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PARTY LINE IDENTIFICATION SYSTEM

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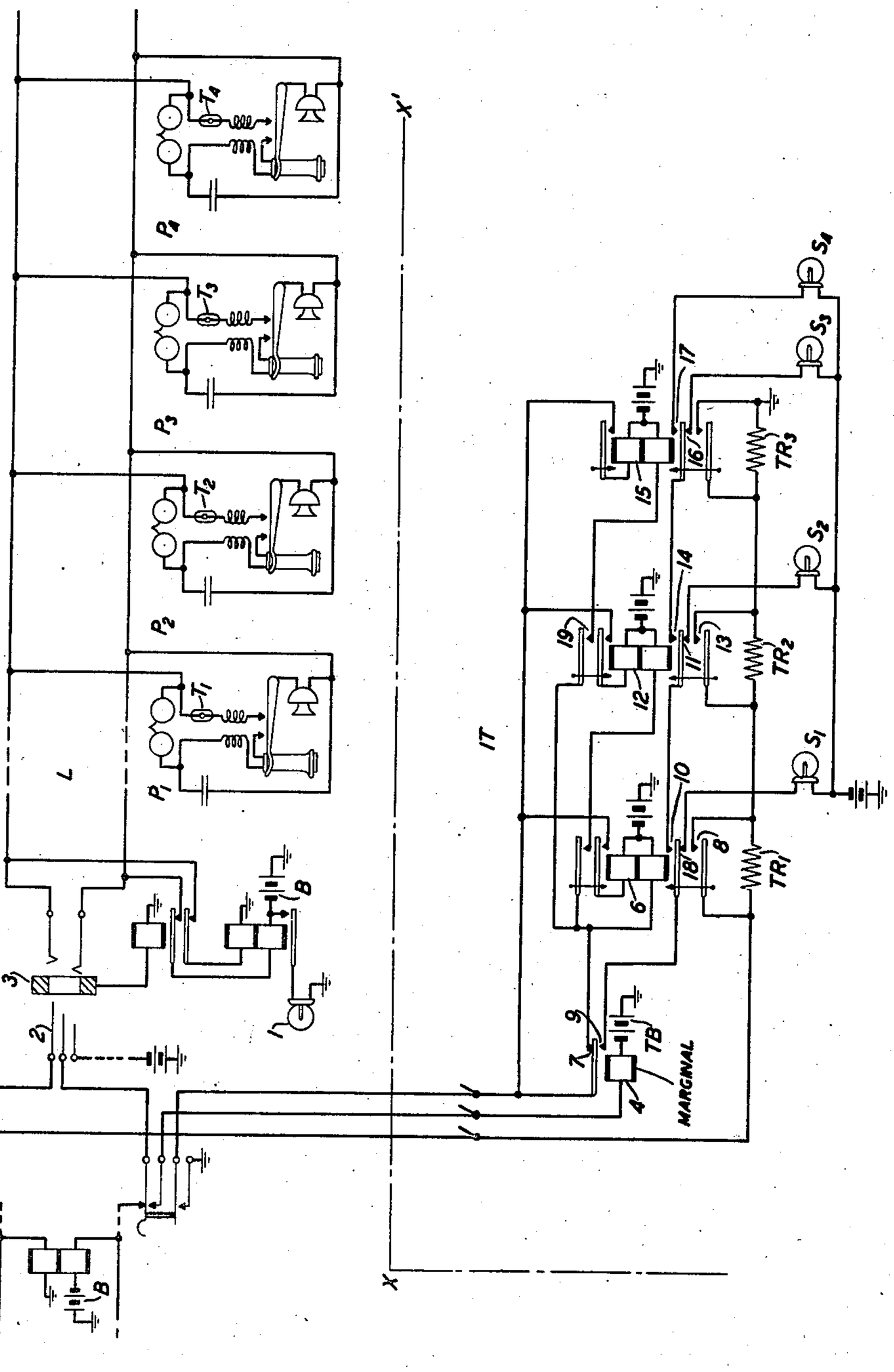

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PARTY LINE IDENTIFICATION SYSTEM

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This invention relates to telephone systems and more particularly to party line systems having testing means at the central office for determining which of the telephones on the line is connected thereto for speech transmission, i. e., has its receiver "off the hook."

A feature of the invention resides in providing (*a*) at each station on the line a negative resistance element having a characteristic critical voltage individual thereto adapted to be connected across the line in series with the associated station transmitter when the corresponding receiver is removed from the switchhook; (*b*) testing means at the central office for serially connecting a source of direct current, a marginal relay, and a resistor to the line, and for progressively reducing the effective resistance of said resistor until said relay operates; and (*c*) means, responsive to operation of said relay, for indicating the resistance reduction effected to cause operation of the relay, whereby the station whose receiver is off the hook is identified.

