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TELEPHONE LINE

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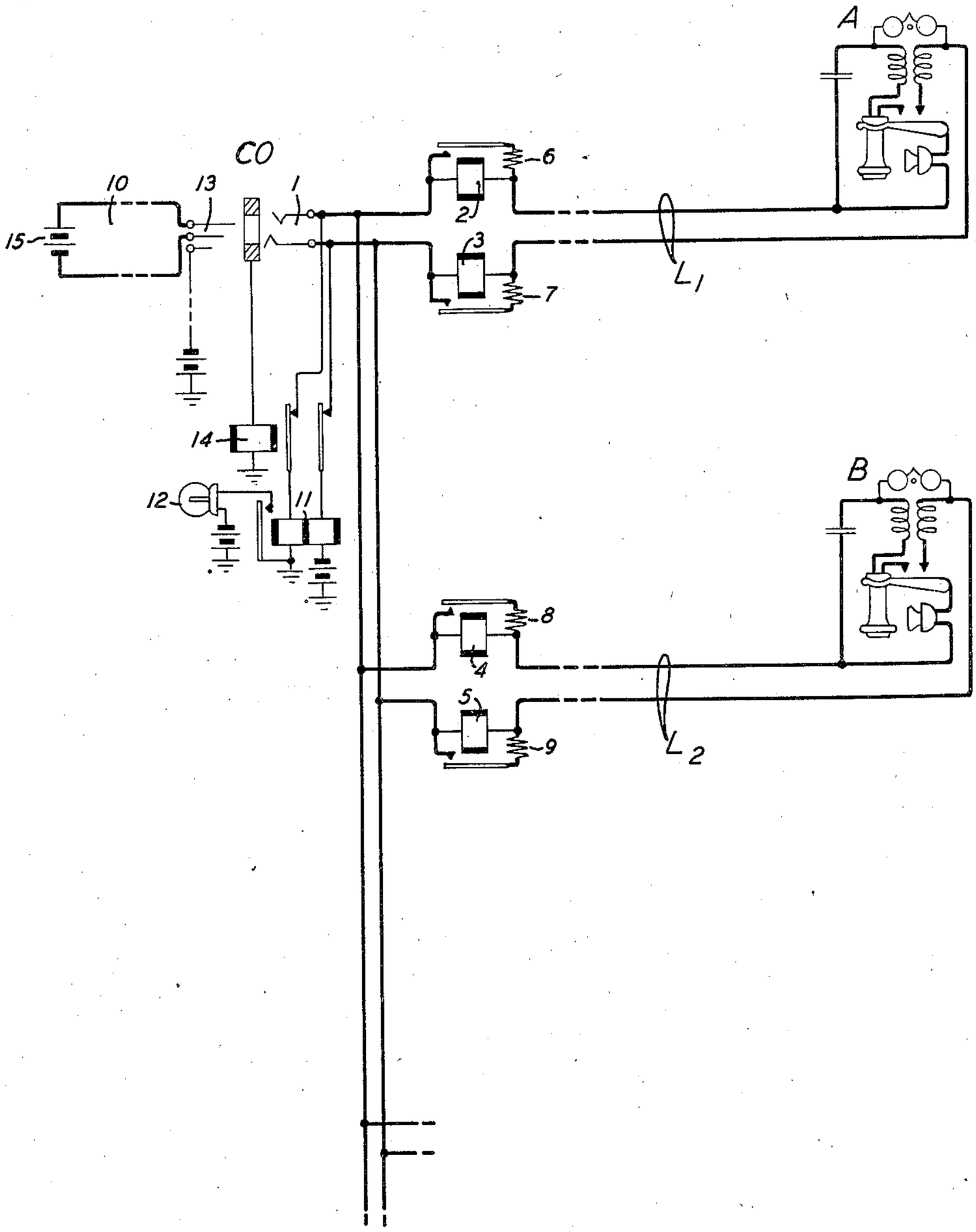

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TELEPHONE LINE

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This invention relates to improvements in telephone systems and more particularly to means for reducing bridged tap losses in speech transmission where two or more relatively long subscribers' loops or pairs of wires are connected in multiple at some central point and terminate as a single line at the telephone exchange.

