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TELETYPEWRITER SWITCHING SYSTEM

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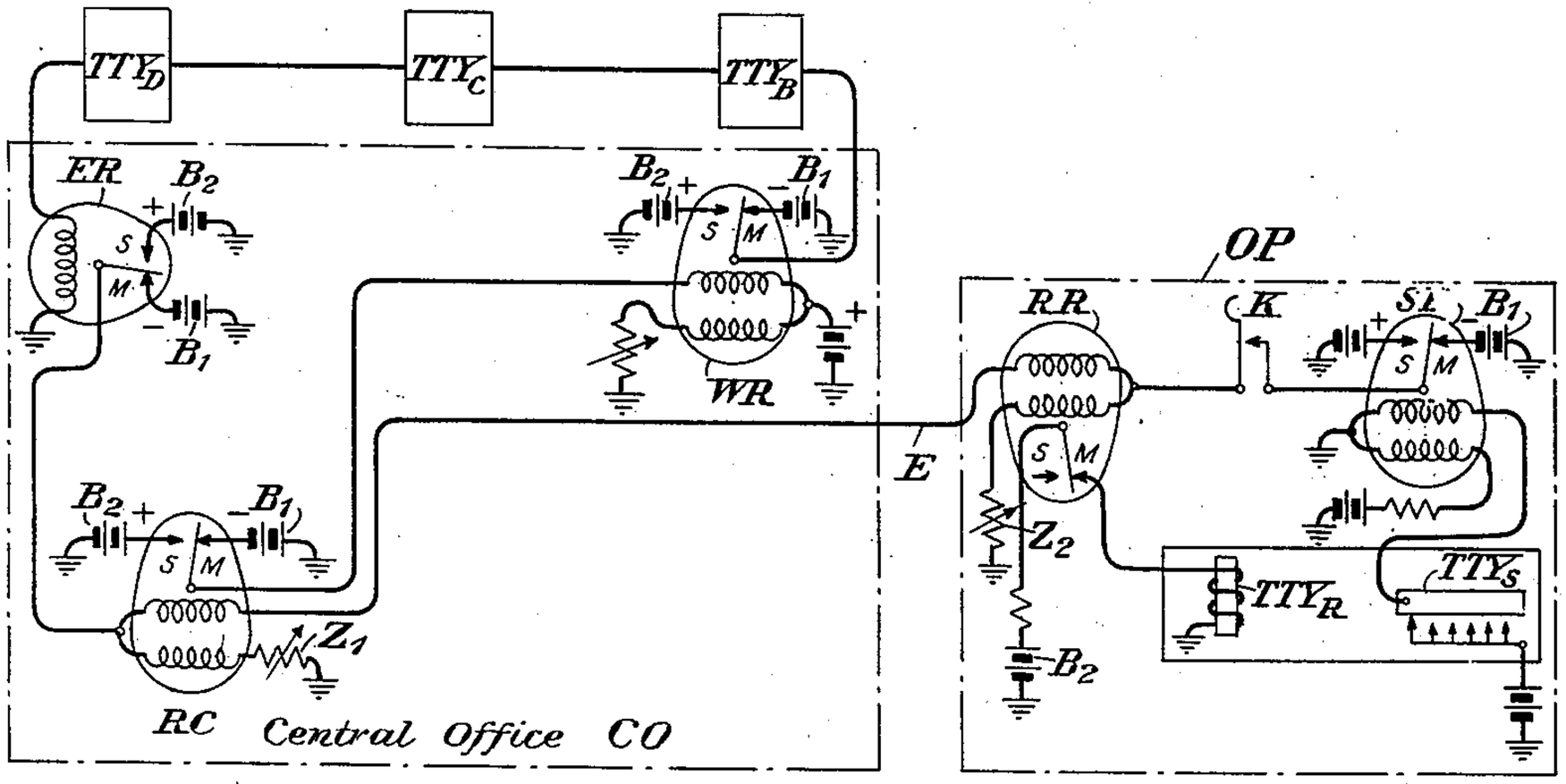

