June 28, 1949. E. E. KLEINSCHMIDT 2,474,257

TELEGRAPHIC COMMUNICATION SYSTEM WITH AUTOMATIC ANSWER BACK AND ALARM SIGNALS

Filed Dec. 24, 1943

6 Sheets-Sheet 1

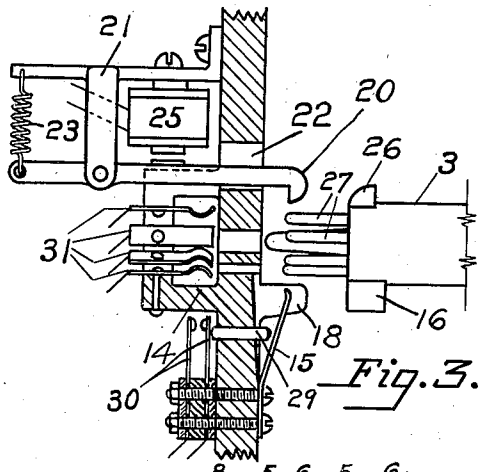


Fig. 3.

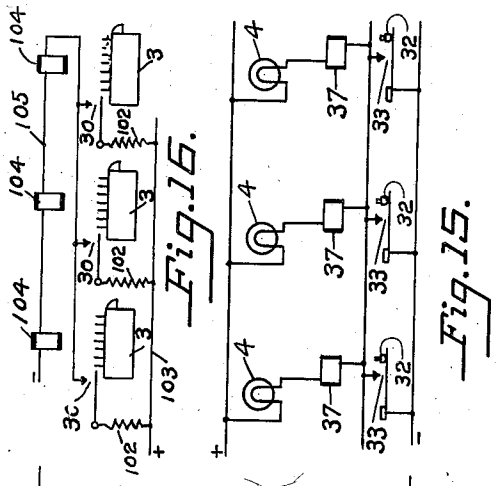


Fig. 15.

Fig. 16.

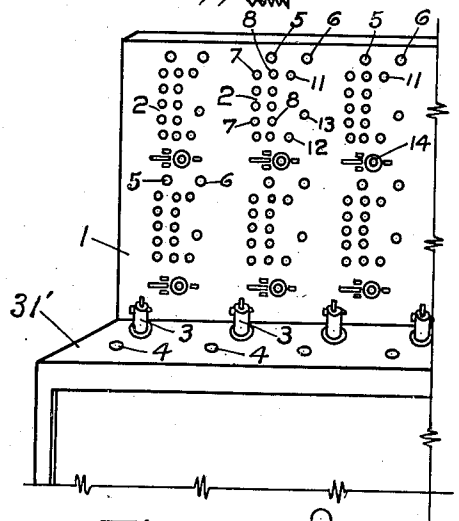


Fig. 1.

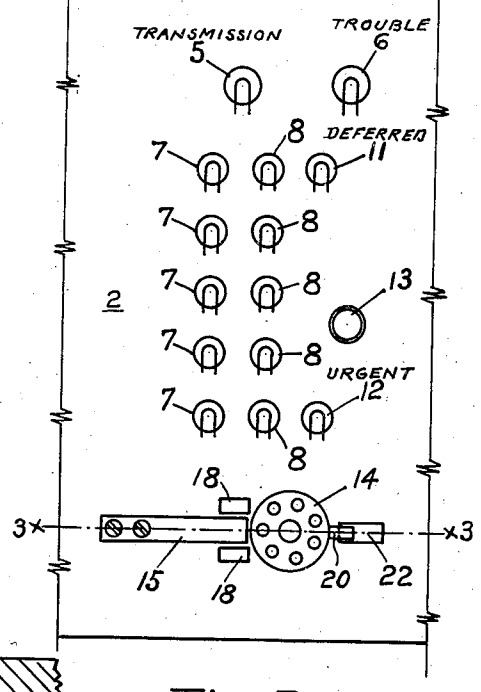


Fig. 2.

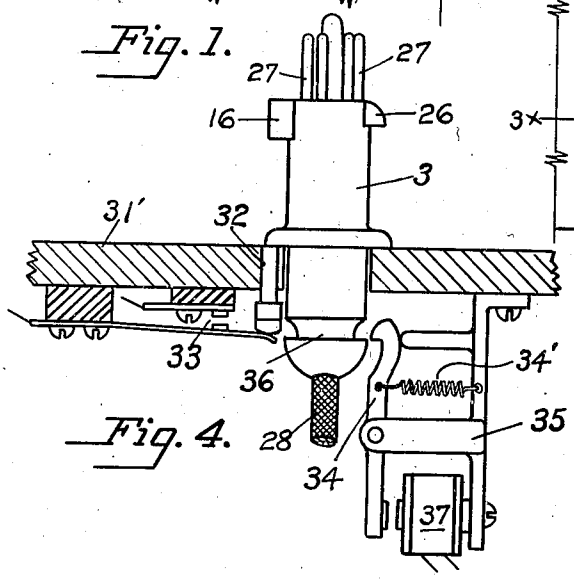


Fig. 4.

