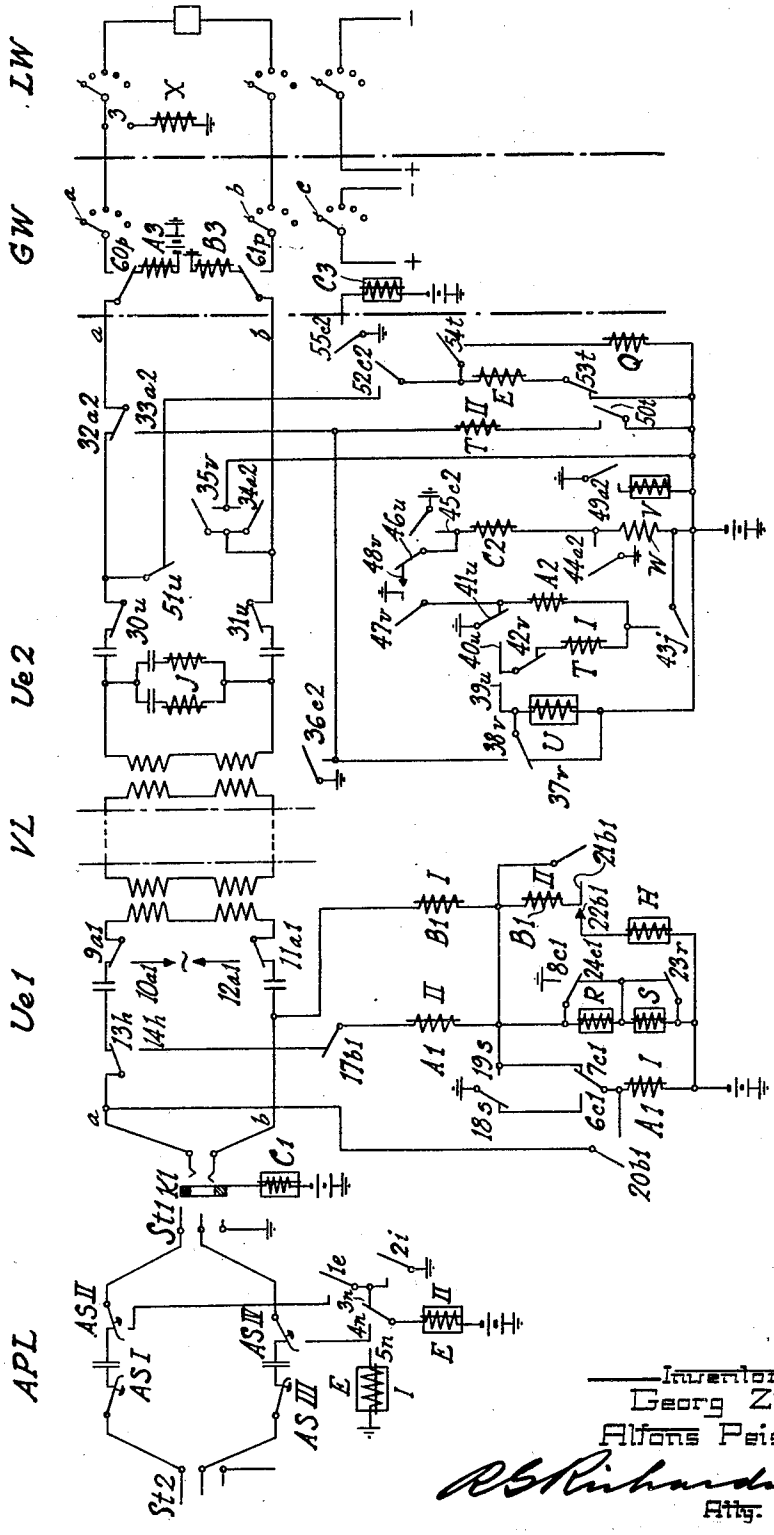
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AUTOMATIC TELEPHONE SYSTEM

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AUTOMATIC TELEPHONE SYSTEM

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This invention relates to automatic telephone systems, in which connections of different value can be set up over the same connecting devices and lines.

In systems of this kind arrangements are commonly used whereby the switching over of the connecting devices for high value connections is effected by one or more auxiliary impulses succeeding the positioning impulses. In the case of connections extending over several junction lines isolated by repeaters there is the liability that the regular setting up of the desired connection may be disturbed by these auxiliary impulses, especially if they are repeated several times during the setting up of the connection.