Fig. 1

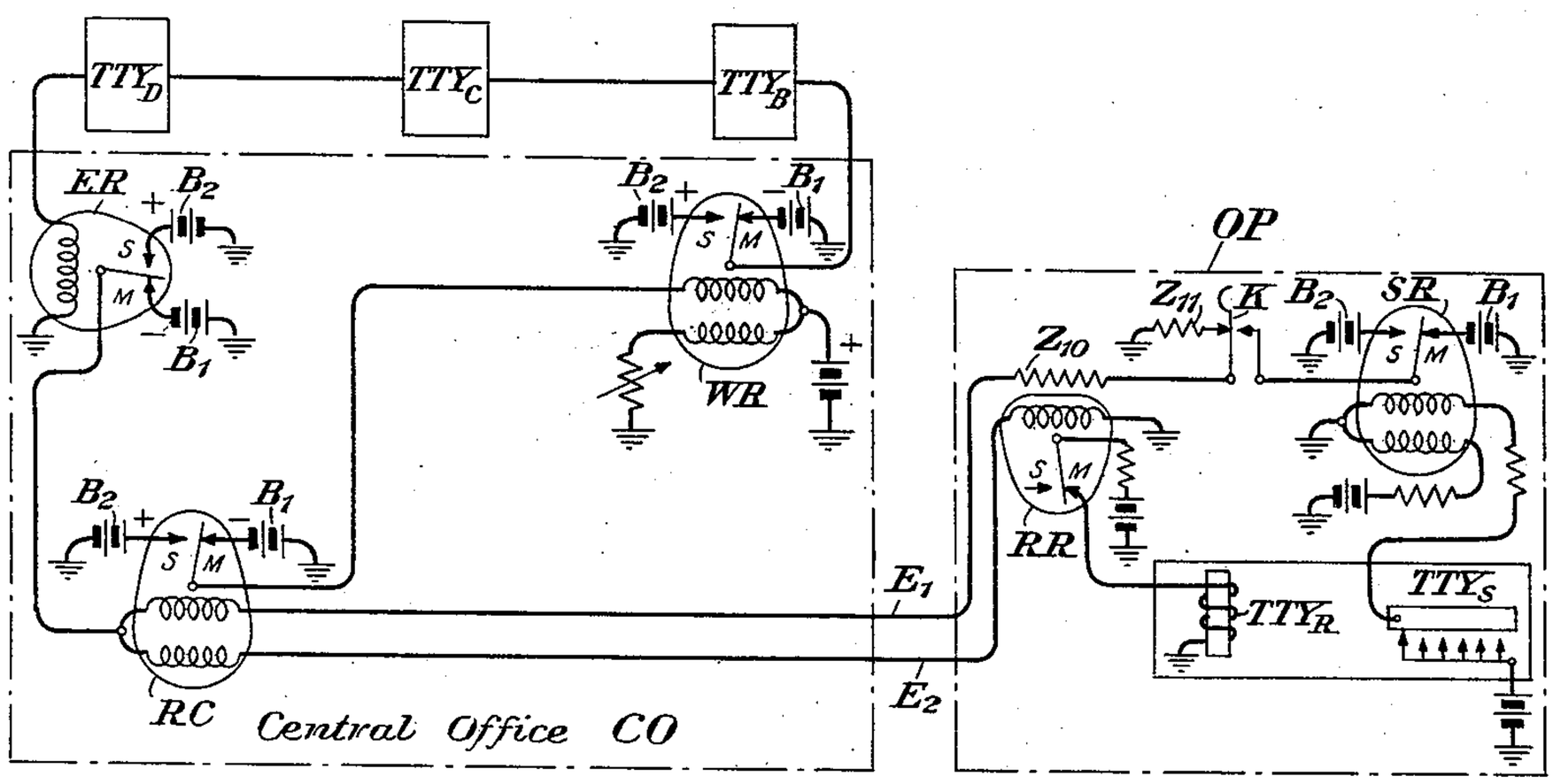

Fig. 2

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TELETYPEWRITER SWITCHING SYSTEM

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11 Claims. (Cl. 178—2)

This invention relates to telegraph and teletypewriter systems, and more particularly to round robin systems for telegraph or teletypewriter circuits and apparatus.

