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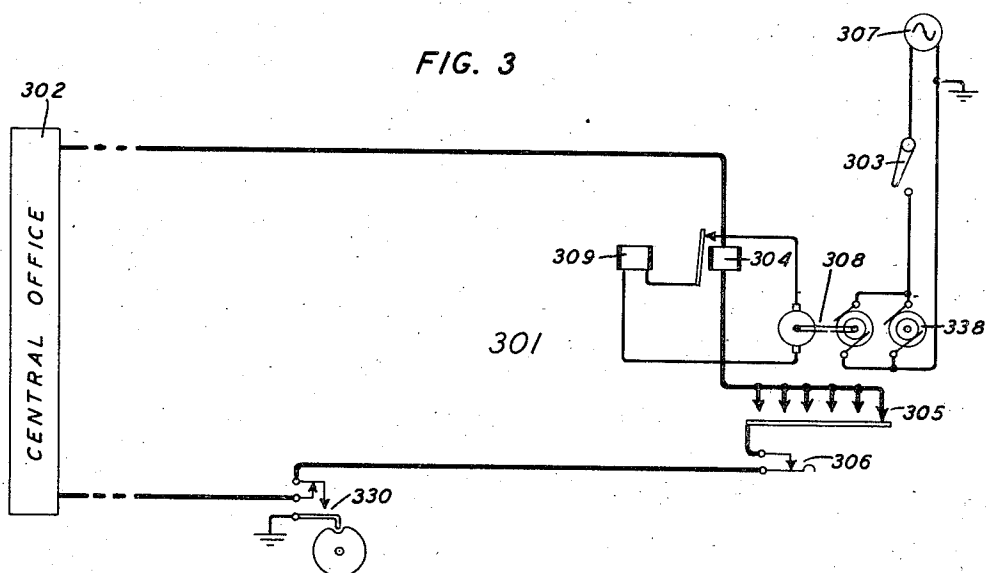
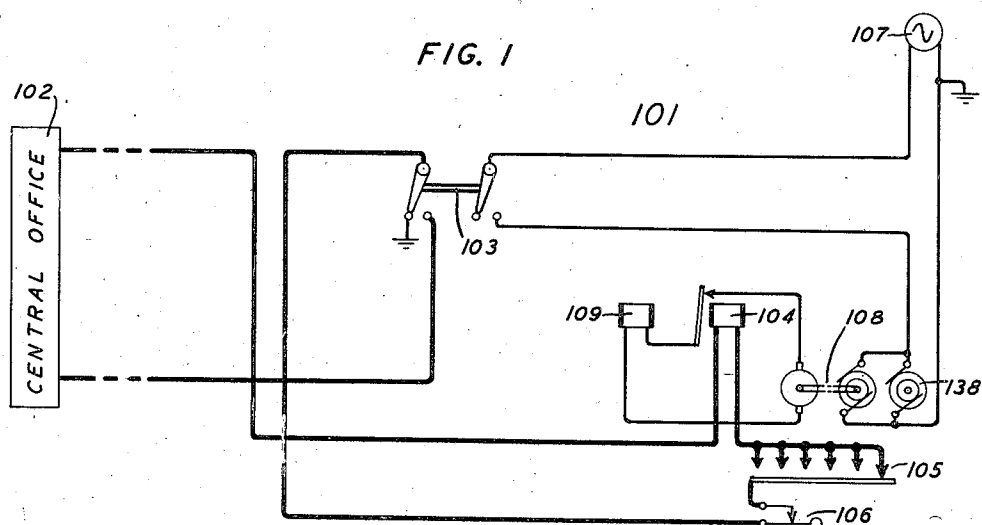
F. S. KINKEAD ET AL