INVENTOR.
Edward E. Kleinschmidt
BY
Strauch & Hoffman
ATTORNEYS

June 28, 1949. E. E. KLEINSCHMIDT 2,474,257

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6 Sheets-Sheet 2

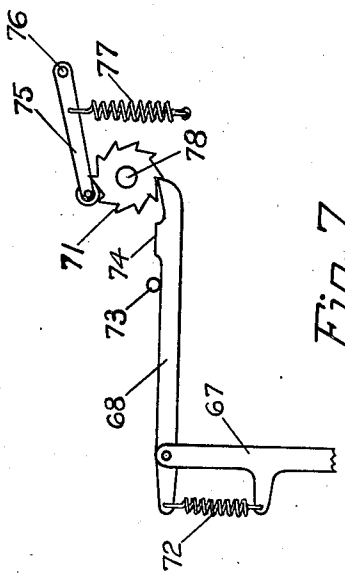


Fig. 7.

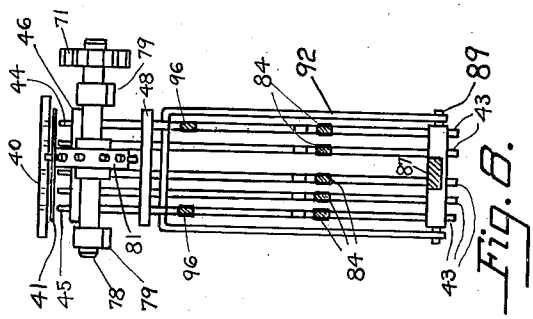


Fig. 8.

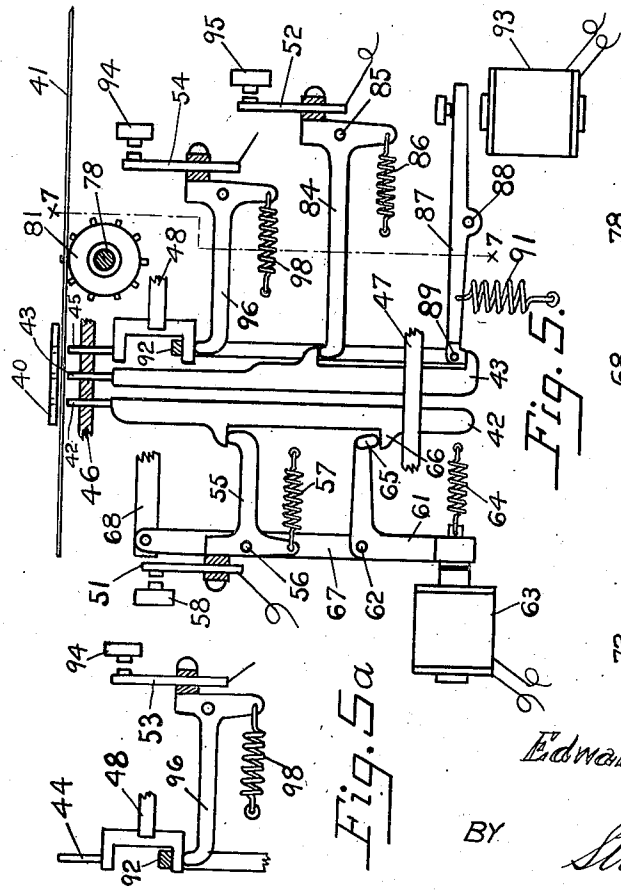


Fig. 5.

Fig. 5a

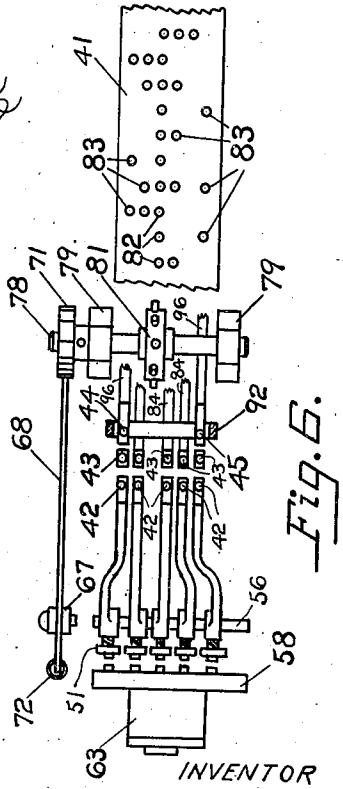


Fig. 6.