It frequently happens that it is desirable or necessary to "bunch" or "bridge" subscribers' cable pairs or "loops" at a central office main frame in order to serve subscribers' stations having the same line number but widely scattered as to location, as for example, any multi-party subscriber's line, or where a so-called secretarial and physicians' call bureau service is given. Further, it is quite common for professional men who have business lines in their offices to have extensions of these lines located at their residences which may be at some distance from their office and frequently in another exchange area.

In all these cases, and particularly where the wires are contained in cables speech transmission over the line is frequently impaired due to the combined capacity of the bridged pairs of wires.

An object of the present invention is to reduce such bridged tap losses in cases where two or more pairs of wires are connected together in multiple.

A feature of the invention whereby the foregoing object is obtained resides in the inclusion of inductance of the proper value in series with each conductor of each pair of bridged wires and located at or near the point where the wires are bridged to the common line circuit and in the provision of means in each bridged pair which respond when their respective station switchhooks are operated to exclude the series inductance from such pairs during the period they are in use.

More specifically the foregoing object is attained by serially including a relay of the well-known supervisory type, and having the proper inductance, in series with each conductor of each bridged pair, said relays being so arranged that, when operated in response to the receiver of a station on the associated pair being removed from the hook, they will shunt their inductive windings by a normally disconnected non-inductive resistance, usually wound on the same core, of such a value as to permit only enough current to flow in the inductive winding to hold the relay operated.

The invention will be understood from the following description when read in connection with the accompanying drawing which shows two subscribers' station loops L_1 and L_2 located at some distance from each other and from the central office CO and connected in multiple at the central office to a common line jack 1.

Connected in series with each loop conductor near the junction point of the loop and the common conductors, which in practice is usually at the central office terminal rack, are relays 2, 3, 4 and 5.

Associated with each relay is a non-inductive resistance 6, 7, 8 and 9, respectively, adapted to be connected in shunt to their respective relay windings upon the closure of the associated relay armature contact. In practice the non-inductive winding will be wound on the relay core.

A cord circuit indicated at 10 is adapted to be connected to jack 1 for the purpose of answering or extending calls on the line loops L_1 and L_2.

Connected across the common line conductors is the usual line relay 11 which controls the line lamp 12.

A description of the operation of the circuit arrangement shown on the drawing will now be given.

Let it be assumed that station A on loop L_1 desires to be connected to some other line terminating at the central office CO. Upon removal of the receiver from the hook a circuit is closed from battery through the winding of relays 11, 2 and 3 all of which relays thereupon operate. Relay 11 in operating closes an obvious circuit to light line lamp 12.

In response to the lighting of lamp 12 the operator inserts the plug 13 of cord circuit 10 in jack 1 thereby operating the sleeve cut-off relay 14 and opening the circuit to relay 11 which releases thereby extinguishing the line lamp 12.

When the plug 13 was inserted in jack 1 battery 15 in the cord circuit is connected to the tip and ring conductors of the line thereby maintaining relays 2 and 3 operated. Relays 2 and 3 by closing their armature contacts shunt their winding by the respective non-inductive resistances 6 and 7. It may be mentioned at this time that the inductance of relay windings 2, 3, 4 and 5 at voice frequencies is relatively high, i. e., of the order of .2 henry and the ohmic resistance of the non-inductive shunt is sufficiently high to permit sufficient current to flow in the inductive windings, when the relays have been operated, to hold their armatures in the operated position.

It will, therefore, be noted that with the receiver off the hook at station A, the high inductance of the windings of relays 2 and 3 is shunted out by the non-inductive resistances 6 and 7 thereby

eliminating the high inductance from the loop L_1. On the other hand, due to the fact that the receiver at station B is on the hook, the high inductance of the windings 4 and 5 is in series with the loop L_2 and the shunting effect of the distributed capacity of the loop L_2 on the transmission efficiency of the loop L_1 is substantially eliminated.

It should be further noted that in case the subscriber at station B desires to listen in on the line removal of his receiver from his hook causes relays 4 and 5 to operate thereby removing the inductive windings of relays 4 and 5 from the line.