2,024,580

COMMUNICATION SYSTEM

Filed April 19, 1933

2 Sheets-Sheet 1



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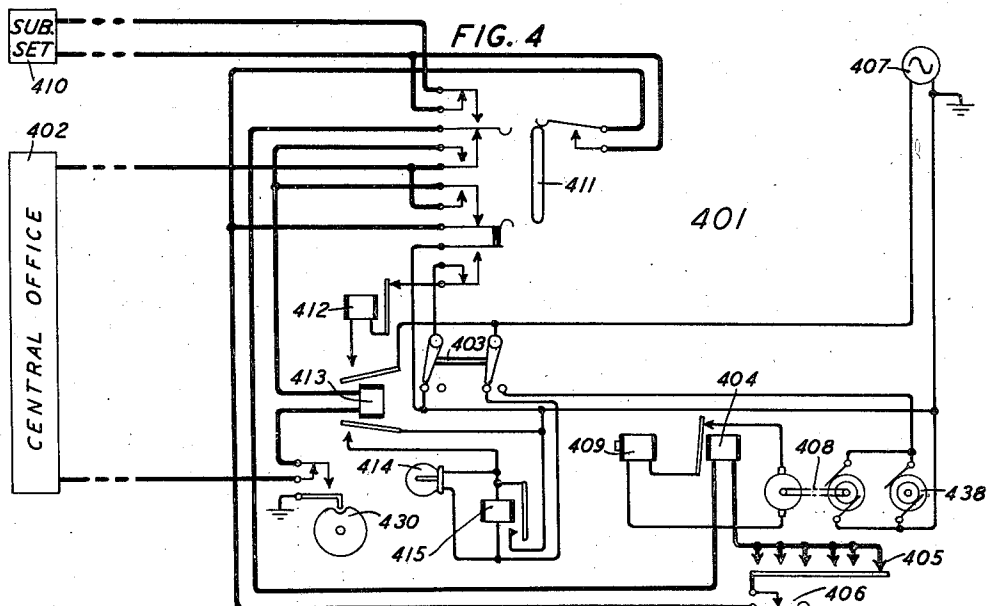
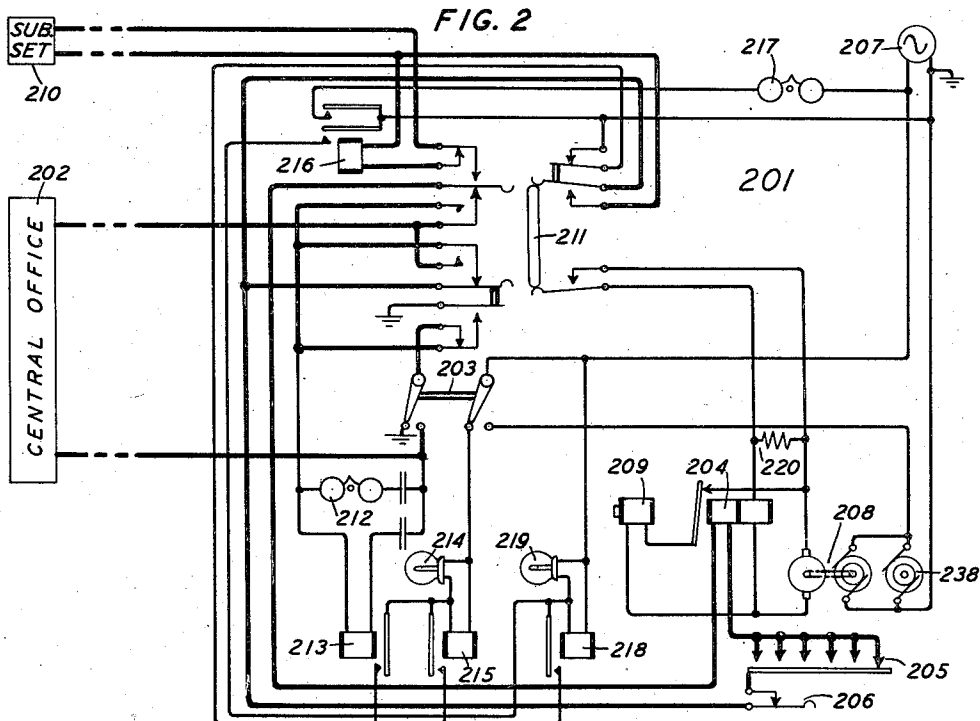
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2,024,580

COMMUNICATION SYSTEM

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1 Claim. (Cl. 178—2)

This invention relates to that type of communication system in which a subscriber's station is provided with dual service in the form of two communication lines connected thereto, one line being for one type of service, such as leased wire service, and the other line being for another type of service, such as exchange service.

