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TELEPHONE EXCHANGE SYSTEM

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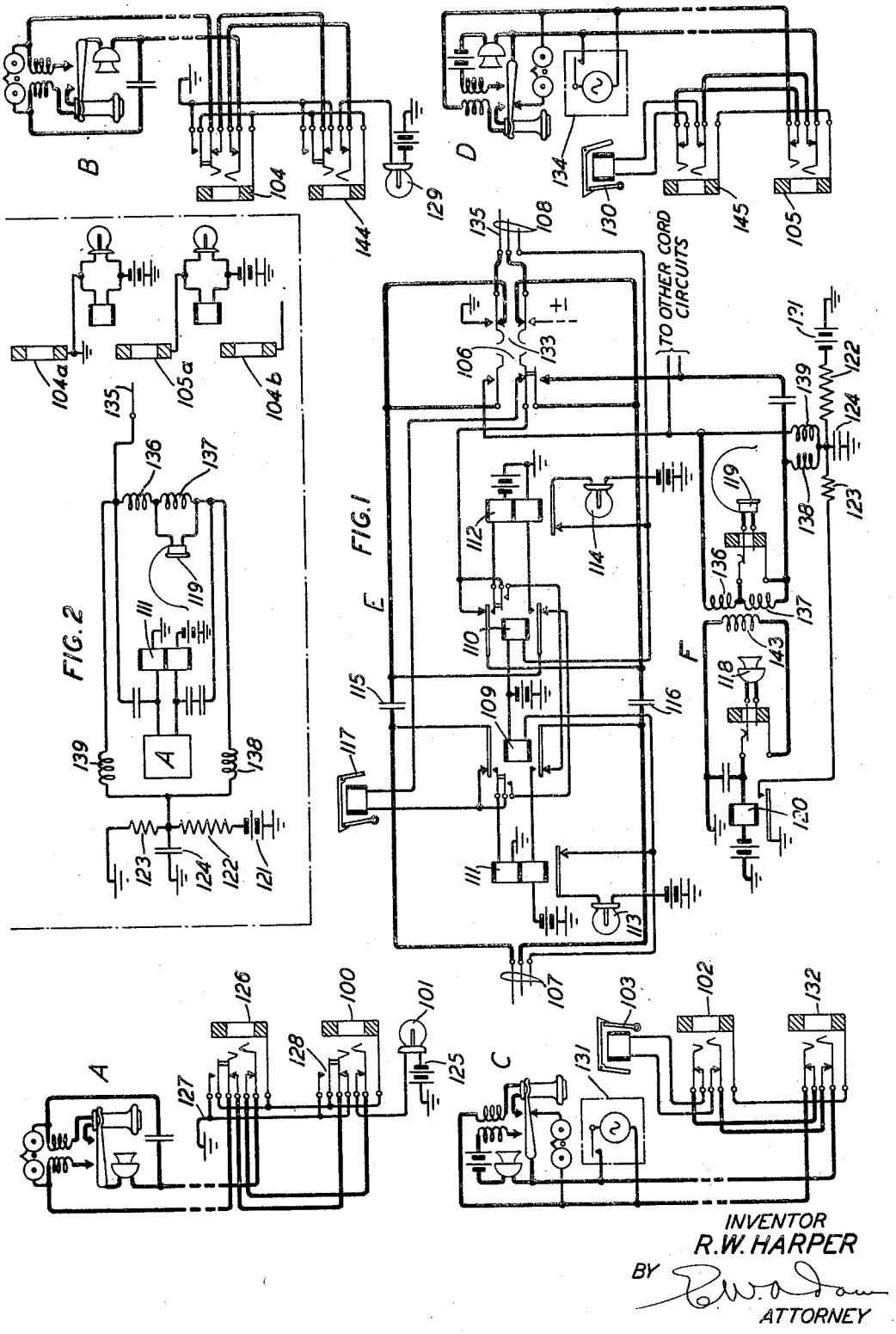

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TELEPHONE EXCHANGE SYSTEM

Application filed April 30, 1932. Serial No. 608,356.

This invention relates to telephone exchange systems and particularly to operator's testing means for determining the idle or busy condition of telephone lines.

An object of the invention is to determine, by use of a single test circuit, the idle or busy condition of lines whose sleeve terminals are at one or the other of two different potentials when busy, for example, battery or ground.

A feature of the present invention, whereby the above stated object is obtained, resides in connecting the operator's telephone circuit between a conductor, maintained at a potential different from the two busy potentials, and the tip of the test plug in order that a flow of current through the operator's receiver will take place when contact is made between said plug tip and a sleeve terminal of a busy line maintained at either potential.

The invention will be understood from the following description together with the accompanying drawing in which an embodiment of the invention is illustrated:

Fig. 1 shows the invention applied to an operator's telephone circuit in a telephone exchange system; and

Fig. 2 shows a schematic diagram of parts of the telephone exchange circuits as they are connected for making a busy test.