The object of the invention is to remove this defect and to obtain a faultless reception and translation of the auxiliary impulses. According to the invention this is achieved in that to the impulse repeaters at the incoming end of a junction line are fitted switching means, which, after switching-over has been effected at the repeater of the connection, by means of one or more auxiliary impulses render ineffective the further auxiliary impulses arriving after every impulse train.

The accompanying single figure of the drawing shows one method of carrying out the invention. Therein the trunk connection is of high value and the local connection is of low value. The latter has no special designation, but the former is designated by one auxiliary impulse. The setting up of a trunk connection will first be described. The circuits that are of no importance for the understanding of the invention are not shown.

The operator at the switchboard position APL, who over a trunk line has been requested to call a particular subscriber, inserts her plug St1 into the jack K1 and so sends over the repeater Ue1 and the junction line VL a seizing impulse to the repeater Ue2. This is brought about in that when the plug St1 is inserted in the jack K1 first of all the relay C1 at the repeater Ue1 is energized over: earth, plug St1, jack K1, winding of relay C1, battery, earth. Thereby the following operating circuit is established for relay A1 at the repeater Ue1: earth, contacts 18*s*, 6*c*1, winding of relay A1, battery, earth. Relay A1 at its contacts 10*a*1 and 12*a*1 applies a source of alternating current to the speaking leads, and over the winding of repeater Ue1 and the junction line VL it sends an impulse to the repeater Ue2. When operated, the relay C1 establishes a circuit for relay R over: earth, contact 8*c*1, winding of relay R, contact 23*r*, battery, earth. Relay R is operated and at contact 23*r* removes the short circuit from the relay S. Thereupon relay S is operated and at contact 19*s* opens the circuit for winding I of relay A1. At repeater Ue2 is operated the alternating current relay J. Relay J closes its contact 43*j* to establish a circuit for relay A2 at repeater Ue2: earth, contact 41*u*, winding of relay A2, contact 43*j*, battery, earth. Relay A2 is operated and its contact 49*a*2 energizes the relay V. A circuit for relay C2 is closed over: earth, contacts 47*v*, 48*v* and 46*u*. But relay C2 cannot be operated while relay A2 is energized because it is short circuited by contact 44*a*2. At the end of the seizing impulse the relay J and also relay A2 fall back, the latter opens its contact 44*a*2; relay C2 is operated in series with resistance W and locks itself over contact 45*c*2. As relay V falls back slowly after relay A2 has fallen back, a circuit for relay U is closed over: earth, contact 36*c*2, contact 38*v*, winding of relay U, battery, earth. Relay U pulls up slowly but is at once short circuited again by contact 37*v* and falls back. During the seizing impulse the relay A2 also closes the contacts 33*a*2 and 34*a*2. As relay C2 is not energized during this time as before described, the relay A3 at the succeeding final selector LW is not energized over contact 33*a*2. But contact 34*a*2 applies steering voltage to the lead *b* whereby the relay

B3 at the group selector GW is energized, without, however, disturbing the setting up of the connection. At the repeater Ue2 only the relay C2 remains energized after the ending of the seizing impulse.

After inserting the plug St1 into the jack K1, the operator at the position APL throws her key As. Thereby at the contacts ASI and ASIII she interrupts the line going to the plug St2, while the contacts ASII and ASIV connect her head set to the line going to the plug St1. Of the operator's instrument there is only shown the contacts 2*i*, 3*n*, 4*n* and 5*n*, which are operated by the number dial.

