

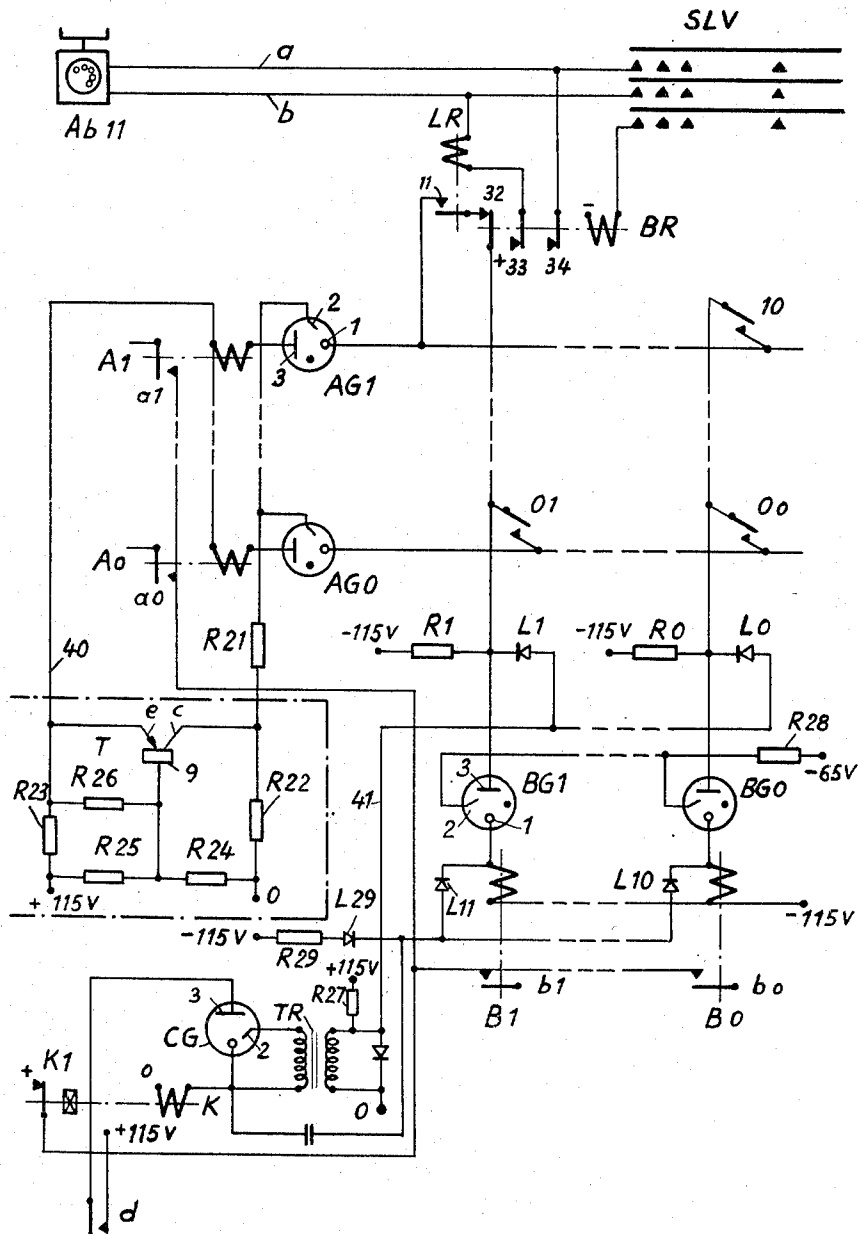
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CONNECTING DEVICE IN AUTOMATIC TELEPHONE SYSTEMS

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CONNECTING DEVICE IN AUTOMATIC TELEPHONE SYSTEMS

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The present invention refers to a device used in automatic telephone systems for identifying a calling circuit, for example a subscriber's circuit.

In an automatic telephone system with cross-bar switches and markers electromechanical relay chains are usually used for identifying calling subscribers, and one or more of said relays are selected for operation when a calling subscriber's line relay attracts. The relays just selected must thus be disconnected to prevent further calls, coming in during the identification, from causing a faulty identification. In order to obtain as simple subscriber's line relays as possible each relay has been provided, as is shown in the Swedish Patent No. 128,013, with only one make contact, the contacts having been arranged in rows which cross each other in such a manner that when one contact is closed, two relays are operated, which together represent the designation of the calling subscriber.

The relay chains which are shown in said patent are however relatively complicated with long contact chains, a faulty contact therefore easily arising and the time of operation having proved to be rather long.

