Oct. 1, 1940. C. F. NELSON 2,216,650

TELEPHONE LINE

Filed March 15. 1939

FIG. 1

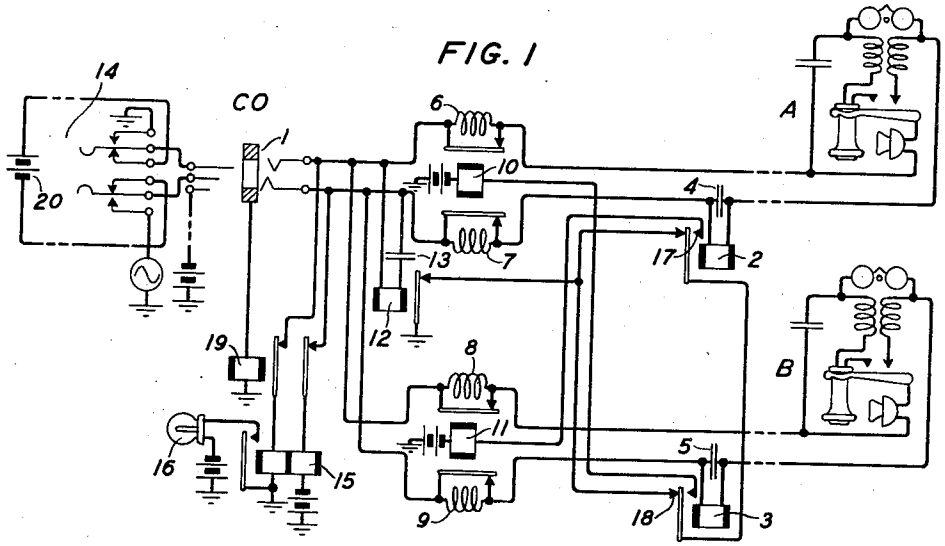
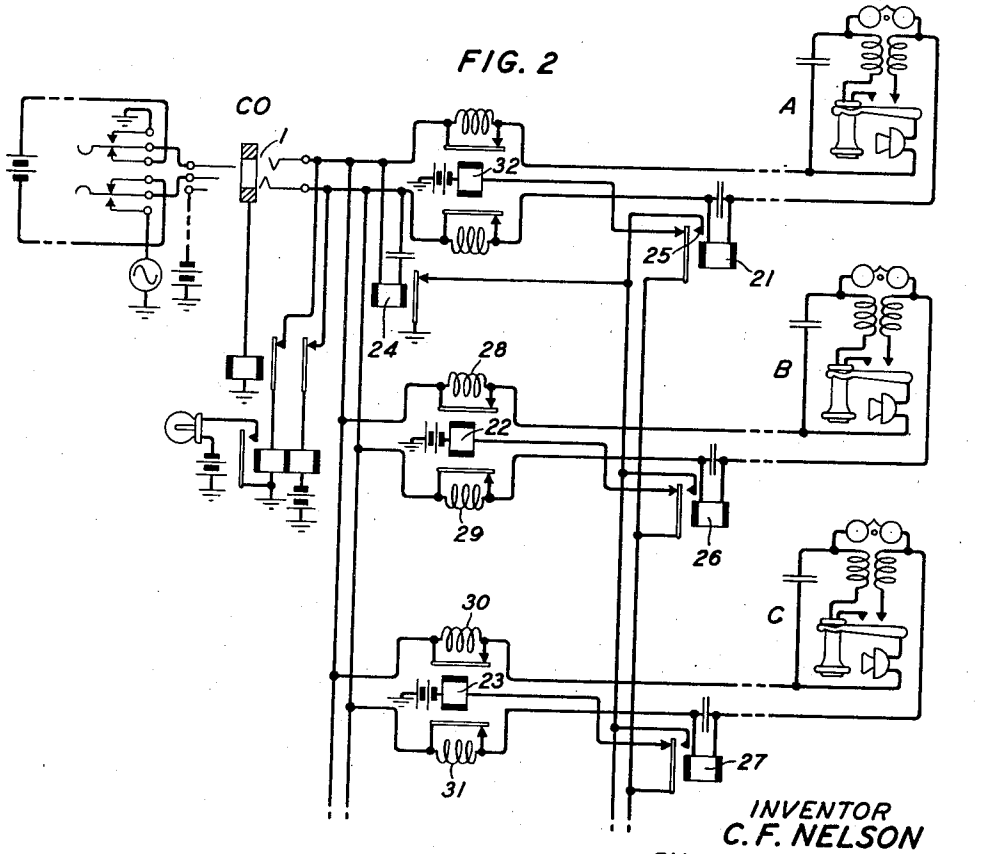