The invention will be understood from the following description when read in connection with the accompanying drawing which shows one embodiment thereof, i. e., a multiparty line L having four bridged stations P1, P2, P3 and P4 associated therewith each of which stations is provided with a negative resistance element T1, T2, etc., hereinafter referred to as thermistors, and arranged to be connected in series with the station transmitter when the receiver of the station is removed from the hook, and an operator's cord circuit C provided with an identification key IK for associating an identification test circuit IT with the line to which the cord is connected. It will be understood that the thermistors T1, T2, etc. each has a different critical voltage characteristic, i. e., requires a different voltage to cause its normal high resistance to rapidly decrease to a relatively low resistance.

The operation of the system, as shown in the drawing, follows: Let it be assumed that the four thermistors T1, T2, etc. are so located on the line that T1, at station P1, requires the lowest voltage to cause its resistance to change from a high to a low value, P2 requires a slightly higher potential, and so on to the last station P4 whose thermistor T4 requires a higher potential than any of the others preceding it.

Now, in case the receiver at station P2 is removed from its switchhook the line lamp 1 at the central office will light in the usual manner to indicate a call. At this point it will also be assumed that the thermistors T1, T2, etc. are so

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chosen that none of their critical voltages are higher than the line voltage of the central office battery B and consequently when any station calls its thermistor resistance is reduced to a sufficiently low voltage to permit satisfactory speech transmission.

When the line lamp 1 is lighted the operator answers the call in the usual manner by inserting the answering plug 2 in the line jack 3 and talks with the calling subscriber. In case the connection desired by the calling subscriber is one requiring a charge and the operator desires to check the identity of the calling station, she will operate identification key IK thereby disconnecting the portion of the cord circuit to the left of the key and connecting the identification test circuit IT to the calling line over the answering plug 2 whereupon the test battery TB is connected to the line in series with marginal relay 4 and test resistances TR1, TR2 and TR3. The voltage of test battery TB is so chosen that when connected to the line in series with the test resistances TR1, TR2 and TR3 and relay 4, the line voltage at any station will be equal or greater than the critical voltage of thermistor T1 but less than the critical voltage of the others, and therefore thermistor TR2 at the calling station will immediately increase its resistance to a sufficiently high value to prevent sufficient current from flowing through relay 4 to cause its operation. When key IK is operated it also closes its lowermost contacts 5 thereby closing an operating circuit for slow-operate relay 6 which includes the back contact 7 of marginal relay 4, which relay as beforenoted is in its non-operated condition. When relay 6 operates it locks over its inner upper contact and contacts 5 of key IK and closes its lowermost contact 8 thereby short-circuiting resistor TR1 thereby increasing the line voltage applied to thermistor T2 at the calling station to the critical voltage of that element whereupon its resistance falls to a low value thus permitting sufficient current to flow through relay 4 to cause its operation.

Relay 4 in operating opens its contacts 7 and closes its contacts 9 thereby completing a circuit to light station indicating lamp S2 which can be traced from ground, contacts 5 of key IK, contacts 9 of relay 4, contacts 10 of relay 6, contacts 11 of slow-operating relay 12, and lamp S2 to battery. The lighting of lamp S2 is an indication to the operator that the receiver at station P2 is "off the hook" and she therefore releases key IK and proceeds to complete the desired connection. The release of key IK releases relays 4 and 6, extinguishes lamp S2 and restores the

line and cord circuit to the condition prior to the identification test.

If we assume that station P3 calls and the operator connects the identification test circuit IT to the line, relay 12 will operate and lock a short interval after relay 6 for the reason that relay 4 does not operate on the line voltage established when resistance TR1 is short-circuited and relay 6 is operated and locked.

Relay 12 in operating closes its contacts 13 thereby short-circuiting resistance TR2 which further increases the line voltage to the critical value of thermistor T3 which immediately lowers its resistance and causes relay 4 to operate at the central office. When relay 4 operates it closes its contacts 9 and completes a circuit to light lamp S3 which circuit includes contacts 10 of relay 6, contacts 14 of relay 12, which is now operated, and contacts 16 of relay 15.

In a like manner if station P4 calls, relay 4 does not operate when relay 12 operates and therefore relay 15 soon operates in a circuit including contacts 19 of relay 12, thereby short-circuiting the final test resistance TR3 and causing the line voltage to increase to the critical value of thermistor TR4, thus causing relay 4 to operate to light lamp S4 in a circuit which includes contacts 10 of relay 6, contacts 14 of relay 12, and contacts 17 of relay 15.

In case station T1 calls, the initial voltage applied to the line in series with the total resistance of relay 4 and test resistance TR1, TR2 and TR3 is equal to or slightly greater than the voltage required to cause thermistor TR1 to reduce its resistance to a low value and therefore relay 4 operates at once thus preventing relay 6 from operating. Relay 4 in closing its contacts 9 completes a circuit to light lamp S1 which includes contacts 18 of relay 6.