INVENTOR

Edward E. Kleinschmidt

BY

Strauch & Hoffman

ATTORNEYS

June 28, 1949. E. E. KLEINSCHMIDT 2,474,257

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6 Sheets-Sheet 3

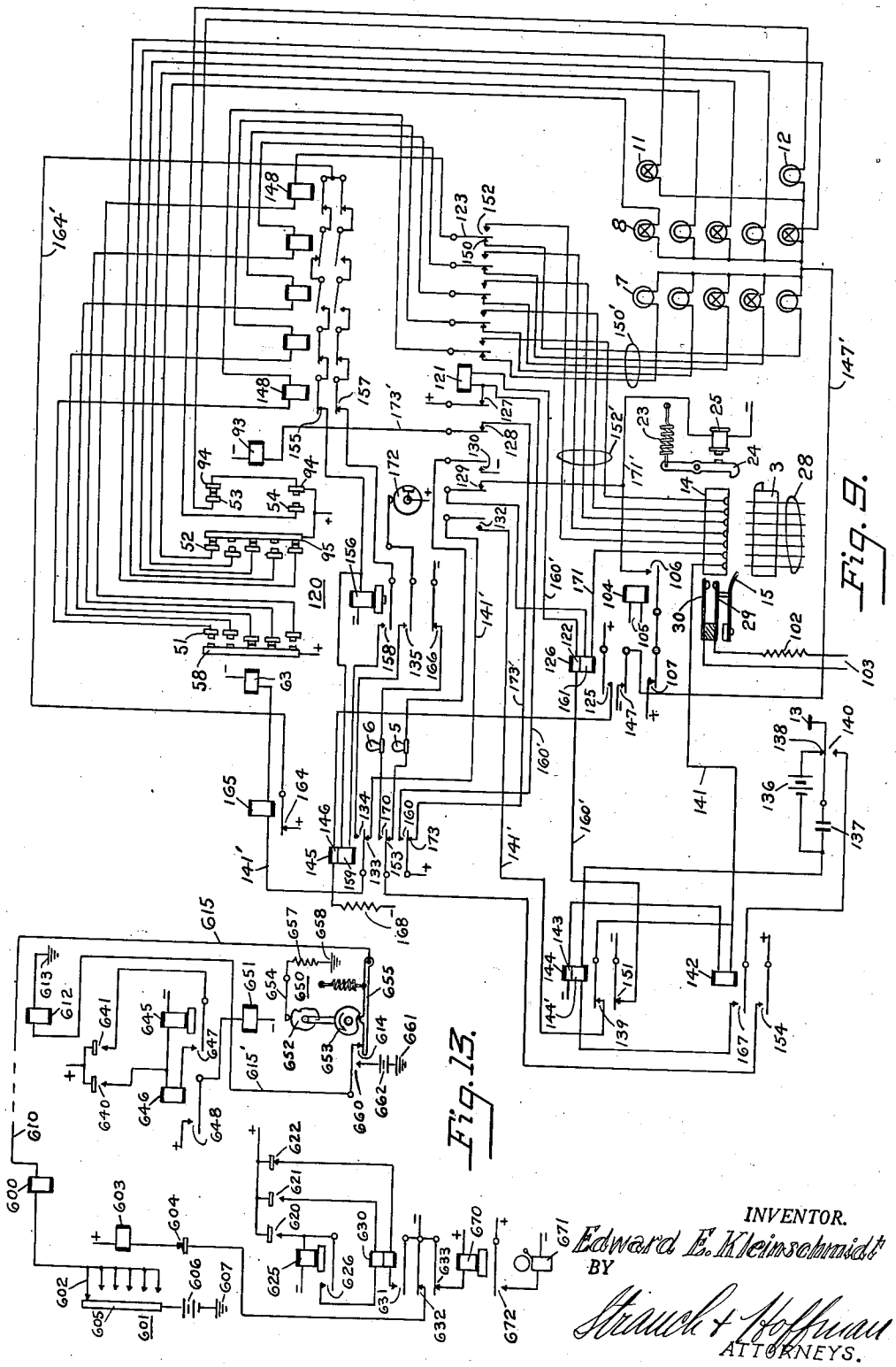


Fig. 9.

Fig. 13.

INVENTOR.
Edward E. Kleinschmidt
BY
Strauch & Hoffman
ATTORNEYS.