FIG. 2



INVENTOR
C. F. NELSON
BY
William P. Kellam
ATTORNEY

Patented Oct. 1, 1940

2,216,650

UNITED STATES PATENT OFFICE

2,216,650

TELEPHONE LINE

Charles Francis Nelson, Tenafly, N. J., assignor to American Telephone and Telegraph Company, a corporation of New York

Application March 15, 1939, Serial No. 262,007

3 Claims. (Cl. 179—34)

This invention relates to improvements in telephone systems and more particularly to means for reducing bridged tap losses in speech transmission circuits 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 a telephone exchange.

It frequently happens that it is desirable or necessary to "bunch" or "bridge" subscribers' "pairs" or "loops" at a central office main frame in order to serve subscribers' stations having the same line number, but widely scattered in location, as for example, any multiparty subscriber's line, or where so-called secretarial or physician's 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 offices and frequently in another exchange area.

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

An object of the 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 attained resides in the inclusion of normally short-circuited inductances, of the proper value, in series with each bridged pair and located at or near the point where the pairs are bridged to the common line circuit and in the provision of means in each bridged pair which responds, when a switchhook on the respective pair is operated, to remove the short circuits from all the inductances in series with the other pairs, but not from the inductances associated with the respective pair, thereby effectively including such inductances in circuit with their respective pairs.

In this connection it will be observed that the present arrangement is an improvement over the arrangement disclosed in United States Patent No. 2,039,413, issued May 5, 1936, to O. Henderson, which patent shows a relay having an inductive winding in series with each conductor of each bridged pair and so arranged that when a switchhook is operated on the associated pair, both relays of the pair respond and shunt their respective windings with a resistance, thereby reducing the inductance of the pair in use but leaving unchanged the inductance of the other pairs.

A further feature of the invention resides in the provision of means, responsive to the application of ringing current to the common conductors, to prevent removal of said short circuits during the ringing interval.

The invention will be understood from the following description when read in connection with the accompanying drawing:

Figure 1 of which shows two subscriber station "loops," or lines, located at some distance from each other and from the central office and connected in multiple at the central office to a common line jack; and

Fig. 2 shows a slightly modified arrangement whereby three or more subscribers' "loops" can be multipled to the common line jack 1 at the central office.

Referring to Fig. 1, relays 2 and 3, individual to stations A and B, respectively, are connected in series with the respective "loops" and bridged by condensers 4 and 5, respectively, which are for the purpose of compensating for the impedance to alternating current introduced by the windings of the relays. Also in series with each "loop" are inductances 6, 7 and 8, 9 respectively, which inductances are normally short-circuited at the back contacts of the respective relays 10 and 11.

Bridged across the tip and ring of jack 1 is a ringing relay 12, in series with a condenser 13, for a purpose to be hereinafter referred to.

The cord circuit indicated at 14 is adapted to be connected to jack 1 for the purpose of answering, or extending calls over, the line "loops" of subscribers A and B.

Connected across the common line conductors is the usual line relay 15 which controls the line lamp 16.

