April 19, 1932. K. H. BLOMBERG 1,855,087

SWITCHING ARRANGEMENT IN TELEPHONE PLANTS

Filed March 13, 1931 2 Sheets-Sheet 1

Fig. 1.

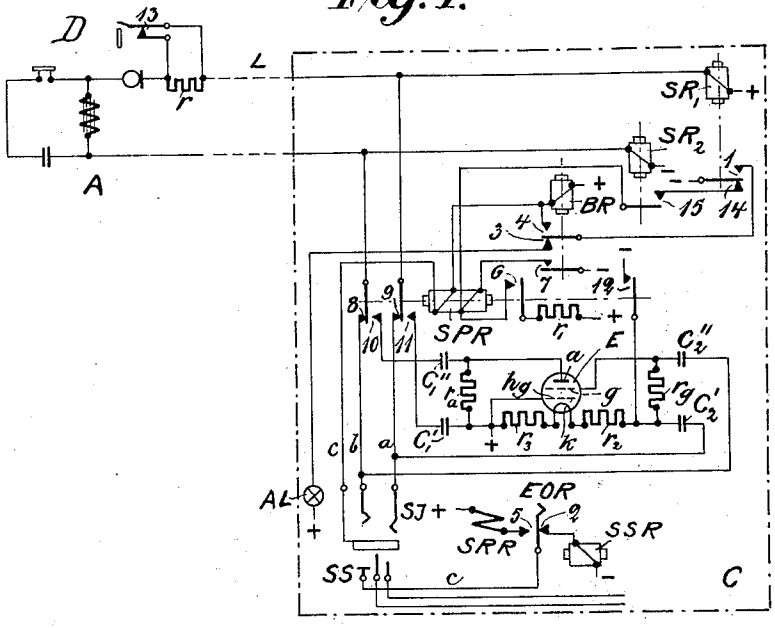

Fig. 2.