Circuit description

In Fig. 1 are shown two common battery telephone stations A and B and two magneto telephone stations C and D connected by telephone lines with a central office wherein the lines are terminated at a switchboard in multiple jacks. The multiple jacks associated with each common battery line are provided with normally open contacts adapted to be closed by the insertion of a plug terminal of a cord circuit to connect ground to the sleeves of all the multiple jacks connected to the same line. The sleeves of the magneto line multiple jacks remain ungrounded when plugged up. A line lamp is associated with one of the jacks connected to each common battery line and a line drop is associated with one of the jacks connected to each magneto line.

In addition a universal cord circuit E is shown which is covered by the copending application of H. W. Ulrich, Ser. No. 609,412, and to which I make no claim. Cord circuit E is one of several located at an operator's position at the switchboard, any of which may be connected to the operator's telephone circuit F by the operation of the individual cord circuit talk key as, for example, key 106 in cord circuit E. We will assume that jack 100 and associated line lamp 101, jack 102 and associated line drop 103, jack 104 and jack 105 are located at the switchboard operator's position with which cord circuit E and telephone circuit F are associated and that the other jacks and line signals are located elsewhere in the switchboard.

Cord circuit E is provided with answering and calling plug terminals 107 and 108, respectively. Answering and calling sleeve relays 109 and 110 operate in response to connections to common battery lines and connect talking battery through the answering and calling supervisory relays 111 and 112, respectively, to the answering and the calling end of the cord talking conductors. Relays 111 and 112 control the answering and calling cord supervisory lamps 113 and 114, respectively.

Condensers 115 and 116 are inserted in the tip and ring cord talking conductors, respectively, in order to prevent the passage of direct current, but to allow variable talking current to be freely transmitted.

Cord drop 117 is designed to operate on alternating current from a subscriber's magneto generator and is normally bridged from the tip conductor of the answering cord to the ring conductor of the calling cord. Relay 109 in operating, with relay 110 unoperated, disconnects drop 117 from the tip of the answering cord and connects it between tip and ring conductors of the calling cord, while relay 110 in operating with relay 109 unoperated, transfers the connection of drop 117 to the tip and ring conductors of the answering cord. With relays 109 and 110 both operated, however, drop 117 is entirely disconnected from both ends of the cord.

The operator's telephone circuit F includes

a transmitter 118 and receiver 119 and is provided with my arrangement for obtaining a "click" busy test upon both common battery and magneto lines. This busy test arrangement comprises condenser 124, the upper plate of which is maintained at a potential intermediate that of the central office battery and that of ground by a potentiometer arrangement including resistances 122 and 123. The potentiometer circuit is energized under control of relay 120 which is held operated on the energizing current for transmitter 118 whenever this is plugged into the position telephone jack. The transmitter current flows in a circuit from battery, through relay 120, transmitter 118 and primary 143 of the induction coil to ground.

The potentiometer circuit extends from central office battery 121 through resistances 122 and 123 and contact of relay 120 to ground. In practice, suitable values for resistances 122 and 123 have been found to be 18,000 ohms and 6,000 ohms, respectively. Condenser 124 is connected from a point between these two resistances to ground and its upper plate is thereby maintained at a potential intermediate that of the ungrounded terminal of the central office battery and ground potential.

In practice, with a 48-volt central office battery and the resistances of the stated values this potential will be approximately 12 volts to ground. When talk key 106 is operated the operator's receiver 119 will be connected between this upper plate and the tip 135 of the calling cord plug.

If a cord is already plugged into one of the jacks of a called common battery line, ground is connected from the normally open contact of the occupied jack, which is now closed, to the sleeves of all of the multiple jacks associated with said line. The multiple jack sleeves of a busy magneto line, however, are connected only to central office battery through the sleeve conductor of the connected cord. The operator makes a busy test by touching the tip 135 of plug 108 to the sleeve of the called line while keeping talk key 106 operated.

In Fig. 2, a schematic diagram of the busy test circuits when the answering cord is connected to station A and talk key 106 is in the operated position, it will be seen that condenser 124 is connected by several parallel paths with the tip 135 of the calling cord, one of which paths is as follows: From condenser 124 through retardation coil winding 138, through the operator's telephone receiver 119, through induction coil winding 136, to the calling cord tip 135. This figure also shows the sleeve 104*a* of the jack of a common battery line and the connections thereto when the line is busy, and the sleeve 105*a* of the jack of a magneto line and the connections to this sleeve when its associated line is busy, and the sleeve 104*b* of any idle line whether of magneto or of common battery type.

Operation

The operation of the busy test circuit will now be described, reference being made to Figs. 1 and 2. On a call from common battery station A the answering cord is connected with that line and talk key 106 is operated.