There are at present several types of so-called "round robin systems" in use in which a plurality of teletypewriter stations are interconnected in the form of a ring or loop in such a way that messages may be transmitted from any one of the stations in the system to all of the other stations so that all of the stations, including the station transmitting the messages, may receive the messages and, if desired, prepare copies of the messages. In the usual round robin system two paths are provided to connect each station into the round robin system, one of the paths being employed for transmitting from any station into the rest of the round robin system and the other path for receiving messages from the other stations. Local or home copy is obtained after the messages have been sent around the ring or loop of the system.

In many cases the stations may be in locations where line facilities are limited and considerable construction might be required to provide sending, receiving and cutting control legs to such stations to include such stations in the round robin systems. In those cases it would be advantageous to operate these legs in such a manner that sending and receiving operations, together with cutting and uncutting operations to connect or disconnect the remote stations into the round robin system, could be done over a single line conductor instead of over three conductors or legs as has been the prior practice.

In accordance with this invention there is provided a novel form of round robin system for teletypewriter or like apparatus, the round robin system including one or more outlying points at which sending and receiving teletypewriter apparatus may be located. In one form of arrangement to be described hereinafter, the outlying point to be considered may be connected by a single telegraph line or channel to the central office already included in the round robin system. In this form of arrangement apparatus is provided to permit the operator at the outlying point to "cut" his sending apparatus into or out of the round robin system as desired. A feature of the arrangement is that the operator at the outlying point may obtain a copy of his own messages only after the messages have been transmitted over the round robin system.

Thus the receiving apparatus at the outlying point will always receive a copy of all messages transmitted over the round robin system, but after a "cut" is instituted at the outlying point, the operator at the outlying point may then send messages over the round robin system. One special feature of the arrangement is that the home copy of the messages emanating from the outlying point will be transmitted over the single line conductor to the various stations of the round robin system and then returned over the same single line conductor. Hence the messages will be received only after they have been transmitted through (and recorded) by the various stations forming the round robin system.

This invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing in which Figure 1 illustrates one embodiment of the invention showing an outlying point connected to a round robin system by a single conductor or telegraph channel, and Fig. 2 illustrates the principles of the arrangement of Fig. 1 applied to a system including an outlying point connected to the round robin circuit by two conductors or channels.

Referring to Fig. 1 of the drawing, there is shown a round robin system for teletypewriter apparatus, the system interconnecting a plurality of stations designated TTY_B, TTY_C and TTY_D, and another station which may include a central office CO and an outlying station or point OP, which is connected to the central office CO by a single line conductor or telegraph channel E. As will be pointed out, messages emanating from any one of the stations, such as TTY_D, will be transmitted to all of the other stations and to the outlying point or station OP, so that copies of the messages may be prepared at each of the various stations and at the outlying point.

The central office CO includes an east repeating relay ER and a west repeating relay WR, which are of wellknown type, and a relay RC which interconnects the armature of the relay ER with one of the windings of the relay WR and with the single line conductor E extending to the outlying point OP. The outlying point OP includes a receiving relay RR for repeating messages into the receiving apparatus TTY_R of the local teletypewriter and a sending relay SR for sending messages emanating from the sending apparatus TTYs of the local teletypewriter to the central office CO over the conductor E and then over the rest of the round robin system. The outlying station OP also includes a cutting key K for performing the cutting operations whenever desired.

The line E is shown connected between the upper winding of the relay RC at the central office CO and the upper winding of the receiving relay RR of the outlying station OP. The line E is balanced at the central office CO and at station OP, the balance being provided by a resistor or impedance which is designated Z_1 at the central office CO and by a similar resistor or impedance Z_2 at the outlying station OP. These balancing impedances Z_1 and Z_2 are carefully adjusted so as to equal the line E impedance. In this arrangement when the cutting key K is open, as shown in the drawing, and a voltage is applied at the apex of the windings of the relay RC, a greater current will flow through the balancing arm Z_1 than through the upper winding of relay RC. This is because the circuit in series with the upper winding of relay RC includes the line E, both windings of relay RR and the impedance Z_2. The impedance of this circuit is approximately twice that of the balancing arm circuit alone. Therefore relay RC will respond to marking and spacing signals applied to the apex of this relay. But when the key K is closed, battery is then connected to the apex of the windings of relay RR, and hence any voltage or signal applied to the apex of relay RC will be ineffective to operate that relay. Likewise with key K closed, any voltage or signal applied to the apex of the winding of relay RR will be ineffective to operate relay RR.