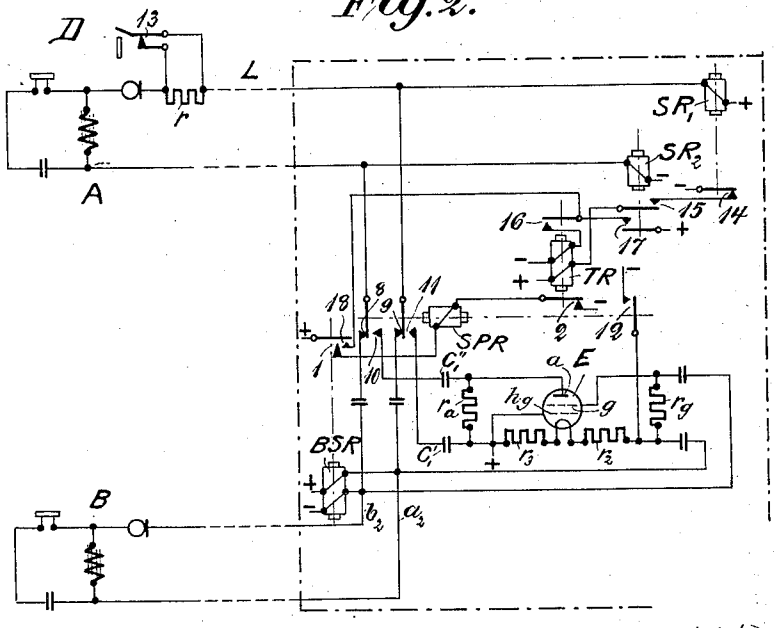

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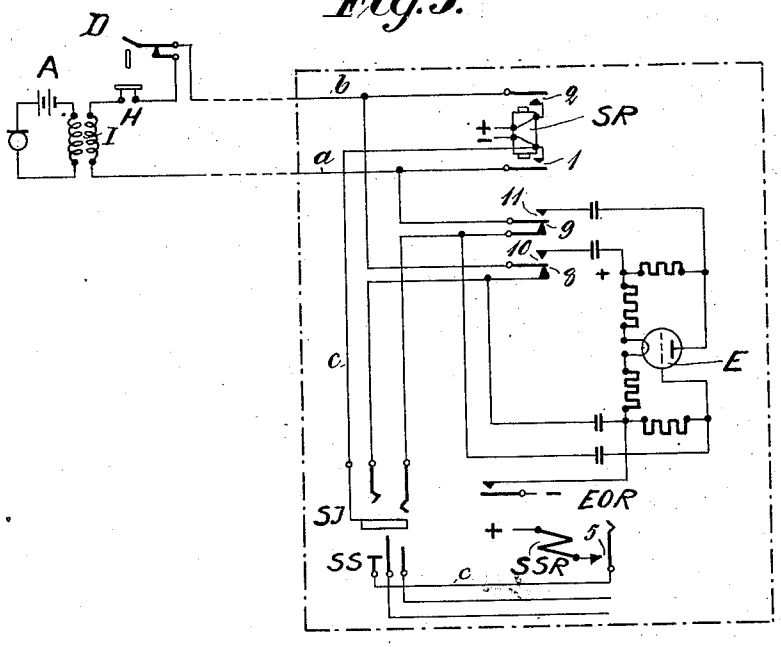
Fig. 3.



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Patented Apr. 19, 1932 1,855,087

UNITED STATES PATENT OFFICE

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SWITCHING ARRANGEMENT IN TELEPHONE PLANTS

Application filed March 13, 1931, Serial No. 522,461, and in Sweden March 21, 1930.

The present invention relates to switching arrangements in telephone plants in which one or more of the speaking devices have to be made inoperative during a certain period of the connection. More particularly the invention relates to pay stations or coin collector telephone apparatus.

The pay stations to which the invention is applicable are disposed in such a manner that the establishment of the talking connection, if performed manually or automatically, may proceed in the same manner as in a call from an ordinary subscriber's station. The call is paid or debited by the calling person himself without being requested by any operator. After the connection to the wanted subscriber is established the calling person may hear when the subscriber replies but is, however, not able to speak with him unless he actuates the paying or debiting device in the pay station whereby full talking connection is established. Before the connection is established the speaking device of the pay station is not inoperative, at least not during the time when the subscriber speaks with the operator whereby he is enabled to give his order to her. First when ringing signal is sent to the wanted subscriber the speaking device is made inoperative.

The blocking of the speaking device in the pay station has been brought about in known apparatus in such a manner that the microphone has been temporarily short-circuited or the current prevented to pass the microphone in other manner. For this purpose one or more relays have usually been disposed in the pay station and actuated in suitable moments so as to prevent speech current from being generated in the microphone. One of the relays has commonly been polarized and actuated by reversal of the central battery current sent from the exchange on the line to the pay station. When the calling person in the pay station hears the reply of the wanted subscriber he is not able to talk to him unless he actuates the paying device, for example by pushing a button, whereby the previously inserted amount is dropped into the coin box or a call meter brought to record one call.

Such pay stations have, however, several inconveniences. They are provided with relays and complicated mechanical devices upon the reliability of which the switching operation is dependent but in which faults easily occur as the apparatus often are disposed outdoors. When using polarized relays the line branches must never be shifted which, however, is likely to take place by mistake in shifting the connections in a distribution box. Another inconvenience is that one may easily speak into the telephone receiver of the pay station which receiver must be connected up in ordinary manner to enable the hearing of the reply of the called up subscriber and which, as known, is a good sender, whereby speech may be sent from the pay station in spite of the fact that the microphone is blocked.