June 28, 1949. E. E. KLEINSCHMIDT 2,474,257

TELEGRAPHIC COMMUNICATION SYSTEM WITH AUTOMATIC ANSWER BACK AND ALARM SIGNALS

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6 Sheets-Sheet 4

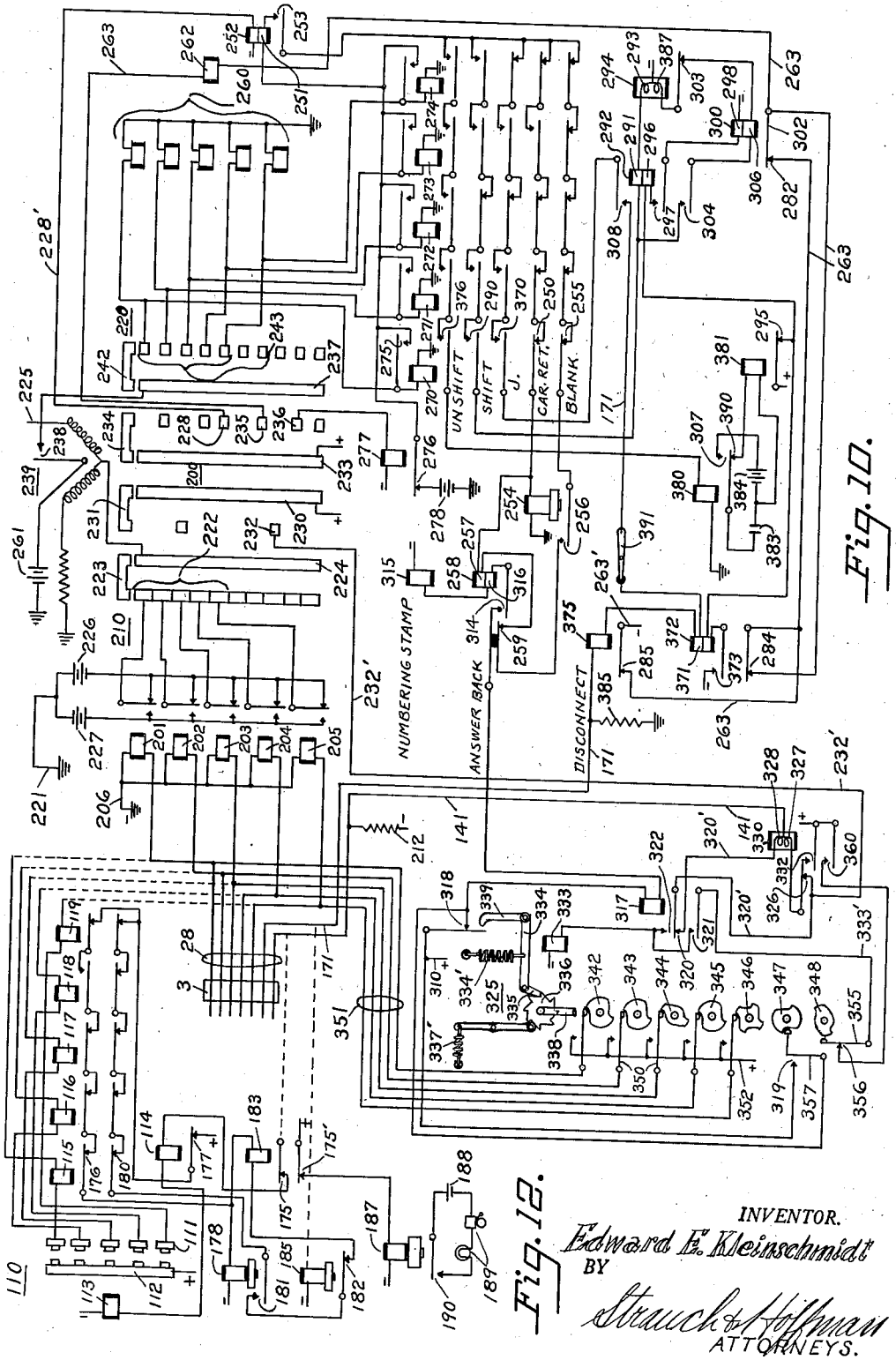


Fig. 10.

Fig. 12.

INVENTOR.
Edward E. Kleinschmidt
BY
Strauch & Hoffman
ATTORNEYS.