According to the invention these relay chains can be replaced by two groups of gas discharge tubes with an anode, a cathode and an ignition electrode, one gas discharge tube in each group firing at call. The ignition electrodes for all the gas discharge tubes within each group are connected to a common point, which in its turn via a resistance is connected to a source of ignition voltage.

The invention is characterized by each circuit to be identified being provided with a make contact connected between the cathode of one of the gas discharge tubes in the first group and the anode of one of the gas discharge tubes in the second group, and by the anode of each gas discharge tube in the second group being connected to a current feeding circuit, the potential of which is sufficient for firing a gas discharge tube in the first group connected to said anode, and which is chiefly constant as long as the current to the cathode of the last mentioned tube does not exceed a determined value, which is higher than the current through the ignition path, but increases with the current fed to the cathode of said tube when said current exceeds said value, until the voltage between the anode and the auxiliary electrode of the gas discharge tube in the second group reaches ignition voltage value.

The invention will be described more closely in connection with the attached figure, which shows a subscriber's identifier in an automatic telephone system.

In the figure, *Ab* designates a subscriber which, by means of a line *a*, *b*, is connected to a line-finder and selector stage *SLV* and to the usual line- and cut-off relay, *LR* and *BR*, respectively. *AG1—AG0* and *BG1—BG0* designate two groups of gas discharge tubes, preferably glow discharge tubes, of which only two in each group are shown on the drawing. However, each group usually comprises 10 to 20 glow discharge tubes. Be-

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tween the cathode of each AB-tube and the anode of each one of the BG-tubes is connected a make contact *11—00* pertaining to a line relay, whereby a determined subscriber connects, when calling, the cathode of a determined AG-tube to the anode of a determined BG-tube. The ignition electrodes of the AG- and BG-tubes are provided with common series resistances *R21* and *R28*, respectively, to prevent more than one tube in each group from firing. In the main discharge circuits of as well the AG- as the BG-tubes are connected marking relays *A1—A0* and *B1—B0*, respectively, the object of which is to transmit the designation of the calling subscriber to the marker. The resistances *R1—R0* and the rectifiers *L1—L0*, which are connected to the anodes of the glow discharge tubes *BG1—BG0*, are, together with the resistance *R27*, comprised in a circuit which ensures that one only of the tubes *AG0—AG1* fires on the ignition gap during the first moment of the call when no current has as yet begun to flow in the main path. The transistor *T* and the resistances *R22*, *R23*, *R24*, *R25* and *R26* are comprised in a voltage regulating means, which, when the main gap of a called AG-tube has fired, reduces the voltage on the ignition electrodes of all the tubes so much that any further tube is prevented from firing, should a further call be received during the identification process. The glow discharge tube *CG*, the transformer *TR* and the relay *K* are, together with the rectifiers *L11—L10*, comprised in a circuit for disconnecting the identifier.

The identifier is fed by means of the normal exchange battery, the poles of which have been designated by + and —, two batteries of 115 v., of which one has its negative pole and the other has its positive pole earthed, and one battery of 65 v., the positive pole of which is earthed. The terminals of the last mentioned three batteries have been designated in the figure by +115, —115, —65 and 0.

When a subscriber makes a call, for example the subscriber shown in the figure and designated by *11*, the subscriber's circuit is closed in the usual manner and the line relay *LR* attracts in the circuit +, contact *33*, relay winding *LR*, subscriber's line *a*, *b*, contact *34*, to negative. The contact *11* on the line relay is closed, the cathode *1* in the glow discharge tube *AG1* thereby being connected to the anode of the glow discharge tube *BG1*. The anode of the glow discharge tube *BG1* is also connected to the battery —115 v. via a resistance *R1* and to +115 v. via the rectifier *L1*, the conductor *41* and the resistance *R27*. The anodes of the other BG-glow discharge tubes are also connected in a corresponding manner to —115 v. and the conductor *41*. The resistance *R27* is thus passed by the sum of the currents through the resistances *R1—R0*. The resistances *R1—R0* and *R27* are dimensioned in such a manner that the anodes of all the BG-tubes have earth potential in the idle condition. When the contact *11* is closed a discharge is set up in the glow discharge tube *AG1* between the cathode *1* and the ignition electrode *2*, which latter in the idle condition is fed with a potential of about 105 v. via the resistance *R21* from the voltage divider consisting of the collector impedance of the transistor *T* and the resistance *R22*.