All said inconveniences are eliminated according to the present invention. Instead of blocking the microphone in the pay station a blocking device for speech currents is included in the established talking connection in the exchange according to the invention whereby speech is prevented from passing from the pay station to the called subscriber's station but not in the opposite direction. Hereby all relays in the pay station are eliminated as well as the necessity of reversing the current on the line. Further no speech currents generated in the microphone or the telephone receiver in the pay station can be sent to the called subscriber. The blocking device is constituted by an electron valve having one or more grids and included in the connection in such a manner that the called subscriber's line is connected to the control grid circuit of the valve whereas the line of the pay station is connected to the anode circuit. Speech currents on the former line are then amplified and sent on the latter line whereas speech currents on the latter line are not allowed to pass from the anode to the control grid without being efficiently blocked by the valve.

The invention will now be more closely described with reference to the accompanying drawings, Figures 1 to 3.

Figure 1 shows the switching diagram for

the connections of the pay station in a manual central battery system of L. M. Ericsson type. In the figure the pay station A is shown in its calling position. The line extending to the exchange is designated L whereas the exchange equipment appertaining to said line is surrounded by a rectangle C.

The pay station proper includes in addition to the parts of an ordinary apparatus a paying or debiting device D which in the shown embodiment is actuated by means of a push button upon the pressing of which a coin, such as 10 cents, may be introduced in the coin box of the apparatus, or a call meter actuated or the like. The coin actuates then in turn a cut off contact 13 which in closed position short circuits a resistance r included in the one branch of the line L. Upon the introduction of the coin in the box said short circuit is removed for a short moment.

The line of the pay station terminates in the exchange in two current feed relays SR_1, SR_2. A local cut off relay BR and a blocking relay SPR are further allotted thereto. The answering jack SJ of the line has a call lamp AL. The answering cord SS belongs to a pair of cords used by the operator when establishing the connection. Of the speaking switch EOR belonging to the pair of cords only the contact group concerned in the present case is shown.

The electron valve E belonging to the line is shown as a two grid valve and receives both filament current and anode and grid biasing voltages from the central battery not shown on the drawings and having by way of example twenty-four volts. The control grid circuit of the valve is permanently connected to the two talking line springs of the answering jack SJ over the condensers C_2' and C_2''. The anode circuit of the valve is connected to normally open contacts 10, 11 of the relay SPR so that said circuit is connected to the line of the pay station upon said relay being energized.

The switching operation when establishing a call is the following. When the calling person in the pay station for example inserts the prescribed amount in the apparatus and makes a call by lifting the microtelephone the two current feed relays SR_1, SR_2 are energized. The call lamp AL is lighted upon closing the contact 1 of the relay SR_1. When the operator answers the call by setting up the cord SS in the answering jack SJ a current path is closed from the minus pole, over the closing relay SSR, the contact 2 in the speaking switch EOR, the third wire c, the left hand winding of the blocking relay SPR having a low resistance, the cut off relay BR, to the plus pole. The relay SPR is so adjusted that its armature is not attracted by this current whereas the relay BR is energized and attracts its armature and opens the contact 3, whereby the lamp AL is put out, and closes the contact 4 whereby the relay receives holding current over the contact 1 to the minus pole.

The calling person may now demand the wanted number of the operator. The operator establishes the connection exactly as in an ordinary local call and sends ringing current to the wanted subscriber by pushing down the switch EOR. When the contact 5 in the switch is closed a current path is formed from the plus pole over the resistance SRR, the third wire, the winding of the relay SPR having low resistance, the contact 4, the contact 1 to the minus pole. The resistance SSR is so small that the relay SPR receives sufficient current for attracting its armature. When the relay SPR attracts its armature a holding circuit therefore is formed from the plus pole over the resistance r_1, the contact 6, the right hand side holding winding of the relay SPR having high resistance, the contact 7 and to the minus pole.