If common battery station B, for example, is asked for, the operator touches the tip of plug 108 to the sleeve of jack 104. If the line is busy due to the presence of another plug in the multiple jack 144 of said line ground on the sleeve of jack 104 will be connected to the tip conductor of the cord circuit E and telephone circuit F causing condenser 124 to partially discharge. Part of this discharge will pass through receiver 119 thus giving a click to the operator as a signal that the line is busy. This circuit condition would be illustrated in Fig. 2, if tip 135 were touched to sleeve 104*a* which is connected directly to ground.

If magneto station D has been called and is already busy, due to the presence of a cord plug in jack 145, battery from this cord on the sleeves of the multiple jacks will be connected to the tip 135 of cord E and to the telephone circuit F. In this case condenser 124 will take on a greater charge, part of the charging current passing through the operator's receiver, thus giving a click to the operator as a signal that this called line is busy. This condition would be illustrated in Fig. 2, if tip 135 were touched to sleeve 105*a* which is connected only to the central office battery through the supervisory lamp and the relay winding in shunt with it.

Providing a called line of either type is idle, however, neither battery nor ground is found connected to the sleeve of the jack and hence no click is received by the operator. This condition would be illustrated for either case by Fig. 2 if tip 135 were touched to sleeve 104*b*.

While the present invention is disclosed as embodied in certain specific arrangements, applicant does not wish to be limited by such disclosure but desires to cover broadly all arrangements which come within the spirit and scope of the appended claims.

What is claimed is:

1. In a busy test system, a telephone switchboard, subscribers' common battery lines terminating in multiple jacks at the switchboard, subscribers' local battery lines also terminating in multiple jacks at the same switchboard, universal cord circuits for interconnecting said lines, an operator's telephone circuit associated with said cord circuits, means responsive to the connection of one of said cord circuits to a common battery line to connect the sleeves of the multiple

jacks of said line to ground, a source of battery potential, means responsive to the connection of said cord circuit to a local battery line to contact only said potential source to the sleeves of the multiple jacks of that line, a conductor, means for maintaining said conductor at a potential intermediate that of battery and ground, and means for connecting the operator's telephone circuit between said conductor and the tip conductor of a second of said cord circuits.

2. In a telephone system, lines of two characters terminating at an exchange, multiple jacks for each line, cord circuits for interconnecting said lines, a battery, means responsive to the connection of a cord circuit to a line of the first character to connect said battery to the sleeves of all the jacks of said line, means responsive to the connection of said cord circuit to a line of the second character to connect a ground to the sleeves of all the jacks of that line, and means to supply a potential, intermediate that of said battery and ground, to the tip conductor of a second cord circuit through an operator's telephone circuit.

3. In a telephone exchange system, telephone lines terminating in multiple jacks at a switchboard, a battery, means responsive to the busy condition of one of said lines to associate battery potential with jacks connected to said line, means responsive to the busy condition of a second of said lines to associate ground potential with jacks connected to said second line, a source of a third potential, a busy test conductor connected to said source, and an electro-responsive device associated with said conductor.

4. In a telephone system, telephone lines terminating in multiple jacks at a switchboard, link circuits for interconnecting said lines, means responsive to the connection of a link circuit to one line to connect ground directly to the sleeves of the multiple jacks of said line, a battery, means responsive to the connection of a link circuit to another line to connect only said battery to the sleeves of the multiple jacks of that line, a potentiometer connected between said battery and ground, a testing plug, and an electro-responsive device connected between said plug and an intermediate point of said potentiometer.

5. A telephone system comprising telephone lines terminating in multiple jacks at a switchboard, link circuits at the switchboard for interconnecting said lines, a terminal on each jack, means for placing one or the other of two different potentials on said terminal when the associated line is busy, a source of a third potential and a busy test circuit comprising a conductor connected to said source, a testing plug, and electro-responsive means connected therebetween.

6. In a telephone system, telephone lines of two characters terminating in multiple jacks at a switchboard, link circuits for connecting any two of said lines, a battery, means responsive to the connection of a link circuit to a line of the first character to connect said battery to the sleeves of the multiple jacks of said line, means responsive to the connection of a link circuit to a line of the second character to connect ground to the sleeves of the multiple jacks of that line, a condenser plate maintained at a potential intermediate that of said battery and that of ground, a conductor connected to said condenser plate and adapted to be touched to the sleeves of said jacks for busy test purposes, and an indicating device associated with said conductor.

7. In a telephone system, a switchboard, subscribers' lines of different characters terminating thereat in multiple jacks, cord circuits associated with said switchboard for connecting any two of said lines, means responsive to the connection of any one of said cord circuits to a multiple jack of a line of one character for placing a potential of a certain value on the sleeve portions of all the jacks associated with that line, means responsive to the connection of any one of said cords to a jack of a line of the other character for placing a higher potential on the jack sleeves of that line and an operator's busy test circuit adapted to be connected to the test conductor of any of said cords, said busy test circuit including a source of potential whose value is intermediate the values of the potentials applied to said different character lines.

In witness whereof, I hereunto subscribe my name this 28th day of April, 1932.

ROBERT W. HARPER.