Heretofore in a communication system, if a subscriber wished to be supplied with two different types of service, he was forced to equip his station with a separate set of station apparatus for each type of service. This duplication of apparatus is objectionable from a cost standpoint as it is practically double the cost of one set of station apparatus. This duplication is also undesirable from the viewpoint of space considerations because the extra apparatus takes up space which could be used for other purposes. Another objection is found in the cost of maintaining and operating two sets of station apparatus.

All of these objections are done away with by means of the present invention, the object of which is to supply dual service over either open or closed loops to a subscriber's station having only one set of station apparatus.

Another object of this invention is to provide switching apparatus at a subscriber's station (provided with dual service) for quickly switching its station apparatus from transmission and/or reception over one communication line to transmission and/or reception over another communication line.

Still another object of this invention is to enable a calling station to give a non-continuous audible signal and a continuous visible signal to an operator at a subscriber's station provided with dual service.

A further object of this invention is to provide a variable biasing arrangement for the line relay of a subscriber's station provided with dual service over transmission lines carrying different amounts of current.

These objects are attained by means of a special switching arrangement located at a subscriber's station which is provided with dual service and which has only one set of station apparatus. The nature of this switching arrangement will be explained by describing its application to a printing telegraph system. This description will be set forth with reference to the drawings in which:

Fig. 1 represents a subscriber's station having only one set of station apparatus which is con-

nected by a normally open loop to another station;

Fig. 2 represents a somewhat similar subscriber's station but which is provided with dual service over normally open loops;

Fig. 3 represents a subscriber's station having only one set of station apparatus which is connected by a normally closed loop to another station; and

Fig. 4 represents a somewhat similar subscriber's station but which is provided with dual service over normally closed loops.

Ordinary service over a normally open loop

As has been stated above, Fig. 1 shows a subscriber's station 101 which has only one set of station apparatus (teletypewriter and associated apparatus) and which is connected by a normally open loop to another station 102. The loop is rendered normally open by means of double pole double throw switch 103 which is normally in its open position as is shown in Fig. 1. When in this open position, the left portion of switch 103 opens the loop so that current from station 102 would go to station 101 and then pass through line relay 104, sending contacts 105, break key 106, and then through switch 103 to ground. Station 102 may be either a single subscriber's station, like station 101, or it may be a central office, such as the central office disclosed in Patent 1,804,548 granted May 12, 1931 to G. S. Vernam. If it is a single subscriber's station, it may have station apparatus similar to that of station 101.

The right portion of switch 103 opens a path from the source of power supply 107 through motor generator 108 and motor 138 of the subscriber's printing telegraph set. Since, under these conditions motor generator 108 will not be operated, it will not supply energizing current to printer magnet 109. Also, motor 138 will not run under these conditions. The transmission or reception of signal impulses by station 101 can not now take place because of the fact that neither printer magnet 109 nor motor 138 is energized.

For the transmission or reception of signal impulses, switch 103 is put in its closed position which is opposite to that shown in Fig. 1. The loop connecting stations 101 and 102 will accordingly be closed. Likewise, the path from power supply 107 through motor generator 108 and motor 138 will also be closed. Current from motor generator 108 may now pass through the armature of line relay 104 and energize printer

magnet 109. When line relay 104 is now successively energized and deenergized in response to the transmission or reception of signal impulses, its armature will successively open and close thereby successively opening and closing the energizing circuit for printer magnet 109.

If station 102 is a single subscriber's station, it may be said that station 102 and station 101 are provided with leased wire service. If station 102 is a central office, then it should be stated that station 101 is provided with exchange service. With the arrangement shown in Fig. 1, if the subscriber at station 101 wishes to be supplied with dual service, that is, with both leased wire and exchange service, it is necessary for him to equip station 101 with a separate set of station apparatus for each type of service. As has been stated above, this duplication of apparatus is objectionable for several reasons.