The current through the ignition gap causes a voltage drop in the resistance *R21* sufficiently great for preventing more than one of the AG-tubes from firing. To prevent the cathode potential in the tube *AG1* from increasing during the time, during which said tube is selected for operation by the ignition path being ionized, the rectifiers *L1—L0* are connected between the anodes of all the BG-tubes and the common conductor *41*. Thus, if the current through the ignition path in the tube *AG1* lies below the current, which in the idle condition flows from +115 v. through the resistance *R27*,

the conductor 41, the rectifier L1 and the resistance R1 to -115 v., the anodes of all the glow discharge tubes BG1—BG0 will be connected together by means of the forward resistances of the rectifiers L1—L0, which resistances are negligible in this connection. As the number of glow discharge tubes BG1—BG0 is relatively great, the current change through the resistance R27 common to all the tubes is rather small and the conductor 41 thus has practically the same potential as at rest even if the glow discharge tube AG1 fires. Thus the cathode potential of the glow discharge tube AG1 is substantially equal to the idle potential, i. e. earth potential, as long as the cathode current in the glow discharge tube AG1 lies below the current through the resistance R1 in the idle condition. If the rectifiers L1—L0 did not exist, the cathode potential of the glow discharge tube AG1 would, due to the voltage drop in R1, increase already during the time when only the ignition gap of the tube is ionized. Since the voltage drop over a glow discharge gap is chiefly constant independent of the current, the voltage on the ignition electrodes of all the glow discharge tubes AG1—AG0 would in this case also increase, and since the cathodes of the fired glow discharge tubes do not remain on zero potential, in this case a further call might fire another of the glow discharge tubes AG1—AG0.

The discharge of the ignition gap is transmitted to the main gap and the current in said last mentioned path increases with a speed which is determined by the inductance of the relay winding A1. When the current through the glow discharge tube AG1 has increased to the same value as the normal current through the resistance R1 in the idle condition the rectifier L1 is blocked and the voltage across the resistance R1 increases successively. When said voltage has increased sufficiently a discharge takes place between the anode 3 and the ignition electrode 2 in the glow discharge tube BG1. By means of the series resistance R28 common to all the ignition electrodes of the glow discharge tubes BG1—BG0, more than one of the glow discharge tubes is prevented from firing, should several of the contacts 11—00 be closed. The main gap is also fired and glows in a circuit which goes from +115 v. through relay A1, glow discharge tube AG1, contact 11, glow discharge tube BG1, relay B1 to -115 v. The relays A1 and B1 attract and mark that subscriber nr. 11 has called by the contacts a1 and b1 in the marker being closed.

To prevent the potential on the ignition electrodes of the glow discharge tubes AG1—AG0 from increasing too much during the time elapsing between the blocking of the rectifier L1 and the ignition of the glow discharge tube BG1 when the voltage on the cathode of the glow discharge tubes AG1 increases, the ignition electrodes of said glow discharge tubes AG1—AG0 are fed from a source of voltage which comprises a transistor T and is controlled in dependence on the current through the main gap of the glow discharge tubes AG1—AG0. All the anodes of the glow discharge tubes AG1—AG0 are fed from the voltage source +115 v. via the conductor 40 and the resistance R23. The emitter of the transistor is connected to the conductor 40, whereas the base electrode is connected to the voltage divider R24, R25, from which it is fed with a potential of about 110 v. R25 is a varistor of silicon carbide type and the voltage over said varistor is relatively independent of the current. Between the emitter and the base electrode there is likewise connected a varistor R26 of silicon carbide type.

In the idle condition a current of about 2 mA. flows from +115 v. through the resistance R23 to the emitter circuit of the transistor, which functions as a diode with a forward direction as indicated by the arrow. Owing thereto the current through the silicon carbide varistor R26 is also small. The transistor has the property that its collector resistance is very low as long as the collector current does not exceed the value of the emitter current

multiplied by a factor of the magnitude 2. As long as this is valid the collector voltage remains slightly negative in relation to the base electrode, or at about 105 v. in our example. As soon as the main discharge gap of the glow discharge tube AG1 has fired, the current through the resistance R23 increases, which causes the potential of the emitter to decrease in relation to that of the base, and the emitter current to cease. The collector resistance thereby increases so much that the voltage from the voltage divider formed by the collector resistance and the resistance R22 falls below the break-down potential of the ignition electrodes of the glow discharge tubes AG1—AG0. This low voltage on the ignition electrodes remains as long as the identifier is connected, i. e. during the time which is necessary for establishing a connecting path to a register.

By the varistors R25, R26 being connected in parallel with the resistance R23 the voltage drop is also reduced, owing to R23.