The operator now begins to dial by forwardly rotating the number dial. The contact 3*n* is opened and the contacts 4*n* and 5*n* are closed as soon as the number dial leaves the normal position. Relay E is energized: earth, winding I of relay E, contacts 5*n*, 4*n*, winding II of relay E, battery, earth. In addition, steering voltage is applied to the *b* lead for the entire duration of an impulse train and thus the relay B1 is energized at repeater Ue1: earth, contact 19*s*, winding I of relay B1, lead *b*, jack K1, plug St1, key ASIV, contact 4*n*, winding II of relay E, battery, earth. Relay B1 closes the following circuit: earth, contact 19*s*, winding II of relay B1, contacts 21*b*1, 22*b*1, winding of relay H, battery, earth. The relay H is actuated in this circuit; its method of functioning will be explained hereafter. Contact 17*b*1 opens the circuit of winding II of relay A1 during the positioning impulse train. Contact 20*b*1 prepares the circuit for the positioning impulses, which during the return motion of the dial pass over: earth, impulse contact 2*i*, contact 1*e*, key ASII, plug St1, jack K1, lead *a*, contact 20*b*1, winding I of relay A1, battery, earth. Relay A1 responds to each impulse and repeats the positioning impulses to repeater Ue2 by applying alternating current to the leads *a* and *b* over contacts 10*a*1 and 12*a*1 as when seizing impulses are transmitted.

Thereby at the repeater Ue2 the alternating current relay J is operated at each impulse. Relay A2, which was energized in the same circuit as in the case of the seizing impulse, closes the already described circuit for relay V. Being slow-acting, the relay V holds up for the entire duration of the impulse train and the relay C2 does so likewise in a locking circuit although it is alternately short-circuited by contact 44*a*2 during the impulse train. Now relay U is also operated: earth, contact 36*c*2, contact 38*v*, winding of relay U, battery, earth. By opening its contacts 30*u* and 31*u*, the relay U interrupts the two speaking leads during the impulse train. Furthermore, it prepares a circuit for the auxiliary impulse by closing the contact 40*u*. By closing its contact 47*v* the relay V keeps the operating circuit for relay A2 closed during the impulse train. Impulses to the succeeding group selector are transmitted over: earth, contacts 36*c*2, 33*a*2, lead *a*, contact 60*p*, winding of relay A3, battery, earth. During the impulse train the contact 35*v* applies steering voltage to the *b* lead, thereby keeping relay B3 at the group selector GW energized over: earth, winding of relay B3, contact 61*p*, lead *b*, contact 35*v*, battery, earth.

When the number dial at the operator's position APL has run down, the contact 3*n* is closed and negative potential is applied to the lead *a* over contact 1*e* as relay E falls back slowly. At the same time the opening of contact 4*n* causes steering voltage to be disconnected from the lead *b*, whereupon relay B1 falls back. At repeater Ue1 relay B1 at contacts 21*b*1 and 22*b*1 removes the short circuit from its winding II and opens the circuit of relay H. As, however, relay H is a slow acting relay, it does not fall back until relay B1 has done so. Thus the following circuit is established: earth, contacts 19*s*, winding II of relay A1, contacts 17*b*1, 14*h*, lead *a*, jack K1, plug St1, key ASII, contacts 1*e*, 3*n*, winding of relay E, battery, earth. Relay A1 is operated in this circuit and sends an auxiliary impulse to repeater Ue2 in the manner already described. Thereupon at repeater Ue2 the relay J is again operated. By closing its contact 43*j* it establishes a circuit for relay T after relay V has fallen back, but relay U remains attracted as it is made slow acting and moreover has its winding short circuited by contact 37*v*. The relay T is energized in the following circuit: earth, contacts 40*u*, 42*v*, winding I of relay T, contact 43*j*, battery, earth. Relay T places itself in a locking circuit over earth, contact 36*c*2, winding II of relay T, contact 50*t*, battery, earth. The impulse repeating relay A2 cannot be operated in this case, because the relay J has fallen back already when the relay U falls back and closes its contact 41*u*.

The further setting up of the connection at the succeeding group selector and final selector takes place in known manner. Therewith the contacts 60*p* and 61*p* are closed at the group selector GW. On the one hand they switch-through the speaking line and on the other hand disconnect the impulse receiving relay A3 and the steering relay B3 from the speaking line.

In the case of a trunk call, at the end of the impulses for positioning the final selector when the relay T at the repeater Ue2 has been energized, a circuit for relay X at the final selector LW and for relay Q at the repeater Ue2 is closed in position 3 of the side switch; earth, winding of relay X, position 3 of the side switch, lead *a*, wiper *a* of the group selector GW, contact 60*p*, contacts 32*a*2, 51*u*, 52*c*2, 54*t*, winding of relay Q, battery, earth. Relays Q and X are operated in

this circuit. Relay X indicates at the final selector LW a trunk call designation, relay Q sends a signalling impulse backwards to the operator's position.