Dual service over normally open loops

However, by means of the special switching arrangement of this invention, a subscriber's station having only one set of station apparatus may be provided with dual service over normally open loops as is shown in Fig. 2 where subscriber's station 201 is connected by means of normally open loops to station 202 and station 210. It may be assumed for the purpose of illustration that station 202 is a central office, such as the central office disclosed in Patent 1,804,548 granted May 12, 1931 to G. S. Vernam, and that station 210 is a single subscriber's station.

The station apparatus (teletypewriter and associated apparatus) at station 201 is rendered normally non-operated by means of double pole double throw switch 203 which is normally in its open position as is shown in Fig. 2. While in this open position, the right portion of switch 203 opens a path from the source of power supply 207 through motor generator 208 and motor 238 of the subscriber's printing telegraph set. Since motor generator 208 is not operated now, it will not supply energizing current to printer magnet 209. Also, under these conditions motor 238 can not run. As was the case with station 101 under similar conditions, the transmission or reception of signal impulses by station 201 can not now take place because of the fact that neither printer magnet 209 nor motor 238 is energized.

The left portion of switch 203 opens the subscriber's loop to central office 202 and provides current from central office 202 with three paths to station 201. The first path leads from central office 202 to station 201 by passing through an upper left pair of contacts of key switch 211, down through line relay 204, sending contacts 205, break key 206, through middle and bottom left sets of contacts of key switch 211, and finally through switch 203 to ground. The second path leads from central office 202 to station 201, through ringer 212, through the bottom left set of contacts of key switch 211, and then through switch 203 to ground. The third path is similar to the second path except that, instead of passing through ringer 212, current will pass through relay 213.

If an operator at central office 202 wishes to communicate with the subscriber at station 201, the operator momentarily impresses a preassigned ringing voltage on the line. This ringing voltage will follow the second and third paths described above. By following the second path, the ringing voltage will cause the operation of an alarm device (ringer 212). Since ringer 212 is operated

only during the time ringing voltage is impressed upon the line, a non-continuous audible signal will be given to the subscriber at station 201. By following the third path, the ringing voltage will operate relay 213. The operation of relay 213 closes a path for current from power supply 207 to pass through switch 203, through both another alarm device (signal lamp 214) and relay 215, through the armature of relay 213, and then back to power supply 207. As soon as relay 215 operates, current from power supply 207 will pass through its armature and lock relay 215. This will cause continuous operation of the second alarm device (signal lamp 214) thereby giving a continuous visible signal to the subscriber. Therefore, calling apparatus (ringer 212 and lamp 214) at subscriber's station 201 is capable of being actuated by another station, such as central office 202, for informing subscriber's station 201 that it desires attention.

If the subscriber at station 201 wishes to answer a call from central office 202, he closes switch 203. The right portion of switch 203 opens the path through relay 215 and lamp 214 thereby extinguishing lamp 214 and releasing relay 215. At the same time, a path is closed from power supply 207 through motor 238 and motor generator 208. This will energize printer magnet 209. The left portion of switch 203 closes a path for current from central office 202 to pass through the subscriber's line relay 204 as described above but, instead of passing through switch 203 to ground, the current will now pass back to central office 202. Transmission or reception of signal impulses may now take place between subscriber's station 201 and central office 202.