Upon attracting its armature, the relay SPR interrupts the direct connection between the line L of the pay station and the answering jack SJ, i. e. the wanted subscriber's line, at the contacts 8, 9. Instead the contacts 10 and 11 are closed whereby the line L is connected to the valve E over the condensers C_1', C_1'' the anode of which valve is connected to that line branch which is associated with the not earthed pole of the central battery or the minus pole. The relay SPR did also close the contact 12 whereby a filament circuit for the valve was formed from the minus pole over the contact 12, the resistance r_2, the filament k, the resistance r_3, and to the plus pole. The resistances r_2 and r_3 are so adjusted that correct filament amperage is received from the central battery at the same time as the control grid over the high resistance r_g and the auxiliary grid h_g directly receive correct biasing voltage whereas the anode a receives correct voltage over the anode resistance r_a. The valve is thus put in operative condition.

Speech currents generated in the pay station are not allowed now to pass to the wanted subscriber as the line L is included between the filament and the anode of the valve. Voltage fluctuations corresponding to the speech currents occur between the terminals of the resistance r_a but said currents do not cause any voltage variations between the grid and filament of the valve and thus not on the called subscriber's line. On the other hand, speech currents may pass from said line over the valve to the pay station. They cause voltage fluctuations over the resistance r_g in the control grid circuit of the valve whereby corresponding fluctuations are caused in the anode current. Said speech currents are thus amplified in the anode cir-

cuit and sent on the line to the pay station. So long as the relay SPR is attracting its armature, speech sent from the pay station is thus blocked whereas speech in the opposite direction is not blocked. When the called subscriber answers, the calling person in the pay station is able to hear but cannot speak to the subscriber unless he pushes down the button of the paying device in the pay station.

When the paying device is actuated in the pay station the contact 13 is opened for a moment the resistance r being then included in series with the line. The current through the current feed relays SR_1 and SR_2 energized upon the call is then reduced. The relays are so adjusted that SR_1 drops its armature whereas SR_2 still holds its armature. Then a current path is closed from the minus pole over the normally closed contact 14 of the relay SR_1, the normally open contact 15 of the relay SR_2 the contact 6, the resistance r_1, and to the plus pole. The holding winding of the relay SPR is thus short-circuited for which reason said relay drops its armature. Then the valve E is disconnected from the connection and instead the direct connection is closed over the normally closed contacts 8 and 9. The full talking connection is then completed between the pay station and the called subscriber and the conversation may proceed normally.

Figure 2 shows a diagram of another embodiment of the invention. A completed connection to the wanted subscriber carried out by an operator or by automatic selectors is shown on the drawings. Instead of connecting up the blocking electron valve upon sending ringing current to the subscriber B as described in the embodiment shown in Figure 1, said connection of the blocking valve here takes place when the subscriber answers.

When the subscriber B lifts his microtelephone a current path is established from the plus pole, over the upper winding of the current feed relay BSR, the line branch a_2, the subscriber's apparatus B, the line branch b_2, the lower winding of the current feed relay BSR, and to the minus pole. The relay BSR attracts its armature, a current path being formed from the plus pole, over the contact 1, the relay SPR, the contact 2, to the minus pole. When the relay SPR then attracts its armature it opens the contacts 8, 9 whereby the direct connection between the pay station A and the subscriber B is interrupted. At the contacts 10 and 11 the electron valve E is connected up instead. In the same manner as in Figure 1 the valve blocks the speech from the pay station but not in the opposite direction.

When the calling person actuates the paying device the contact 13 is opened, as above described, for a moment and the relay SR_1 drops its armature but SR_2 holds its armature. Then the relay TR is energized over a current path from the plus pole, over the lower winding of the relay TR, the contact 15, the contact 14, to the minus pole. Upon being energized, the relay TR receives holding current over its own contact 16 and the contacts 17 and 18 until both microtelephones of the pay station A and of the subscriber's apparatus B are hooked up. The energized relay TR opens also the contact 2 whereby the current of the relay SPR is interrupted, so that the latter relay drops its armature. Hereby the contacts 10, 11 are opened and the contacts 8, 9 closed. The valve is hereby disconnected and the line of the pay station and of the called subscriber are again joined with full talking facilities.

Figure 3 shows an embodiment of the invention applied to pay stations which are not fed with current from the exchange, for example in local battery systems, for which purpose the invention is particularly applicable. The arrangement operates in the following manner.