In the case of a local call the relay T at the repeater U*e*2 is not energized because it gets through without any special auxiliary designating impulse, hence after the final selector has been positioned the following circuit is closed: earth, relay X, position 3 of the side switch, lead *a*, wiper *a* of the group selector GW, contacts 60*p*, 32*a*2, 51*u*, 52*c*2, winding of relay E, contact 53*t*, battery, earth. In this circuit is operated only the high resistance relay E at repeater U*e*2. It again gives a signal impulse back to the operator's position. The further circuit changes for setting up the connection do not concern the invention.

When the operator again rotates her number dial for transmitting another impulse train, the same circuit changes take place as for the transmission of the first impulse train. But the auxiliary impulse, which is again transmitted when contact 3*n* is closed upon the return of the number dial, does not have any effect at the repeater U*e*2 because relay T has its winding II in a locking circuit and the impulse transmitting relay A2 cannot be energized by an auxiliary impulse as relay V has already fallen back while relay U is still energized as already described.

The connection is released by the operator at position APL withdrawing the plug S*t*1. Relay C1 at repeater U*e*1 falls back, so closing the following circuit for relay A1: earth, contacts 19*s*, 7*c*1, winding I of relay A1, battery, earth. Relay A1 is operated in this circuit and by means of its contacts 10*a*1 and 12*a*1 it transmits a long releasing impulse to repeater U*e*2. When relay C1 at repeater U*e*1 falls back, the closing of contact 24*c*1 short circuits relay R. Relay R falls back and by closing its contact 23*r* it short circuits the relay S. Both relays fall back slowly in succession. Relay S at contact 19*s* opens the circuit of winding I of relay A1, which was closed during the release, and thus the releasing impulse is ended. At repeater U*e*2 the relay J is again pulled up by the release impulse. Relay J energizes relay A2: earth, contact 41*u*, winding of relay A2, contact 43*j*, battery, earth. Relay A2 is operated and with its contact 44*a*2 short circuits relay C2 thus releasing it. At contact 36*c*2 the relay C2 opens the locking circuit for winding II of relay T and at contact 55*c*2 it opens the test circuit to group selector GW.

In the example described the switching over of the junction lines is effected according to the value, in this case for example for a trunk connection, by means of an auxiliary impulse, while for a low value connection such as a local connection no auxiliary impulse is given. But the invention is not limited to this arrangement and it can be applied to systems in which the designation of the different values can be effected by several auxiliary impulses.

What is claimed is:

1. In a telephone system, an impulse repeater, a trunk line incoming to the repeater, a trunk line outgoing from the repeater, means for transmitting a series of similar current impulses over the incoming trunk line, and means in the repeater for repeating each impulse except the last of the series over the outgoing trunk line.

2. In a telephone system, an impulse repeater, an incoming trunk line and an outgoing trunk line terminating in the repeater, means for transmitting a plurality of series of similar current impulses over the incoming trunk line, and means in the repeater for cancelling the last impulse and for repeating the remainder of the impulses of each series over the outgoing trunk line.

3. In a telephone system, an impulse repeater, an incoming trunk line and an outgoing trunk line terminating in the repeater, means for transmitting a plurality of series of similar current impulses over the incoming trunk line, means in the repeater for repeating all impulses except the last impulse of each series over the outgoing trunk line, and switching means in the repeater operated by the last impulse of the first series of impulses.

4. In a telephone system in which local and toll connections are established over the same trunk lines and switching devices by transmitting series of impulses corresponding to called numbers over a trunk line, and in which an additional impulse is transmitted over the trunk line after each series of impulses transmitted to establish a toll connection, means operated by an additional impulse for changing-over the switching devices for toll operation, and means responsive to the operation of said last means for rendering succeeding additional impulses ineffective.

5. In a telephone system in which connections of different values are established over the same trunk line and switching devices, means for transmitting series of impulses corresponding to the digits of called numbers over the trunk line, means for transmitting an additional impulse over the trunk line following each series of digit impulses transmitted to establish a connection of a certain value, an impulse repeater associated with the trunk line for repeating the digit impulses to the switching devices, switch-over means in the repeater operated responsive to the first of said additional impulses for adapting the repeater to operate in accordance with the value of the connection, means responsive to the operation of said switch-over means for rendering the same independ-

ent of succeeding additional impulses, and means controlled by said switch-over means for adapting the switching devices to operate in accordance with the value of the connection.