The operation of the system will be the same in case either station A or B is called instead of calling. Insertion of plug 13 in jack 1 will operate relay 14 and when either station answers by removing his receiver from the hook the respective series relays 2, and 3, or 4, and 5 will operate thereby conditioning the answering subscriber's loop for conversation.

The system of this invention is adapted for use in connection with any multi-station line where two or more loops or pairs are connected to a pair of common line conductors and where one or more of the bridged loops, due to length or for other reasons, have a relatively large distributed capacity. In such cases the high inductance series relays are inserted in the high capacity loop or loops at a point as near as possible to the junction of the loop with the common or main line conductors.

Instead of employing an individual relay in each conductor of the loop, as shown on the drawing, it should be noted that a single relay structure having two inductive windings, one for each side of the line, and two non-inductive windings, all wound on the same core, may be employed without departing from the spirit of the invention.

What is claimed is:

1. In a common battery telephone system, a switchboard, a plurality of station lines, a common line terminating at said switchboard and connecting said station lines in multiple thereto, a relay in series with each of said station lines, and a non-inductive resistance associated with each relay and adapted to be connected in shunt thereto when the relay is operated.

2. In a common battery telephone system, a central office, a line extending therefrom, a plurality of station lines multiply connected to said first line, a relay individual to and in series with each of said station lines and adapted to be operated when their respective lines are closed at a subscriber's station, and a non-inductive resistance associated with each relay and adapted to be connected in shunt thereto when the relay is operated.

3. In a common battery telephone system, a central office, a line extending therefrom, a plurality of station lines multiply connected to said first line, a relay individual to and in series with each conductor of each station line and adapted to be operated when their respective station lines are closed at a subscriber's station, and a non-inductive resistance associated with each relay and adapted to be connected in shunt thereto when the relay is operated.

4. In a common battery telephone system, a plurality of station lines, a common line connected to all of said station lines in multiple, a non-inductive resistance individual to each of said station lines, and individual means in each of said station lines responsive to current flowing therein to connect the respective resistances in shunt to said means.

5. In a common battery telephone system, a switchboard, a plurality of station lines, a common line terminating at said switchboard connecting said station lines in multiple thereto, a relay having an inductive winding in series with each of said station lines near their point of connection with the common line, and a non-inductive winding on each of said relays and adapted to be connected in shunt to the inductive winding when the relay is operated.

6. In a common battery telephone system, a central office, a line extending therefrom, a plurality of station lines multiply connected to said first line, a relay having an inductive and a non-inductive winding individual to and having its inductive winding in series with each conductor of each station line and adapted to be operated when the respective station lines are closed at a subscriber's station, and means responsive to the operation of each relay for connecting the respective non-inductive winding in shunt to the inductive winding.

7. In a common battery telephone system, a switchboard, a plurality of station lines each normally including in series therewith a relatively high inductance relay, a common line terminating at said switchboard and connecting said station line in multiple thereto, any one of said relays being arranged to operate when a station on the respective line is conditioned for conversation, and a non-inductive resistance associated with each of said relays and adapted to be connected in shunt thereto when the relay is operated.

8. A common battery telephone system comprising a switchboard, a common line terminating thereat, a plurality of station lines connected in multiple to said common line, said station lines each containing a series relay of such high inductance as to counteract any capacity shunting effects by the respective station lines on voice frequency current flowing in said common line, each of said series relays being adapted to operate when the corresponding station line is conditioned for conversation, a non-inductive resistance associated with each relay, and switching means for connecting the associated resistance in shunt to its relay responsive when the relay operates.

9. In a common battery telephone system, a plurality of relatively high capacity station lines, a common line terminating in a central office, each of said station lines being connected in multiple to said common line, a relay in series with each station line near the point of connection to the common line, said relays being of such an inductance as to substantially prevent the capacity of the respective lines from shunting speech currents flowing in the common line and also being adapted to operate when their respective lines are conditioned for conversation, a non-inductive resistance associated with each relay and adapted to be connected in shunt to the winding thereof when the relay is operated, said resistance being of such a value as to prevent only sufficient current to flow through the respective inductive windings when the relay is operated to maintain it operated as long as the station line is in a conversational condition.

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