If the subscriber at station 210 wishes to communicate with the subscriber at station 201, he momentarily closes the loop leading from station 210 to station 201. This enables current to pass through relay 216 and energize it. When station 201 is connected to central office 202, the line current is applied at central office 202, but when station 201 is connected to station 210 one of them must apply line current. For the sake of simplicity, it may be assumed that it is applied at station 210. When relay 216 operates, its armature closes a path for current from power supply 207 to pass through and operate an alarm device (ringer 217). Also, a path is closed through the armature of relay 216 through both relay 218 and another alarm device (signal lamp 219), and then back to power supply 207. When relay 218 operates, its armature closes a locking-up circuit leading from power supply 207 through the top right set of contacts of switch 211, the armature of relay 218, through both relay 218 and alarm device 219, and then back to power supply 207. When relay 218 releases, ringer 217 will become unoperated but, due to the locking-up circuit, lamp 219 will remain lit. This procedure gives a non-continuous audible signal and a continuous visible signal to the subscriber at station 201. Therefore, calling apparatus (ringer 217 and lamp 219) at subscriber's station 201 is capable of being actuated by another station, such as subscriber's station 210, for informing subscriber's station 201 that it desires attention.

It is to be understood that the invention is not to be limited to the particular kinds of alarm devices described above. Ringers 212 and 217 and signal lamps 214 and 219 could be interchanged if desired thereby giving the subscriber a non-continuous visible signal and a continuous audible signal. Also, any other type of alarm device

could be substituted for ringers 212 and 217 and/or signal lamps 214 and 219.

If the subscriber at station 201 wishes to answer a call from the subscriber at station 210, he closes switch 203 and operates switch 211 to the left which is the position opposite to that shown on the drawings. As has been described above, the right portion of switch 203 closes a path from power supply 207 through motor 238 and motor generator 208 thereby energizing printer magnet 209. When switch 211 is put into position at the left, the top right set of contacts of switch 211 will open thereby opening the locking-up path from power supply 207 through lamp 219. This will extinguish lamp 219. At the same time, the path from subscriber's station 210 through relay 216 will be opened by the top left set of contacts of switch 211. The path from central office 202 through the subscriber's line relay 204 will now be changed so as to lead from central office 202 through the middle left sets of contacts of switch 211 down through the bottom left sets of contacts of switch 211 to ground. In the path for ringing current from central office 202, the ground connected to the lower left set of contacts of switch 211 will now be substituted for the ground associated with switch 203. The path will now be closed for current from subscriber's station 210 to pass through the middle right set of contacts of switch 211, down and around through break key 206, sending contacts 205, line relay 204, upper left set of contacts of switch 211, and then back to station 210. Transmission or reception of signal impulses may now take place between subscriber's stations 201 and 210.

The current used for communication between stations 201 and subscriber's station 210 may not always be equal to the current used for communication between station 201 and central office 202. To take care of any difference between these two currents, a biasing circuit is provided for line relay 204. For the sake of illustration, let it be supposed that the current in the loop leading to central office 202 is less than the current in the loop leading to subscriber's station 210. Let it also be assumed that the amount of the difference between these two currents is known and that resistance 220 compensates for the amount of the difference. Now, when switch 211 is in the position shown in the drawings, resistance 220 will reduce the biasing current from motor generator 208. When switch 211 is in the opposite position to that shown in the drawings, resistance 220 will be short-circuited out of the biasing circuit thereby increasing the biasing current.

Ordinary service over a normally closed loop

Fig. 3 shows a subscriber's station 301 which has only one set of station apparatus (teletypewriter and associated apparatus) and which is connected by a normally closed loop to another station 302. Current from station 302 is provided with a path over the loop to station 301, then through special delay key 330, break key 306, sending contacts 305, line relay 304, and back over the loop to station 302. Station 302 may be either a single subscriber's station like station 301, or it may be a central office, such as the central office disclosed in Patent 1,804,548 granted May 12, 1931 to G. S. Vernam. If it is a single subscriber's station, it may have station apparatus similar to that of station 301.

When no signal impulses are being transmitted or received at station 301, power switch 303 is kept in its open position, as is shown in the drawings.

In this open position, switch 303 opens a path from the source of power supply 307 through motor generator 308 and motor 338 of the subscriber's printing telegraph set. Since under these conditions motor generator 308 will not be operated, it will not supply energizing current to printer magnet 309. Also, under these conditions motor 338 can not run. The transmission or reception of signal impulses by station 301 can not now take place because of the fact that neither printer magnet 309 nor motor 338 is energized.