When the operator has received the call from the pay station and answered, she pushes down the speaking switch EOR to send ringing current whereby a relay SR is connected into the line of the pay station which relay immediately is energized and inter-connects the valve E between the two lines in a manner corresponding to that shown in Figure 1. Upon pushing down the switch EOR a current path is formed from the plus pole, over the resistance SSR, the contact 5 of the relay EOR, the third wire c, the one winding of the relay SR, to the minus pole. When the relay SR is energized it receives holding current from the minus pole, over the lower winding of the relay SR, the contact 1, the line branch a of the line L, the induction coil I of the pay station, the telephone receiver H, the paying device D, the line branch b, the contact 2, the upper winding of the relay SR, to the plus pole. The contacts 8, 9 of the relay SR are opened and the contacts 10, 11 closed whereby the direct connection is interrupted and the valve E included in the circuit. When thus the called subscriber answers the calling person in the pay station is able to hear but cannot speak to the subscriber unless he actuates the paying device D in the pay station. When this is done said holding circuit for the relay SR is interrupted for a moment, the relay SR is deenergized, and the contacts 10, 11 opened and 8, 9 closed. A full talking connection has thereby been established.

As is clearly understood by the shown embodiments, the subscriber's apparatus proper includes no blocking devices or relays at all but only a simple contact device. The blocking device with the appertaining relays is instead disposed in the exchange.

The importance of this disposition from the point of view of reliability in operation is self-evident. If the valve for any reason has to be included in the pay station proper such a disposition would not present any difficulties and would, of course, fall within the scope of the invention.

In Figures 1 and 3 the valve is shown as belonging to the line of the pay station in question. This is, of course, not necessary. Said valve may also be so disposed, that it belongs to the pair of cords. The switching arrangement will in such a case be substantially the same. The valve may then be included in the connection in such a manner that when the operator connects up her speaking device to speak with the calling person in the pay station, the speaking device is included between the valve and the answering cord whereby complete talking connection exists between the pay station and the operator whereas speech sent to the called subscriber's line is blocked.

The invention is described with reference to some embodiments applied to pay stations. The invention is, however, not restricted to only this purpose. It may, of course, be used in all cases when speech sent on a talking connection has to be blocked from a certain apparatus. This is the case for example in conference telephone systems. For that and similar purposes more or less great modifications may be required in the shown switching arrangements without receding from the idea of the invention.

I claim:—

1. A switching arrangement in telephone systems for periodical unidirectional blocking of speech currents between two speaking sets, comprising a thermionic valve, means for including said valve into the line between the two sets during the blocking period in such a manner that the valve anode circuit is associated with the set to be blocked and the control grid circuit with the other set, and means for removing said valve from the connection between the two sets at the end of the blocking period.

2. A switching arrangement in telephone systems for blocking speech currents from a pay station to a called subscriber prior to payment, comprising a thermionic valve, means for including said valve in the line between the pay station and the called subscriber in such a manner that the valve anode circuit is associated with the pay station and the control grid circuit with the called subscriber's set, and means for removing said valve from the connection between the pay station and the called subscriber's set upon payment.

3. A switching arrangement as claimed in claim 2 in which the thermionic valve is disposed in the exchange.

4. A switching arrangement as claimed in claim 2 in which the thermionic valve is associated with the line of the pay station.

5. A switching arrangement as claimed in claim 2 in which the thermionic valve is supplied with filament current and anode and grid biasing voltages from the normal central battery of the exchange.

6. A switching arrangement as claimed in claim 2, in which the thermionic valve is included in the connection through condensers blocking the direct current circuits of the valve from the other direct current circuits of the connection.

7. A switching arrangement as claimed in claim 2 comprising a relay adapted to switch the thermionic valve into the connection, which was normal prior to the actuation of the relay, and at the same time to close the feed circuits of the electron valve.

In testimony whereof I affix my signature.

KNUT HUGO BLOMBERG.