Assume that cutting key K is in its open position, and that one of the stations, such as TTY_B, is sending marking and spacing signals to stations TTY_C and TTY_D and to the rest of the round robin system. The current flowing through the winding of the relay ER will move the armature of that relay between its marking and spacing contacts M and S in accordance with the signals to connect oppositely poled batteries B_1 and B_2 alternately to the apex of the windings of relay RC. The armature of relay RC will move between its contacts M and S in accordance with these signals because of the impedance conditions introduced into the circuit when key K is open, as already explained. As the armature of the relay RC follows these signals, it will connect oppositely poled batteries B_1 and B_2 to the upper winding of the relay WR, and hence the armature of the relay WR will move between its contacts M and S in accordance with the signals. Oppositely poled batteries will then be alternately connected to the round robin circuit which extends to station TTY_B to supply home copy to that station. As the armature of the relay ER moves between its contacts M and S in accordance with the signals emanating from, for example, station TTY_B, the flow of current through the upper winding of relay RC and over line E, and then through the windings of receiving relay RR, will cause the armature of the latter relay to follow the signals and repeat them to the receiving apparatus TTY_R of the teletypewriter at the point OP.

In order to break the transmission at station OP from any one of the stations, such as TTY_B, the operator's cutting key K will be operated or closed. The sending apparatus TTY_S of the local teletypewriter will permit current to flow through the upper winding of the sending relay SR to hold the armature of the relay SR on its marking contact M, thereby connecting the battery B_1 through the key K to the apex of the windings of relay RR. This produces a balanced condition in the windings of relay RC, and hence relay RC will not respond to signals relayed from the armature of relay ER to the windings of relay RC, for the reasons already noted hereinabove. Thus the relay RC will stop repeating to the relay WR. The round robin circuit will be in effect "cut" and the operator at the sending station TTY_B will recognize this because no home copy will be received at that station. Station TTY_B will, therefore, stop sending.

After the break has been communicated to the operator at, for example, station TTY_B, the teletypewriter sending apparatus TTY_S may then be operated in the usual way. The marking and spacing pulses from the sending teletypewriter apparatus TTY_S will cause the armature of the relay SR to move between its M and S contacts and thereby connect oppositely poled batteries alternately to the apex of the windings of the relay RR. The receiving relay RR will not be affected by the currents provided by these batteries at this time for the reasons noted hereinabove, but the relay RC at the central office CO will be operated to move its armature between its M and S contacts in accordance with the signals. As the armature of relay RC connects oppositely poled batteries to the upper winding of the relay WR, the armature will move between its M and S contacts in accordance with the signals, and these signals will then be relayed through stations TTY_B, TTY_C and TTY_D to the winding of the relay ER at the central office CO. This relay will also follow the signals and connect oppositely poled batteries B_1 and B_2 to the apex of the relay RC. However, relay RC will be unaffected by these currents at this time. But as these currents are transmitted over line E, they will operate the relay RR at station OP so as to move its armature between its M and S contacts and thereby operate the receiving teletypewriter apparatus TTY_R. This provides the home copy for station OP.

It will be observed that when signals or messages are being transmitted from the outlying point OP by operation of the teletypewriter sending equipment TTY_S, the home copy will be provided by transmitting the signals over the line E, then over the rest of the round robin system and back over the line E to operate the receiving teletypewriter apparatus TTY_R. The home copy thus will be obtained after transmission of the signals over the round robin system rather than from some local circuit at the outlying point OP without passage over the round robin system. The round trip of the messages over line E is an important feature of this invention. Were home copy provided at a station such as OP without passage over the round robin system, the operator at any such station would be unable to determine that his messages were being received by the intended parties.

The circuit shown at the outlying point OP is the equivalent of a differential duplex repeater arranged for full duplex operation. The relay RC and the relay ER at the central office provide the equivalent of a differential duplex in the central office. These equivalent repeaters are assumed to have been well balanced for full duplex operation with the cutting key K in the station OP in its operated position to connect battery to the apex of the relay RR. The quality of the transmission will be dependent upon the degree of balance obtained in these circuits.

