

UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

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The invention relates to a circuit arrangement in telephone systems with connecting devices, consisting of setting and conversational switches, in which the conversational switches are constructed with a plurality of wiper sets.

One object of the invention is to effect the selection of the set of wipers to be used for setting up the connection in a simple and reliable manner. This is achieved by contact devices, which are influenced by the wipers of the setting switch to connect up one set of wipers of the conversational switch when the setting switch wipers are on certain of the bank contacts and the other set of wipers when the setting switch wipers are on certain other bank contacts.

Another object of the invention is to effect a guarding circuit as soon as a junction line is seized and to maintain the circuit for the duration of the connection. This guarding of a junction line, reached from the conversational switch, is achieved over the contact devices of the setting switch used for the control of the conversational switch.

An embodiment of the invention is shown in the illustration.

A subscriber, represented by T1, can, over a preselector allocated to him, operate numerical impulse receivers namely IGW, IIGW, and LW for the purpose of setting up a connection with, for example, the subscriber T2. The numerical impulse receivers, with the exception of the numerical impulse receiver IIGW, are only shown schematically. Their setting can be effected in any known manner.

The numerical impulse receiver IIGW consists of a conversational switch with two sets of wipers and a setting switch controlling its setting. The conversational switch moves only in one direction (rotation) and in such a manner that the setting switch marks the line group in which the conversational switch hunts for a free line.

In detail the connecting operation is as follows: When the subscriber T1 lifts his receiver, the preselector VW allocated to him, in known manner, is set by free hunting on to a succeeding numerical impulse receiver, by way of example, IGW. At the seizure

of this switch relay C is energized over: Earth, relay C, wiper of preselector VW, resistance W1, battery, earth. Relay A is energized over the subscriber's line loop in the following circuit: Earth, battery, winding I of relay A, wiper of preselector VW, *a*-lead, subscriber T1, *b*-lead, wiper of preselector VW, winding II of relay A, earth. At the transmission of numerical current impulses, relay A is intermittently deenergized by the breaking of this energizing circuit and causes thereby a setting of the numerical impulse receiver IGW. The setting procedures are of no interest in this case. In the group reached by the number impulses the numerical impulse receiver IGW hunts for a free connecting line which might, by way of example, lead to the shown numerical impulse receiver IIGW. The following circuit is then completed: Earth, battery, winding II of relay C1, the winding I of relay V2, parallel therewith, rotary off-normal contact 4*w* of the conversational switch, rotary off-normal contact 5*w**e* of the setting switch, wiper *c* of the numerical impulse receiver IGW, resistance W2, earth. Relays C1 and V2 respond in this circuit whereby relay C1 connects itself with its winding I over contact 3*e*1 to the just described circuit. By the closing of contact 7*v*2 the rotary magnet *De* of the setting switch is connected to the *a*-lead of the junction line.

When the subscriber sends out the second impulse series for the setting of the numerical impulse receiver IIGW the line relay A falls back a number of times due to the breaking of the line loop. At contact 1*a* the line relay therefore sends impulses for operating the magnet *De* over: earth, battery, rotary magnet *De* of the setting switch, winding II of relay V2, contacts 7*v*2, 1*a*, 2*e*, earth. Relay V2 remains uninterruptedly energized in this circuit during the impulse series. After the first rotary step of the setting switch the rotary off-normal contact 10*w**e* is closed, with the result that a circuit is closed for automatically operating the rotary magnet D of the conversational switch. This circuit extends over: earth, battery, rotary magnet D, contact 12*p*, 26*e*1, rotary off-normal

contact *10we* of the setting switch, relay interrupter RU, earth.

If, for example, the subscriber transmits three impulses, e. g. operates the rotary magnet of the setting switch three times, the wiper *de* reaches the contact 3. The wipers of the conversational switch are advanced by the rotary magnet D under control of interrupter RU until the wiper *d1* reaches the contact segment 31—30 which is connected to contact 3 of the setting switch. At this time the following circuit is completed: earth, windings I and II of relay P, contact 21*c1*, wiper *de* of the setting switch, contact 3; contact segment 31—30, wiper *d1* of the conversational switch, contact 25*v2*, resistance W*i2*, battery, earth. Relay P responds in this circuit and by the opening of contact 12*p* brings the rotary magnet D of the conversational switch to rest. After the deenergization of relay V2 at the termination of the current impulse series, the just described energizing circuit for relay P is cut off at contact 25*v2* and by the closing of contact 24*v2* relay P is connected to the wiper *c1* of the conversational switch. Assuming now that the contact engaged by wiper *c1* is busy, relay P falls back. The rotary magnet D is now energized afresh due to the closing of the contact 12*p* over: earth, battery, rotary magnet D, contact 12*p*, rotary off-normal contact 11*w* of the conversational switch, relay interrupter RU, earth. The conversational switch now hunts freely for an idle junction line leading to a succeeding numerical impulse receiver. When this has been reached, the following circuit is completed: earth, windings I and II of relay P, contact 21*c1*, wiper *de* of the setting switch, contact 3, contact segment 31—30, wiper *d1* of the conversational switch, contact 24*v2*, wiper *c1* of the conversational switch, resistance W*i3*, battery, earth. Relay P responds in this circuit and by opening the contact 20*p* short circuits the high resistance winding I of relay P and guards thereby the reached junction line; in addition, the conversational switch is brought to rest by the opening of contact 12*p*. The numerical impulse receiver LW is now reached over the wiper-set *a1* and *b1*.