When the relays A1 and B1 have attracted, a positive potential is fed to the digit relays of the marker over the contacts a1, b1 on said relays and a break contact on the relay K1. The digit relays which determine for example the units and the tens of the subscriber establish in a known manner circuits for selection of a free connection path to the subscriber, a free register and a free link. When the digit relays attract, the contact d in the anode circuit of the glow discharge tube CG is also closed. As soon as the connection has been set up to the register the break relay BR attracts, the contact 32 thereby breaking the connection between the cathode of the glow discharge tube AG1 and the anode of the glow discharge tube BG1. The current through the glow discharge tube AG1 is thereby broken and the relay A1 falls, but the glow discharge tube BG1 is energized via the rectifier L1 and the resistance R27 from +115 v. Thus when contact 32 breaks, the current through the resistance R27 increases and the potential on the conductor 41 decreases considerably. The arising negative impulse is transmitted via the transformer TR to the ignition gap of the gas discharge tube CG, which fires. The main gap fires in a circuit from +115 v., contact d, main gap 2—1 and relay winding K to earth. Across the relay winding K, which is connected in the cathode circuit, there arises a positive voltage impulse, which via a condenser and the rectifiers L11—L10 is transmitted to the cathodes of the glow discharge tubes BG1—BG0, relay B1 thereby releasing and breaking contact b1. When the glow discharge tube CG fired, relay K also attracted, contact K1 thereby breaking the current to the digit relays in the marker. When the digit relays release the auxiliary relay controlled by the digit relays, which kept the contact d closed during the connecting process, also releases. The glow discharge tube CG is extinguished and relay K, which is slow-releasing, releases, the identifier thereafter being ready for a new identification.

We claim:

1. An identifying device for calling circuits in an automatic telephone system comprising a first and a second group of gaseous discharge tubes each having a first and a second main electrode and an ignition electrode, voltage supply means for said tubes, a plurality of make contacts connected between the first main electrode in one of the tubes within said first group and the second main electrode in one of the tubes within the second group, said contacts being operated in response to a call originating from the associated circuit, each of said second electrodes of the tubes in the second group being connected to an individual point in a voltage supply network, each of said points having normally a potential sufficient to ionize the discharge gap between the ignition electrode and the first main electrode of the tube in the first group which is connected to the point by means of one of said contacts, said voltage supply network comprising means for keeping the voltage of each of said points being con-

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ected to the first main electrode of one of the tubes in the first group substantially constant until the current flowing to the last mentioned electrode has reached a value exceeding the normal current to the auxiliary electrode and thereafter for successively changing the potential of said point with the current through the tube in the first group until the ionizing potential between the second main electrode and the ignition electrode in the associated tube in the second group is reached, the ignition electrodes of each group being via a resistance common to the group connected to voltage supply means separate for each group, the voltage supply means of the ignition electrodes of the first group comprising means controlled by the current through the tubes of this group for decreasing the ignition electrode potential to a low value before the potential of said point is beginning to change, whereby further tubes of the first group are prevented from firing.

2. An identifying device as claimed in claim 1, in which each of said points of the voltage supply network is connected on one hand via a series resistance to one terminal of a voltage source, and on the other hand via a rectifier to a conductor common to all points, said conductor being, via a resistance, connected to the other terminal of said voltage source, said resistances and said voltage source being so selected, that the currents normally flowing through said series resistances are somewhat greater than the current through the ignition gaps of the associated tube in the first group when ionized, the rectifier being so directed, that it is conducting as long as the current through the associated tube in the first group is lower than said normal current but is blocked

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as soon as the current to the associated tube in the first group exceeds said normal current.

3. An identifying device as claimed in claim 2, wherein the voltage supply means for the ignition electrodes of the tubes in the first group comprises a voltage divider, one branch of which consists of the collector-base impedance of a transistor, the emitter-base circuit of which is connected across an impedance connected in series with the voltage supply of the main electrodes of the tubes in the first group in such way, that the emitter potential is decreasing with increasing current through the main gap, whereby the collector impedance, as soon as the emitter current is decreased below half the collector current, is increasing so much, that the potential of the ignition electrodes gets a value sufficient to prevent any tube in the first group from firing.

4. An identifying device as claimed in claim 2 where the common conductor is connected to an amplifier for amplifying and changing the polarity of the impulse appearing across the resistance connected between said conductor and the voltage source when the contact connecting one tube in each group is opened after a completed identifying operation, said amplified impulse being impressed on said first electrodes of all the gaseous discharge tubes of the second group causing these tubes to be extinguished.

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