comprise digits. On the shaft W is mounted a setting up device comprising several levers L cooperating with contacts O, so that according to the position of said levers the bridging of the impulse contact J lasts for a longer or shorter period.

A calling relay RR is switched in parallel with the station T. By means of the setting up levers L, which may be mutually displaced at the required angles, it is possible to bridge the impulse contact J between the different periods separated by the contact K and thus send, by the subscriber's loop formed by the auxiliary connection between the called subscriber and the exchange, a relatively high number of impulses corresponding to the number or the new station which is to be called.

The represented arrangement works as follows:

At the called subscriber's station the relay RR is energized by an incoming call. Contact *rr* closes and motor M is started. Contact C closes, bridges the contact *rr* and causes rotation of the motor until the cam shaft has completed one revolution. The contact A short-circuits the subscriber's loop, stops the calling signal of the exchange and remains closed during a whole revolution of the cam shaft. The contact B earths for an instant the line *a* to produce the energizing of the differential relay CR which then holds its circuit by the coil CR_1 and over its contact cr_2. The contacts cr_1 and cr_3 connect the station with the auxiliary connection. Contact K frees in this position the impulse contact J and the latter breaks the auxiliary connection from 1 to 10 times according to the setting of the setting up levers. After the contact J has given a series of impulses corresponding to the first digit of the telephone number, it will be short-circuited by one of the levers L in such a way that the impulse contact becomes ineffective for a short while, which corresponds to the pause between the two digit impulses. Then the impulse contact is freed by said lever L and the second digit impulses are sent by the contact J. This play will be repeated as many times as the telephone number has digits. Finally, contact B earths once more the auxiliary connection, whereby the differential relay DR is energized, which will connect the new station directly with the calling station. This is effected by means of the contacts dr_1 dr_2. The relays CR and DR will hold in series until the calling subscriber puts down his receiver. If a call is not to be forwarded, the circuit of the motor M (in the case of the embodiments according to Figs. 1 and 2) is opened by means of a switch S.

What I claim is:

1. In an automatic telephone system, in combination, an exchange, a plurality of subscribers' lines, impulse actuated line connecting means at the exchange, a motor associated with a called subscriber's line, a circuit including a relay for starting said motor when a call is received on said called line, an impulse sending device in the called subscriber's line, switch means operated by said motor and having settable contacts cooperating with the impulse sending device to determine the sending of impulses corresponding to the number of a third subscriber to whose line

said call is to be diverted, means operated at the beginning of impulse sending to connect the impulse sending device to said line connecting means at the exchange, normally open switch means in circuit with the called line and line connecting means, said switch means being closed at the end of impulse sending to connect said called line through said connecting means with the third subscriber's line, and contact means operated by the motor for timing the action of the impulse sending device.

2. A system according to claim 1, in which the contact means operated by the motor also includes a contact controlling holding means for the circuit of the motor.

3. A system according to claim 1, in which the the contact means operated by the motor shaft also includes a contact controlling the closing of the loop of the called line.

4. In an automatic telephone system, in combination, an exchange, a plurality of subscribers' lines, impulse actuated line connecting means at the exchange, a motor associated with a called subscriber's line, a circuit including a relay for starting said motor when a call is received on said called line, an impulse sending device in the called subscriber's line, switch means including an arm operated by said motor over banks of contacts selectively connectible to ground to determine the sending of impulses by said impulse sending device corresponding to the number of another subscriber to whose line said call is to be diverted, a relay energized by said switch arm over said grounded contacts to short-circuit the impulse sending device at predetermined intervals, means operated at the beginning of impulse sending to connect the impulse sending device to said line connecting means at the exchange, normally open switch means in circuit with the called line and said line connecting means, said switch means being closed at the end of impulse sending to connect said called line through said connecting means with the third subscriber's line, and contact means operated by the motor for timing the action of the impulse sending device and for de-energizing said relay at predetermined intervals.

5. In an automatic telephone system, in combination, an exchange, a plurality of subscribers' lines, impulse actuated line connecting means at the exchange, a motor associated with a called subscriber's line, an impulse sending device in the called line and actuated by the motor, a shaft driven by said motor and carrying a plurality of adjustable arms capable of being set corresponding to the digits of the number of a third subscriber's line to which the call is to be diverted, a series of contacts cooperating with said arms and arranged when closed to short-circuit the impulse sending device, a relay operated at the beginning of impulse sending to connect the impulse sending device to said line connecting means, a relay at the exchange having normally open contacts in circuit with the called line and the line connecting means, and a contact operated by said motor driven shaft after the short-circuiting of the impulse sending device by the last adjustable arm to energize said exchange relay to close said normally open contacts and thereby connect the calling subscriber's line through said line connecting means to said third subscriber's line.

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