June 28, 1949. E. E. KLEINSCHMIDT 2,474,257

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6 Sheets-Sheet 5

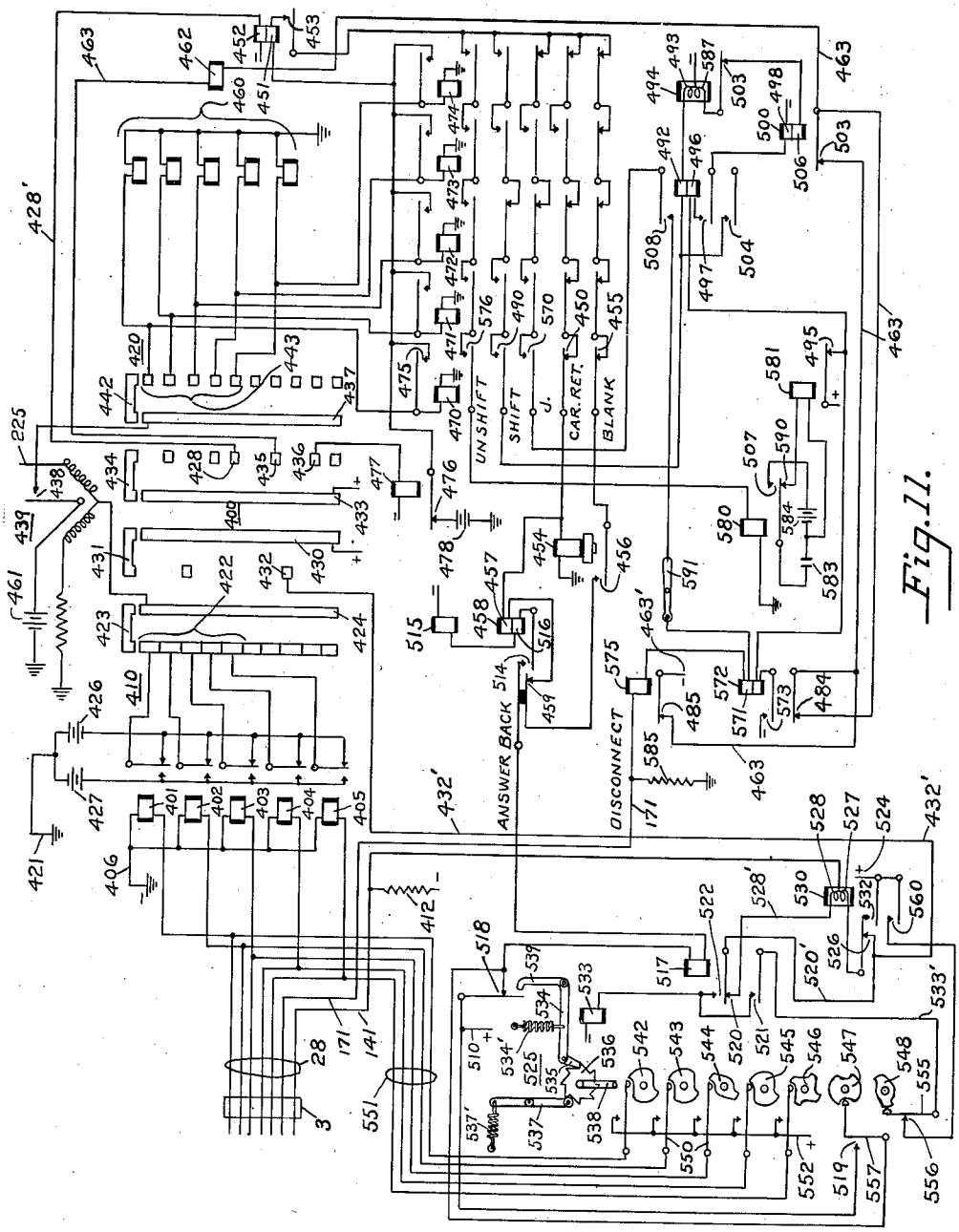


Fig. 11.

INVENTOR.
Edward E. Kleinschmidt
BY
Strauch & Hoffman
ATTORNEYS.

June 28, 1949. E. E. KLEINSCHMIDT 2,474,257

TELEGRAPHIC COMMUNICATION SYSTEM WITH AUTOMATIC ANSWER BACK AND ALARM SIGNALS

Filed Dec. 24, 1943

6 Sheets-Sheet 6

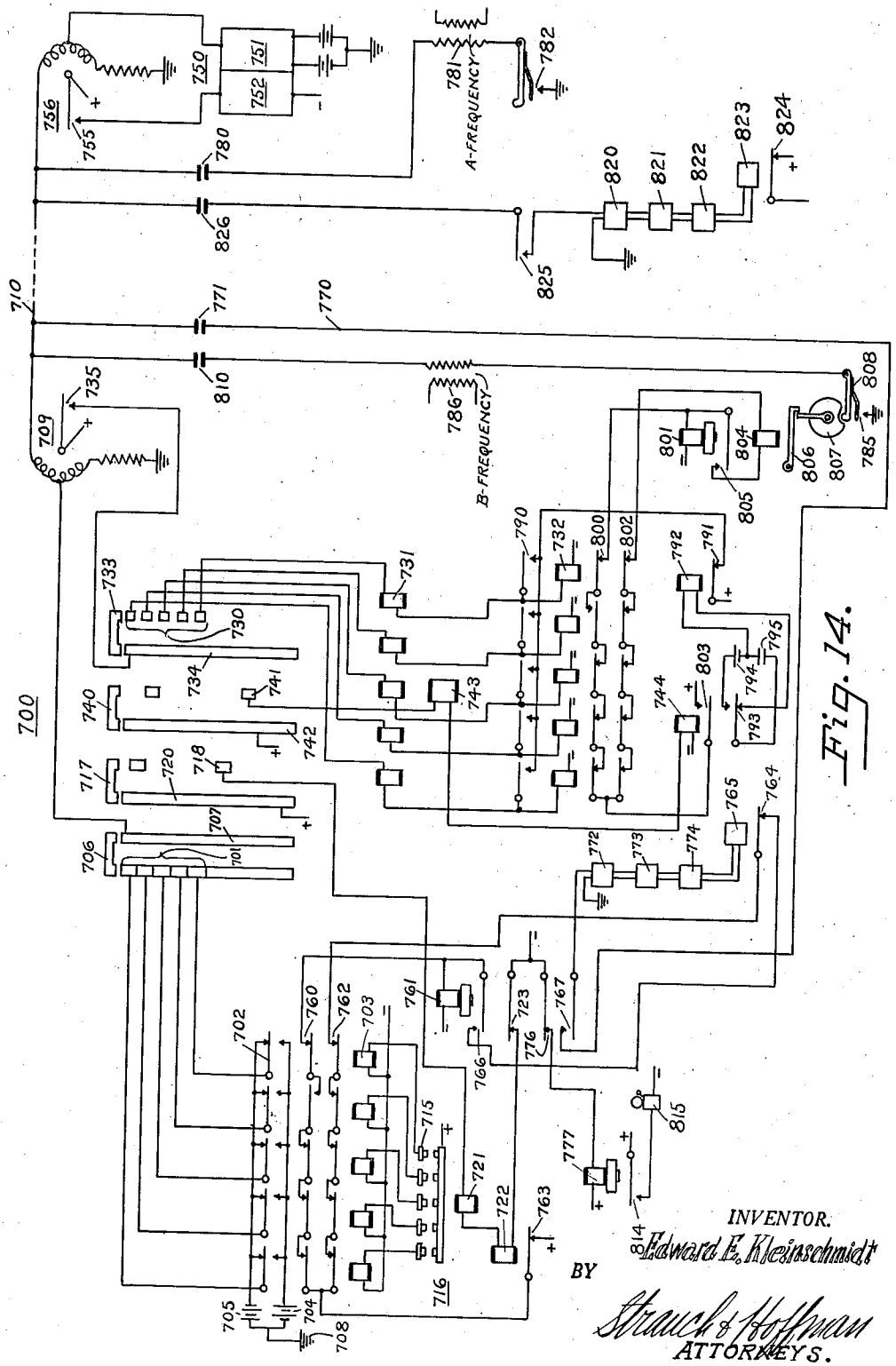


Fig. 14.