For the transmission or reception of signal impulses, switch 303 is put in its closed position which is opposite to that shown in Fig. 3. The path from power supply 307 through motor generator 308 and motor 338 will now be closed. Current from motor generator 308 may now pass through the armature of line relay 304 and energize printer magnet 309. When line relay 304 is now successively energized and deenergized in response to the transmission or reception of signal impulses, its armature will successively open and close thereby successively opening and closing the energizing circuit for printer magnet 309. A disconnect signal may be given by the subscriber at station 301 by operating the special delay key 330 which causes a long break signal to be transmitted. Key 330 is so arranged that that portion of the loop which is at station 301 will be held closed during the transmission of the long break signal.

As was the case with the arrangement shown in Fig. 1, if the subscriber at station 301 wishes to be supplied with dual service, that is, with both leased wire and exchange service, it is necessary for him to equip station 301 with a separate set of station apparatus for each type of service. As has been stated above, this duplication of apparatus is objectionable for several reasons.

Dual service over normally closed loops

However, by means of the special switching arrangement of this invention, a subscriber's station having only one set of station apparatus (teletypewriter and associated apparatus) may be provided with dual service over normally closed loops as is shown in Fig. 4. In Fig. 4, subscriber's station 401 is connected by means of normally closed loops to stations 402 and 410. It may be assumed for the purpose of illustration that station 402 is a central office, such as the central office disclosed in Patent 1,804,548 granted May 12, 1931 to G. S. Vernam, and that station 410 is a single subscriber's station. According to this assumption, station 401 is now provided with dual service comprising exchange service to central office 402 and leased wire service to subscriber's station 410.

Under the normal conditions shown in Fig. 4, current from central office 402 passes over the loop to station 401, then through special delay key 430, through relay 413, through a middle left set of contacts of key switch 411 to break key 406, sending contacts 405, line relay 404, up through another middle left set of contacts of switch 411, and then back over the loop to central office 402. At the same time, the loop leading to subscriber's station 410 is short-circuited by the top left set of contacts of switch 411. Under normal conditions, printer magnet 409 is not energized because the path from power supply 407 through motor generator 408 and motor 438 is opened by reason of switch 403 being in its open position.

If an operator at central office 402 wishes to communicate with the subscriber at station 401, 75

the operator momentarily opens the loop to station 401. The opening of the subscriber's loop will cause relay 413 to release. The top contact of relay 413 will now close a path to operate an alarm device (buzzer 412). This path leads from power supply 407, the top armature of relay 413, through buzzer 412, the armature of buzzer 412, the bottom left set of contacts of switch 411, the left portion of switch 403, and then back to power supply 407. However, buzzer 412 will operate when current passes through it and its armature will be drawn away from its contact thereby opening the path just described. When this path opens, buzzer 412 will release and its armature will fall back thereby closing the circuit and causing this procedure to be repeated during the time that relay 413 remains unoperated. The effect of this action is the generation of a buzzing sound by the armature of buzzer 412.

At the same time, the bottom armature of relay 413 will close a path to operate another alarm device (signal lamp 414). This path leads from power supply 407, through the right portion of switch 403, through both lamp 414 and relay 415, the bottom armature of relay 413, and then back to power supply 407. This will light lamp 414 and will cause the operation of relay 415 which will result in its armature closing a locking-up circuit for relay 415.

When the operator at central office 402 closes the loop to subscriber's station 401, relay 413 will be operated again. The top armature of relay 413 will open the path to buzzer 412 thereby causing it to cease operating. However, since relay 415 is provided with a locking-up circuit, lamp 414 will remain lit. In summary, it may be stated that calling apparatus (buzzer 412 and lamp 414) at subscriber's station 401 is capable of being actuated by another station, such as central office 402, for informing subscriber's station 401 that it desires attention by giving a non-continuous audible signal and a continuous visible signal to the subscriber at station 401.