It will be noted that other testing arrangements which involve the progressive step by step increase of a potential and its application to a line will cause an increase in the test current depending on the value of a bridged resistance, and means for indicating the value of the test potential when this current increase occurs is within the scope of the present invention.

What is claimed is:

1. In a telephone system in combination, a central office, a line terminating thereat having a plurality of telephones associated therewith each of which comprises a transmitter in series with a negative resistance element adapted to be connected in bridge of the line when the telephone is taken for use, each of said elements having a normal high resistance and a different critical point in its voltage resistance characteristic at which its resistance rapidly falls to a relatively low value, a source of potential, a resistance and a marginal relay at said central office, and means at the central office for testing said line to determine which of said telephones have been taken for use comprising a switching mechanism for serially connecting said source, resistance, and relay, with the line and for progressively reducing said resistance by predetermined stages until said relay operates, and means for indicating the stage to which said resistance has been reduced when said relay operates.

2. In a telephone system, a central office, a line terminating thereat, a plurality of telephone stations thereon each of which is adapted to be connected thereto for conversation, and testing means controlled at the central office for indicating which telephone is taken for use, said

means comprising a negative resistance element associated with each telephone in series with the respective transmitter, each element having a normal high resistance and a different critical point in its voltage-resistance characteristic at which point its resistance rapidly falls to a relatively low value, a source of direct current adapted to be connected to the line and progressively increased in voltage, and a selective arrangement for indicating the line voltage at which the resistance of the element at the connected station falls to a low value.

3. In a telephone system, a central office, a line terminating thereat, a plurality of telephone stations thereon each of which is adapted to be connected thereto for speech transmission and testing means controlled at the central office for identifying the station taken for use, said means comprising a negative resistance thermistor associated with each telephone in series with the respective transmitter, each thermistor having a normal high resistance and an individually different critical point in its voltage-resistance characteristic at which its resistance rapidly falls to a relatively low value, a source of variable test potential, means in said central office for applying said test potential to the line and for automatically increasing its voltage in successive stages, and identification means responsive to a decrease in the line resistance for discontinuing said voltage increase and for indicating the voltage stage at which said line resistance decrease occurs.

4. In a telephone system in combination, a central office, a line terminating thereat having a plurality of telephones associated therewith each of which comprises a transmitter in series with a negative resistance element adapted to be connected in bridge of the line when the telephone is taken for use, each of said elements having a normal high resistance and a different critical point in its voltage resistance characteristic at which its resistance rapidly falls to a relatively low value, a source of potential, a resistance and a marginal relay at said central office and means at the central office for testing said line to determine which of said telephones has been taken for use comprising a switching mechanism for serially connecting said source, resistance, and relay, with the line, said source of potential and associated resistance having such value that when one of said telephones is taken for use the potential across the respective negative resistance element is equal to the critical value of the element associated with the line having the lowest critical potential but below the critical value of the other, and said relay being so constructed that it will operate in circuit with any of said elements when its specified critical potential is applied thereto, said switching mechanism being adapted, that when a telephone is taken for use and said source of potential is connected to the line, to progressively reduce said resistance in series with the source by predetermined stages as long as said relay remains unoperated, and means for selectively indicating the stage to which said resistance has been reduced when said relay operates.

5. In a telephone system in combination, a central office, a line terminating thereat having a plurality of telephones associated therewith each of which comprises a transmitter in series with a negative resistance element adapted to be connected in bridge of the line when the telephone is taken for use, each of said elements having a

normal high resistance and a different critical point in its voltage resistance characteristic at which its resistance rapidly falls to a relatively low value, a source of potential, a resistance and a marginal relay at said central office, and means at the central office for testing said line to determine which of said telephones has been taken for use comprising a switching mechanism for serially connecting said source, resistance and relay with the line, said source of potential and associated resistance having such value that when a telephone is taken for use the potential applied to the respective negative resistance element is equal to that required by the elements associated with the line having the lowest critical potential but lower than the critical potential of the other element, and said relay being so constructed that it will operate on current therethrough when a critical potential is applied to any one of said negative resistance elements, said switching mechanism being also adapted, upon the failure of said relay to operate to progressively reduce said resistance at the central office by predetermined failures until said relay

operates, and means for selectively indicating the reduction in resistance effective to cause operation of said relay.

6. In a party line identification system, a line, a plurality of stations thereon, a negative resistance element at each station adapted to be connected across the line in series with the associated transmitter when the corresponding receiver is removed from the switchhook, said elements having differing critical points in their voltage-resistance characteristic at which their resistance changes from a relatively high to a relatively low value, a central office at which said line terminates, a source of variable test potential, and means at the central office for applying said test potential to the line and automatically increasing its voltage in successive stages until the resistance of the line decreases to a relatively low value, and other means responsive to a decrease in the line resistance for selectively indicating the voltage stage at which said line resistance decrease occurs.

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