When sending from station OP has been completed, the key K may be released. This restores the circuit at station OP to its condition as shown

in the drawing so that the signals transmitted from any of the other stations of the round robin system will be received and recorded at station OP.

The arrangement shown in the drawing enables the operator at the station OP to cut the transmission over the round robin system whenever desired, the cut being effected from a point which is connected to the central office by a single wire conductor or telegraph channel. This enables the operator to transmit signals over this conductor or channel to the rest of the round robin system, and then receive, practically simultaneously, his own signals or messages over this same conductor or channel to obtain the home copy, as already explained. The general features of this arrangement may be applied to an outlying station, such as OP, even if it were connected to the central office CO by two wires or channels. This is shown in Fig. 2.

One of the features of Fig. 2 is that all of the balancing equipment is concentrated in the central office CO. In Fig. 2, moreover, the relay RR includes but one winding, and an impedance Z_{10} is substituted for the other winding. The swinger of the key K, when unoperated, is connected to ground through an impedance Z_{11}. The impedance of Z_{10} may be made approximately equal to that of the winding of the relay RR. The impedance Z_{11} may be made equal to the impedance of the line E_1, which forms the sending conductor or channel, the receiving conductor or channel being designated E_2.

When the key K of the Fig. 2 arrangement is unoperated, signals from any round robin station, such as TTY_B, will traverse stations TTY_C and TTY_D and operate the relay ER in accordance with these signals. The movement of the armature of relay ER will convey the signals to relay RC so as to move its armature between its M and S contacts. This in turn will operate the relay WR to apply oppositely poled batteries B_1 and B_2 to the line extending to station TTY_B to provide its home copy. Relay ER will also convey the signals to relay RR through the lower winding of relay RC and line E_2 to provide home copy at the receiving apparatus TTY_R at the station OP.

Immediately after the cutting key K is operated to break the transmission, the relay RC will cease to respond to the signals that are transmitted from relay ER to the apex of the windings of relay RC. Shortly thereafter the operator at station OP may send. By operating the sending equipment TTYs the armature of the sending relay SR will move between its M and S contacts in accordance with the signals and convey oppositely poled pulses through impedance Z_{10} and over the sending conductor E_1 to operate the relay RC at the central office. The armature of the relay RC will repeat the signals to the relay WR, which will then transmit these signals over the rest of the round robin system. As these signals return to the winding of the relay ER, they will then be sent over the receiving line or channel E_2 to operate the receiving relay RR and the receiving equipment TTY_R. Thus the home copy will be prepared after transmission over the round robin system.

Another feature of the arrangement of Fig. 2 is that it employs two conductors or channels to connect an outlying point or station to a round robin system instead of the usual three conductors (one of which is a control conductor) heretofore required. Installation and maintenance costs are therefore considerably reduced. Furthermore, the absence of balancing equipment of station OP simplifies the structure and operation of the system.

Instead of the balancing arrangements described in connection with Fig. 1, the balancing arrangements at a station such as OP may be of an automatic type. If such balancing apparatus is not desired at that point, the two-wire system of Fig. 2 may be employed.

It will be understood that any one or all of the stations TTY_B, TTY_C and TTY_D may be set up to include a central office such as CO and one or more outlying stations such as OP connected to the same central office. It will also be understood that although the invention has been described for use with teletypewriter apparatus, the teletypewriter apparatus may be replaced by any telegraph apparatus well-known in the art.

While this invention has been shown and described in certain particular embodiments merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a telegraph system, the combination of a plurality of stations arranged in a round robin circuit, an outlying station connected by a single conductor to the round robin circuit, and means for sending signals from said outlying station over said single conductor and then over said round robbin circuit and back over said single conductor to said outlying station.

2. In a telegraph system, the combination of a plurality of stations arranged to form a round robin system, an additional station, a balanced circuit interconnecting said additional station to said round robin system, means responsive to signals produced at said additional station to convey said signals over said balanced circuit to said round robin system and back over said balanced circuit to said additional station.

3. In a telegraph system, the combination of a plurality of stations arranged in a round robin system, an additional station connected by a single conductor to said round robin system, said additional station having receiving means for receiving over said conductor all signals transmitted from any one of the stations of said round robin system, and means for sending signals from said additional station over said single conductor to the round robin system and back over said single conductor to said receiving means at said additional station.