INVENTOR.
Edward E. Kleinschmidt
BY
Strauch & Hoffman
ATTORNEYS.

Patented June 28, 1949

2,474,257

UNITED STATES PATENT OFFICE

2,474,257

TELEGRAPHIC COMMUNICATION SYSTEM WITH AUTOMATIC ANSWER BACK AND ALARM SIGNALS

Edward E. Kleinschmidt, Miami Beach, Fla.

Application December 24, 1943, Serial No. 515,562

36 Claims. (Cl. 178—4)

1

My invention relates to a system of telegraphic communication. While the preferred embodiment is especially adapted for switching telegraph messages by a manually operated switchboard, my invention also embodies features useful in automatic switching systems, such for example as the control and supervision of transmission circuits by means of automatically transmitted and received answerback signals; the feature of transmitting the complete address of a message, that is, one containing more than one code combination, to an automatic switch from an address transmitter in one operation; and the feature of maintaining two transmission circuits connected until an answerback signal is received indicating the full reception of a transmitted message at the ultimate receiving station, as well as others.

Manually operated telegraph switchboards have heretofore been proposed and are used to some extent. These are, however, complicated and require the numbering of messages by the automatic transmission of successive numbers over trunk circuits. To prevent loss of messages in such prior systems a great amount of manual supervision is required and it has also been necessary for the switchboard operator to read a printed or perforated tape to determine the destination of a message so that he may switch it to the proper circuits.

The elimination of the foregoing objectionable features of prior switching systems is a primary object of my invention which I accomplish by providing a simplified system in which incoming lines are brought to a switchboard assembly in a manner similar to a telephone switchboard. Each incoming line position has associated with it a series of lamps to indicate the ultimate destination of the message, a multiple contact jack, a start button, a signal lamp to indicate that a message is being transmitted and a signal lamp to give an alarm signal and means to retain the connection locked if the message has not been received or if there is a fault in the circuit or apparatus. Each jack is provided with a locking device to prevent the plug being withdrawn from the jack during the transmission of a message, an ejecting device to disconnect the plug when the transmitted message is correctly received and devices to prevent connecting a plug to a busy circuit.

A further object of the invention is to provide a novel form of perforated tape controlled transmitter with feelers and contacts that are operative only when a message is waiting to be transmitted and which then close circuits to indicator lamps on the switchboard for giving the ultimate destination address as well as indicating whether the message is an ordinary one or a deferred message or an urgent message. These circuits from the transmitter may, in an automatic switching system, be connected to control the selective switch mechanism.

2

Another object of the invention is to provide novel means for automatically sending and receiving answer back signals for each message or group of messages transmitted. In the preferred embodiment disclosed the answerback signals are started at the receiving station under control of the message end signals, and are transmitted to the transmitting apparatus. After each message or group of messages has been transmitted, transmission is stopped until the answerback signals are received whereupon the transmission is automatically restarted. If the answer back signals are not correctly received, the circuits are held locked and a trouble indication given so that service operators may correct any trouble and retransmit the message wherein the fault occurred.

A further object is to provide means to prevent registration of the answerback signals in a transmitted message and to prevent the recording in a message of the unshifted signal combination included in answerback or service signals when the message includes figures or punctuations which are recorded in the shifted position of the message character receiver.

Another object is to automatically feed out accumulated blank signal combinations at the transmitter between messages without transmitting such blanks over the circuit.

A still further object is to provide means to cancel the stoppage of the message transmission function of answerback signals when, through some fault, these arrive in the body of a message.

Other objects will become apparent from the following description and claims.

Referring to the drawings:

Figure 1 illustrates more or less diagrammatically a section of an assembled switchboard to be used in the preferred embodiment of my invention;

Figure 2 illustrates diagrammatically one panel of an incoming circuit at the switchboard;

Figure 3 is an enlarged detail section on the line 3—3 of Figure 2, showing the construction of the jack and plug;

Figure 4 shows the plug in its seat at the

switchboard and associated connections and locking device;

Figure 5 is a side elevation partially in section showing the essential elements of a preferred form of tape transmitter used in the preferred embodiment of my invention;

Figure 5a is a similar view of certain of the elements not seen in Figure 5;

Figure 6 is a plan view with parts broken away of the mechanism illustrated in Figure 5;

Figure 7 is a fragmental side elevation of the stepping mechanism illustrated in Figure 6;

Figure 8 is a sectional view along line 7—7 of Figure 5;

Figure 9 shows the circuits from an incoming line to the jack and the various indicator lamps at the switchboard;

Figure 10 shows the apparatus and circuits at the transmitting terminal of a duplexed multiplex channel and connections to the switchboard;

Figure 11 shows the apparatus and circuits at the receiving terminal of a duplexed multiplex channel and associated apparatus;

Figure 12 (Sheet 4) shows how the answerback method is applied to automatic transmission systems;

Figure 13 (Sheet 3) shows how the answerback method may be applied to a simplex telegraph system;

Figure 14 shows the answerback control method applied to a duplex transmission system using relatively high frequency currents for the answerback signals;

Figure 15 (Sheet 1) shows the switchboard busy circuit; and

Figure 16 (Sheet 1) shows the method of preventing a plug connection to a busy circuit.