A description of the operation of the circuit arrangement of Fig. 1 will now be given. Let it be assumed that station A desires to be connected to some other line reached through the central office. Upon removal of the receiver from the hook at the station, a circuit will be closed through the windings of line relay 15 and series relay 2 whereupon both relays operate. Relay 15 in operating lights the line lamp 16 and relay 2 closes a circuit to operate relay 11 associated with the loop of subscriber B which can be traced from battery, winding of relay 11, front contacts 17 of relay 2, back contacts 18 of relay 3 to ground at the back contacts of relay 12. Relay 11 operates in this circuit and removes the short circuits around inductances 8 and 9 thereby effectively introducing these inductances in series with the

loop of subscriber B which raises its impedance to voice currents to a relatively high value.

In response to the lighting of line lamp 16, the operator inserts the plug of her cord circuit 14 in jack 1 thereby operating the sleeve relay 19 which releases line relay 15 and extinguishes lamp 16. When the plug is inserted, the cord circuit battery 20 is substituted for the line battery thereby maintaining relay 2 operated.

It will now be observed that whereas inductances 6 and 7, associated with the loop of the calling subscriber A are short-circuited, and therefore effectively removed from the loop, the inductance of the loop of subscriber B is relatively high due to the inclusion therein of inductances 8 and 9 thereby compensating for the distributed capacity of that loop and reducing its effect on the connection. It will be noted that in case subscriber B desires to listen on the line, the removal of the receiver operates relay 3 which opens its contacts 18 thereby releasing relay 11 and short-circuiting inductances 8 and 9 thereby conditioning the loop for speech transmission. The operation will be the same if station B calls instead of station A except that relays 3 and 10 operate to increase the inductance of the loop of station A.

In case station A, for example, is called instead of calling, the operator will insert the plug of her cord circuit in jack 1 and ring in the usual manner whereupon relay 12, which is bridged across the line, responds and during the ringing interval removes the ground at its back contacts thereby preventing false operation of either relay 2 or 3, due to the ringing current, from causing operation of relay 11 or 10. When ringing ceases relay 12 recloses its back contacts and when station A answers by removing the receiver from the hook, relay 11 operates as before and increases the inductance of the loop of subscriber B.

Fig. 2 shows an arrangement whereby more than two subscribers' loops can be connected in multiple.

In case subscriber A calls, relay 21 will operate thereby closing a circuit to operate relays 22 and 23 associated with the loops of the other stations, B, C, etc., which circuits can be traced from ground at the back contacts of relay 24, front contacts 25 of relay 21 and over the multiple back contact of relays 26 and 27 to battery through the windings of relays 22 and 23 which latter relays operate and introduce inductances 28, 29 and 30, 31 in series with their respective loops. Operation of relay 24, in response to ringing operates as before described and prevents false operation of any of the relays 21, 26 and 27 from operating any of the relays 32, 22 or 23.

What is claimed is:

1. In a common battery telephone system, a central office, a common line terminating at said central office, a plurality of station lines connected in multiple to said common line, an inductance element in series with each station line, means normally short-circuiting all of said inductances, and a relay in series with each of said station lines adapted to operate when a corresponding station switchhook is actuated to operate said means to remove the short circuit from the inductances in all the other station lines but not the inductances in the line in which the relay is operated.

2. In a common battery telephone system, a central office, a common line terminating at said central office, a plurality of station lines connected in multiple to said common line, a normally short-circuited inductive element in series with each of said station lines, and means in each station line responsive to actuation of a station switchhook on the respective line to cause the removal of all the short circuits from inductances in all the other multiply-connected station lines but not from the inductances in the line on which the switchhook is actuated.

3. In a common battery telephone system, a central office, a common line terminating at said central office, a plurality of station lines connected in multiple to said common lines, an inductive element in series with each station line, means normally short-circuiting all of said inductances, a relay in series with each of said station lines, adapted to operate when a corresponding station switchhook is actuated to operate said short-circuit removal means to remove the short circuits from the inductances in all the other station lines, and means responsive to application of ringing current to said common line for preventing said short-circuit removal means from operating.

CHARLES F. NELSON.