4. In a telegraph system, the combination of a plurality of stations connected in series with each other to form a round robin system, an additional station connected to said round robin system by a single conductor, transmitting apparatus and receiving apparatus at said additional station, said receiving apparatus receiving over said conductor all signals from any of the stations of the round robin system, and means for operating said transmitting apparatus for sending signals over said conductor to the round robin system and back over said conductor to said receiving apparatus.

5. In a signaling system, the combination of a plurality of telegraph stations connected in series with each other to form a round robin system, an additional telegraph station having transmitting apparatus and receiving apparatus, a single wire line connecting said additional station to said round robin system, means for operating said receiving apparatus in accordance

with the signals transmitted from any one of the stations of the round robin system, the signals being supplied to said receiving apparatus over said single wire line, means for cutting said transmitting apparatus into the round robin system for transmitting signals over said line to all of the telegraph stations of the round robin system and for receiving said transmitted signals over said line at said receiving apparatus.

6. The combination of a plurality of teletypewriter stations connected in series with each other to form a round robin system, an additional station, a single wire line, said single wire line connecting said additional station to the round robin system, means at said additional station for receiving over said line the messages transmitted from any one of the stations of the round robin system, transmitting apparatus at said additional station, means for cutting said transmitting apparatus into the round robin system, the messages transmitted from said transmitting apparatus over said line to the stations of the round robin system being returned over said line to said receiving means.

7. In a system including a plurality of stations forming a round robin telegraph system, the combination of a central office connected to the stations of said round robin system, an additional station, a single wire line connecting said central office to said additional station, means for transmitting signals from said additional station over said line to said central office, and means responsive to the receipt of said signals at said central office to return the same signals over said line to said additional station.

8. In a telegraph system, the combination of a station having sending apparatus and receiving apparatus, an office, a full duplex circuit interconnecting said station and said office, means for connecting said sending apparatus to said circuit to send signals over said circuit to said office, and means responsive to the reception of said signals at said office to return said signals over said circuit to the receiving apparatus at said station.

9. In a teletypewriter system, the combination of a plurality of stations connected to each other to form a round robin system, a main station included in said round robin system, an additional station connected by a single wire conductor to said main station, transmitting apparatus and receiving apparatus at said additional station, means for actuating said receiving apparatus in accordance with the messages transmitted from any one of the stations connected in the round robin system, means for connecting said transmitting apparatus to the round robin system through said main station so that messages may be transmitted over said single wire conductor to said main station and over the round robin system, said transmitted messages being returned over said single wire conductor to said receiving apparatus, thereby preparing home copy of the messages emanating from said additional station after they have been transmitted over the round robin system.

10. The combination of a central station, an additional station connected to the central station by a single wire line, said central station including a receiving relay, a sending relay, and a third relay interconnecting said transmitting and receiving relays and said single wire line, said additional station including a receiving relay, a sending relay, sending apparatus, and receiving apparatus, said third relay at the central station and the receiving relay at the additional station being connected to said single wire line to form a full duplex circuit, said receiving relay at said additional station repeating received signals to the receiving apparatus, the sending apparatus at said additional station being connected to the winding of the sending relay thereat, and means for connecting said sending relay to said single wire line.

11. In a telegraph system, the combination of a central station including a receiving relay, a sending relay and a third relay which repeats signals received by said receiving relay to said sending relay, an additional station connected to the central station by a single wire line, said additional station including a receiving relay, a sending relay, transmitting apparatus, receiving apparatus, and a cutting key, said third relay at said central station and said receiving relay at said additional station being connected to said single wire line to form a full duplex circuit, said receiving relay at said additional station being connected to the receiving apparatus to repeat signals received by said receiving relay to said receiving apparatus, the transmitting apparatus being connected to the sending relay at said additional station, the sending relay at said additional station being connected to said single wire line through said cutting key, and means responsive to the operation of said transmitting apparatus after the cutting key has been operated to send signals over said single wire line to said central station and back over said single wire line so that the signals may be repeated by the receiving relay at said additional station to the receiving apparatus.

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