Referring to Figure 1, included in the switchboard assembly 1 are the panel assemblies 2 of incoming lines which may be multiplied to various switchboard positions in usual manner. Plugs 3 are connected to outgoing trunks multiplied to various switchboard positions. Signal lights 4 are connected to indicate busy trunks in well known manner.

In the panel assembly (Figure 2) of an incoming line; white indicator lamp 5 flashes during the transmission of a message; red indicator lamp 6 flashes to indicate trouble when the answerback message is not received; the first two rows 7 and 8 of 5 lamps each indicate the address of the ultimate distributing point for the message; a deferred message is indicated by the lamp 11; and an urgent message is indicated by the lamp 12 all as will more fully hereinafter appear. The circuit arrangements for lamps 11 and 12, as hereinafter pointed out, are such that when both are lighted at the same time, the indication is for an ordinary message. Start button 13 is operated to start transmission. Jack 14 is provided with an ejecting spring 15 which engages flange 16 of the multiple contact plug 3 when the plug is inserted in jack 14. Flange 16 must fit between guide walls 18 to insure proper insertion of the plug. Hook lever 20 is pivoted on a bracket 21 and normally held against the edge of opening 22 by a spring 23. Magnet 25 when energized attracts hook lever 20 to release it from lug 26 of plug 3 thus permitting spring 15 to eject plug 3 out of its socket. Contact pins 27, of which there are seven carried by plug 3, are connected through cable 28 to circuits at an outgoing channel as will be described later. When plug 3 is inserted in jack 14, spring 15 presses an insulated plunger 29 against contact springs 30 to close them, and pins 27 each engage one of seven contact springs 31, only four springs 31 being shown in Figure 3. Contact springs 31 are connected to circuits of a local transmitter as will be described later.

In Figure 4 plug 3 is shown resting in its socket on table portion 31' of the switchboard. When in this position, it depresses button 32 which disengages busy contacts 33 to hold the circuit of signal lamp 4 normally open, as in Figure 15, Sheet 1. A hook lever 34 pivotally mounted in a bracket 35 is normally held out of contact by spring 34' with ledge 36 forming a part of plug 3. A magnet 37 included in the busy circuit and mounted on bracket 35 attracts hook lever 34 to engage same with ledge 36 when the trunk to which the plug is connected is busy, all as more fully hereinafter described.

Referring to Figures 5, 6, 7 and 8 which show the operating parts of a preferred tape transmitter used in my system, perforated tape 41, movable beneath a perforated plate 40, is engaged by a row of five tape feelers 42 for sensing messages and at times address signals. A row of five tape feelers 43 sense tape 41 for address signals. Deferred message signals are sensed by tape feeler 44, and tape feeler 45 senses tape 41 for urgent message signals. All of the tape feelers are guided at their upper ends in a plate 46, tape feelers 42 and 43 are guided at their lower ends in a slotted plate 47, and tape feelers 44 and 45 are guided in plate 48. The upper ends of the several tape feelers are received in the registering perforations of plate 40. Each tape feeler has associated with it a contact lever; those associated with tape feelers 42 are numbered 51; those associated with the tape feelers 43 are numbered 52; the one associated with tape feeler 44 is numbered 53 (Figure 5a); and the one associated with tape feeler 45 is numbered 54. Contact members 51 are individually supported by insulated mountings on levers 55 pivoted on a common bearing 56 carried on the supporting framework, not shown. Springs 57 act on levers 55 to urge the connected tape feelers 42 upward and contact member 51 against a common contact bar 58. A bell crank armature lever 61 pivoted on a bearing 62 is shown attracted by transmitter operated magnet 63. A spring 64 retracts armature lever 61 when magnet 63 is deenergized. The horizontal arm of bell crank lever 61 has a terminal bail 65 which engages all of the ledges 66 forming a part of tape feelers 42 so that, when magnet 63 is energized as shown, all tape feelers 42 are withdrawn from engagement with tape 41 and contact 51 is disengaged from contact bar 58. An upward extension 67 (Figures 6 and 7) from bell crank lever 61 carries a pawl 68 which is held in operative contact with ratchet 71 by spring 72. A stud 73 engages ledge 74 forming a part of pawl 68, when magnet 63 is deenergized and bell crank armature 61 moves to its retracted position. Detent lever 75 mounted on a bearing 76 is pressed against ratchet 71 by spring 77 to hold the ratchet in the set position. Ratchet 71 is fastened to a shaft 78 mounted in bearings 79 (Figure 6). A feed wheel 81 also fastened to shaft 78 is equipped with pin projections which engage the feed holes 82 of the transmitting tape 41 to feed the tape step-by-step by the action of operating magnet 63.

Code holes 83 are perforated in the tape to correspond with the code combinations required for each character to be transmitted. As the tape is fed through the transmitter step-by-step

during the transmission of a message, tape feelers 42 either press against the tape 41 or pass through a code hole 83 and permit the associated lever 55 to move its contact member 51 against contact bar 58. The plate 40 is so positioned with respect to tape 41 that those of the tape feelers 42 which engage blank tape, that is, where there are no code perforations, do not permit lever 55 to move a sufficient distance to allow contact lever 51 to engage contact bar 58. This operation of similar parts in standard tape transmitters is well known.