It is to be understood that this invention is not to be limited to the particular kinds of alarm devices described above. Buzzer 412 and signal lamp 414 could be interchanged if desired thereby giving the subscriber a non-continuous visible signal and a continuous audible signal. Also, any other type of alarm device could be substituted for buzzer 412 and/or signal lamp 414.

If the subscriber at station 401 wishes to answer a call from central office 402, he closes switch 403. The right portion of switch 403 opens the path through lamp 414 thereby extinguishing it. At the same time, a path is closed from power supply 407 through motor 438 and motor generator 408. This will energize printer magnet 409. The left portion of switch 403 opens the path from power supply 407 to buzzer 412. Transmission or reception of signal impulses may now take place between subscriber's station 401 and central office 402.

If the subscriber at station 401 wishes to extinguish lamp 414 without holding communication with central office 402, he could do so by momentarily operating switch 403 to its closed position. The momentary closure of switch 403 would open the path from power supply 407 to lamp 414. This would cause relay 415 to release thereby opening its locking-up circuit.

If the subscriber at station 401 wishes to communicate with subscriber at station 410, he closes switch 403 and operates switch 411 to the left which is the position opposite to that shown in

the drawings. As has been described above, the right portion of switch 403 closes a path from power supply 407 through motor 438 and motor generator 408 thereby energizing printer magnet 409. When switch 411 is put into the position at the left, the top left set of contacts of switch 411 will open thereby removing the short-circuit across the loop to subscriber's station 410. Current from central office 402 is now provided with a path over the loop to subscriber's station 401, through special delay key 430, through relay 413, the middle sets of contacts of switch 411, and then back over the loop to central office 402. Buzzer 412 is provided with a path from power supply 407 through the armature of relay 413 (when relay 413 has released), through buzzer 412, the armature of buzzer 412, the lower set of contacts of switch 411, and then back to power supply 407. This enables central office 402 to signal the subscriber at station 401 by means of buzzer 412. Current from subscriber's station 410 is now provided with a path over the loop to station 401 through the right set of contacts of switch 411, break key 406, sending contacts 405, line relay 404, the upper left set of contacts of switch 411, and then back over the loop to station 410. Transmission or reception of signal impulses may now take place between subscriber's stations 401 and 410.

For the sake of simplicity, no alarm device has been shown at station 401 which can be operated by the subscriber at station 410. If desired, such calling apparatus may be added to the station apparatus at station 401 in a manner similar to that in which it was added to the station apparatus of station 201 shown in Fig. 2. Also, for the sake of simplicity, it has been assumed that the current used for communication between station 401 and subscriber's station 410 is equal to the current used for communication between station 401 and central office 402. If there should be any difference between these two currents, a biasing circuit could be provided for line relay 404 which would be essentially the same as the biasing circuit provided for line relay 204 shown in Fig. 2. Also, station 410 could be connected to station 401 by means of a normally open loop if desired.

Stations 201 and 401 have been shown to be supplied with dual service. If it were desired to supply them with multiple service of several different types by means of a plurality of transmission lines connected to a plurality of different stations, this could readily be done in a manner similar to that shown in the drawings. In fact, it is to be understood that the arrangements shown in the drawings and described above are illustrative of the operation of the invention and will serve to assist in interpreting the claim.

The claim is not to be restricted to the precise construction described above, but is intended to include all changes and modifications employing the principles and features of operation of the invention.

What is claimed is:

In a printing telegraph system, a subscriber's printing telegraph station supplied with multiple service in the form of a plurality of transmission lines connected thereto for communication with a plurality of different printing telegraph stations connected to the transmission lines, the transmission lines being for different types of service with line current of different amounts, said subscriber's printing telegraph station having only one printing telegraph set for the

transmission and reception of messages over the transmission lines, and switching apparatus for switching the printing telegraph set from operation over one transmission line to operation over another transmission line, said printing telegraph set including only one line relay, a biasing circuit for enabling the line relay to operate correctly with current of any amount that is used by any of the transmission lines, said switching apparatus including means for switching the biasing circuit into and out of the transmission lines in accordance with the amount of current in the particular transmission line which is being used for communication purposes at a given time.

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