The switching over from the wiper set *a1* and *b1* to the wiper set *a2* and *b2* is effected by the rotary off-normal contacts 15*we*, 16*we*, 17*we*, and 18*we*, respectively. These rotary off-normal contacts are mechanically operated by the switch shaft of the setting switch which is moved by the rotary magnet *De* in such a way, that, at each odd rotary step of the setting switch contacts 15*we* and 17*we*, respectively, are closed; and at each even rotary step contacts 16*we* and 18*we*, respectively, are closed. This is conveniently done for example, by means of a cam *de1*, having five notches corresponding to the five even steps 2, 4, 6, etc., of the setting switch. This

cam controls a lever *we* which in turn operates the switch levers or contact springs which engage the contacts 15*we*, 16*we*, 17*we*, and 18*we*. Thus the junction lines tested over the wipers *c1* and *d1* of the conversational switch, that is to say the odd step junction lines, are reachable over the wiper set *a1* and *b1*; while the junction lines tested over the wipers *c2* and *d2* of the conversational switch, that is to say the even step junction lines, are accessible over the wiper set *a2* and *b2*.

By the transmission of further impulses the numerical impulse receiver LW can be set to the required subscriber T2 after the setting of the numerical impulse receiver IIGW. By the transmission of ringing current the calling subscriber T1 is connected to the required subscriber when he replies.

The release, after the termination of the conversation, can be effected in any manner of no interest in this case.

What is claimed is:

1. In an automatic telephone system, a switch having a plurality of sets of wipers, a second switch individual to said first switch arranged to control the positioning of said first switch, and mechanical means in said second switch for selecting the set of wipers over which the connection is to be completed.

2. In an automatic telephone system, a switch having a plurality of sets of wipers, a second switch individual to said first switch having a shaft and wiper, a cam on said shaft for connecting one or the other set of wipers in the first switch, and means controlled over the wiper of said second switch for controlling the positioning of the connected set of wipers.

3. In an automatic telephone system, an incoming trunk line, an outgoing trunk line, a switch for interconnecting said trunk lines, a plurality of sets of wipers for said switch, a second switch connected to said first switch arranged to control the positioning of said first switch, mechanical means in said second switch for selecting one of said sets of wipers, and means operative responsive to the establishment of a connection between said trunk lines for guarding said outgoing trunk line over a wiper of said second switch.

4. In an automatic telephone system, a switch having a plurality of sets of wipers, a second switch individual to said first switch arranged to control the positioning of said first switch, mechanical means in said second switch for selecting the set of wipers over which the connection is to be completed, and means operative over the wiper of said second switch for guarding a connection completed over said first switch.

5. In an automatic telephone system, a switch having a plurality of sets of wipers, a second switch individual to said first switch arranged to control the positioning of said first switch, mechanical means in said second

switch for selecting the set of wipers over which the connection is to be completed, and means operative over the wiper of said second switch for guarding a connection completed
5 over said first switch irrespective of the set of wipers used.

6. In an automatic telephone system, a switch having a plurality of sets of wipers, an auxiliary switch connected thereto, means
10 for positioning said auxiliary switch, a test wiper for each of said sets of wipers, means operative responsive to the positioning of said auxiliary switch for automatically stepping said first switch and for
15 connecting one of said sets of wipers, and means controlled over one of said test wipers and the wipers of said auxiliary switch for stopping the stepping of said first switch.

7. In an automatic telephone system, a
20 calling line, a called line, a calling device, an auxiliary switch operative responsive to the operation of said calling device, a single motion connecting device for connecting calling and called lines, said connecting device
25 consisting of a certain number of series of contacts, and an equal number of sets of wipers, means for setting said wipers in accordance with the position of said auxiliary switch, and means controlled over one of
30 said wipers and a wiper of said auxiliary switch for controlling the setting of said connecting device.

8. In an automatic telephone system, a
35 calling line, a called line, a calling device, an auxiliary switch operative responsive to the operation of said calling device, a single motion connecting device for connecting calling and called lines, said connecting device
40 consisting of a certain number of series of contacts, and an equal number of sets of wipers, means for setting said wipers in accordance with the position of said auxiliary switch, and means for mechanically connecting
45 a certain series of wipers in the connecting device according to the position of said auxiliary switch.

In witness whereof, I hereunto subscribe my name this 3rd day of December, A. D. 1930.

50 ERNST HORN.

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