6. In a telephone system in which connections of different values are set up over the same trunk line and switching devices by means of digit impulses transmitted over the trunk line and in which an additional impulse is transmitted over the trunk line after each digit transmitted to set up a connection of a certain value, a repeater associated with the trunk line for repeating the digit impulses to the switching devices, a relay in the repeater operated responsive to the receipt of the first additional impulse and locked for the duration of the connection, and means controlled by said relay for adapting the repeater to operate in a particular manner in accordance with the value of the connection.

7. In a telephone system, a repeater, incoming and outgoing trunk lines terminating in the repeater, an impulse receiving relay in the repeater, a switch-over relay in the repeater for adapting the repeater to operate in a particular manner in connections of a certain value, means for transmitting series of impulses corresponding to digits of called numbers over the incoming trunk line to operate said impulse receiving relay for establishing connections of different values, means for transmitting an additional impulse over the trunk line to operate said impulse receiving relay following each series of impulses transmitted to establish a connection of said certain value, means controlled by said impulse receiving relay for repeating the digit impulses over the outgoing trunk line, means controlled by the impulse relay for repeating the first additional impulse to said switch-over relay to operate the same, and means controlled by said switch-over relay on operating for locking itself operated for the duration of the connection.

8. In a telephone system, a repeater, incoming and outgoing trunk lines terminating in the repeater, an impulse receiving relay in the repeater, a first slow relay controlled by said impulse receiving relay, a second slow relay controlled by said first slow relay, a switch-over relay for adapting the repeater to operate in a particular manner in connections of a certain value, means for transmitting series of digit impulses over the incoming trunk line to operate said impulse receiving relay for establishing connections of different values, means for transmitting an additional impulse over the incoming trunk line to operate said impulse relay following each series of digit impulses transmitted to establish a connection of said certain value, means controlled by said impulse relay for repeating the digit impulses over said outgoing trunk line, means for operating said slow relays during the repeating of each series of impulses, means for releasing said slow relays in succession after the last digit impulse is repeated, a circuit for said switch-over relay prepared responsive to the release of said first slow relay and prior to the release of said second slow relay, and means controlled by said impulse receiving relay in operating responsive to said additional impulse for completing said circuit to operate said switch-over relay.

9. In a telephone system, a repeater, incoming and outgoing talking conductors for the repeater, a double-wound impulse receiving relay for the repeater, means for transmitting a series of impulses corresponding to a digit of a called number followed by an additional impulse over an incoming talking conductor, means for connecting one winding of the relay to said talking conductor during the transmission of said series of impulses, means controlled by the relay for repeating the digit impulses over said outgoing talking conductors, means for connecting the other winding of said relay to said incoming talking conductor following the repeating of the last digit impulse of the series wherein said last means is reoperated to repeat the additional impulse over said outgoing talking conductors.

10. In a telephone system, a trunk line including two talking conductors, a double-wound impulse receiving relay for the trunk line, means for transmitting a series of impulses of current of one polarity over one of said talking conductors, means for transmitting an impulse of current of a different polarity over said one conductor following the transmission of said series of impulses, means for connecting one winding of said relay to said one talking conductor during the transmission of said series of impulses, and means for connecting the other winding of said relay to said one talking conductor during the transmission of said last impulse.

11. In a telephone system, a trunk line connecting two exchanges and terminating in a repeater at each exchange, means in one repeater for receiving a series of direct current impulses and for transmitting a similar series of alternating current impulses over the trunk line, means in the other repeater for receiving said series of alternating current impulses and for transmitting to automatic switches a series of direct current impulses consisting of one impulse less than the number of impulses received, the impulse suppressed being in each case the last impulse of the series received.

12. In a telephone system, an impulse repeater, a trunk line incoming to the repeater, a trunk line outgoing from the repeater, means for transmitting a series of impulses of alterating current over the incoming trunk line, and means in the repeater responsive

to said impulses for transmitting an impulse of direct current over the outgoing trunk line for each of the incoming impulses except the last of the series.

In witness whereof, I hereunto subscribe my name this 23rd day of December, A. D. 1930.

GEORG ZAPF.

In witness whereof, I hereunto subscribe my name this 23rd day of December, A. D. 1930.

ALFONS PEISSNER.