Tape feelers 43, 44 and 45 are added to the standard tape transmitter mechanism for the purpose of reading the address of a message and/or for controlling automatic switches when used. Tape feelers 43 are individually associated with contact levers 84 which carry contacts 52 and are pivoted on bearings 85 and pressed upward by individual springs 86. All of the tape feelers 43 are normally held out of engagement with tape 41 by a terminal bail 89 forming a part of armature lever 87 and pivoted on a bearing 88, by the action of spring 91. Tape feeler 44 associated with contact 53 and tape feeler 45 associated with contact 54 are held in their normal lower position by a bail 92 operatively connected to bail 89. Levers 96 carry the contacts 53 and 54 respectively and are actuated to circuit closing position by springs 98. It will be understood that the armature spring 91 is of greater strength than the springs 86 and 98 to restrain action of the latter and normally maintain contacts 52, 53 and 54 in open-circuit position. When the address of a message is to be recorded, magnet 93 is energized to release tape feelers 43, 44 and 45 which thereupon assume positions in accordance with perforations in the tape. Those passing through code perforations in the tape permit corresponding levers 84 and 96 to be operated to move contacts 52, 53 and 54 carried thereby into circuit closing engagement with common bars 94 and 95. Magnet 93 remains de-energized during message transmission.

The system herein disclosed contemplates that the receiving operator (a telegraph employee) when receiving a message from the public over the telephone at a branch office or over a subscriber teletype circuit will prefix each message when retransmitting it into the switching system with the code address of the ultimate central office distributing point, such code address to include special signals to indicate whether the message is an ordinary one, a deferred message, or an urgent message. Two letter code combinations will indicate the ultimate central office and the third combination will indicate the type of message. At the end of the message he adds a message end signal combination.

Switchboard connection from incoming line

Referring now to Figure 9, Sheet 3, which shows the circuit arrangements associated with the transmitter of an incoming line, transmitter 120 is constructed in accordance with the showings of Figures 5, 6, 7, and 8, Sheet 2. The parts shown in this view, which are numbered correspondingly, are controlled by perforated tape 41 in the manner previously explained. The connections of the transmitter, as well as the relay positions in this view, are in the condition they will be in when a message is waiting to be transmitted. At this time transfer relay 121 will be energized. Address magnet 93 will be energized permitting tape feelers 43, 44 and 45 to engage the message tape. Transmitter operating magnet 63 will be de-energized permitting tape feelers 42 to engage the message tape.

It is assumed that the perforations in the tape at that time will be such as to set contacts 51, 52, 53 and 54 in the positions shown in Figure 9. Current will pass from plus battery contact bar 58, through the connected contact members 51, selecting relays 148, to corresponding armature levers 123 of transfer relay 121, contacts 150, wires 150' and to address lamps 7, wire 147', contacts 147, and negative battery. Current will also pass from plus battery, common bar 95 to the connected contact members 52 and lamps in group 8, contacts 147, to negative battery, and to contact member 53, lamp 11, contacts 147, to negative battery. In accordance with the connection shown the third and fourth lamp in group 7, the first, third, and fifth lamp in group 8, and lamp 11 will be lighted indicating on the address lamps that the message waiting is a deferred one, destined for NY which are the symbols for New York. This address and type of message will be read by the switchboard operator who then inserts a plug 3 connected to a New York trunk in a jack 14 connected to the waiting message, or if the lines are busy and since the waiting message is a deferred one, inserts a plug 3 that is connected to storage apparatus especially provided for deferred messages. The storage apparatus may be located at the New York trunks or may be connected to special switchboard positions.

Transmission from incoming circuit

Before describing the operation of relays, etc., when a plug 3 is connected to the circuit, I will give a general description of the condition of the circuits at the time of a waiting message, that is, when the address lamps are lighted. Only relay 121 and holding coil 122 of relay 126 are energized at this time. Relay 121 was energized by the operation of the message end signal and relay 126 was energized by the answerback signal. Battery 136 is at this time charging condenser 137 through contacts 138. Holding coil 122 of relay 126, holding coil 143 of relay 144 and holding coil 146 of relay 145 are composed of windings of a comparatively small number of turns, insufficient when energized to attract the armatures of the relays but sufficient to hold the armatures attracted after the relays are operated by their respective operating coils.

When a switchboard operator inserts a plug 3 in jack 14 to transmit the waiting message, sixth pulse impulses from the trunk to which plug 3 is connected will periodically pass over wire 141 from positive battery at the trunk through relay 142, holding coil 143 of relay 144 and negative battery. Start key 13 is now depressed closing contact 140 to prepare a circuit for the discharge of condenser 137 which is closed through operating coil 144' of relay 144 when contacts 167 are closed by a sixth pulse arriving on wire 141. Energized holding coil 143 holds relay 144 operated during the sixth pulse. The pulse from start key 13, when that is depressed, is a momentary condenser discharge, so that if the key is held down during the transmission of one or two letters, nothing occurs. Contacts 151 and 139 of relay 144 will be opened during this sixth pulse interval. Contacts 151 open the holding circuit for relays 121 and 126. Contacts 139 open the sixth pulse circuit wire 141' to relay 165 and magnet 63. Relay 126 when released opens contacts 147 disconnecting negative battery from the address lamps and closes contacts 125 which close

a circuit from positive battery through holding coil 146 of relay 145, resistance 168 and negative battery. Relay 121 when released by the opening of contacts 151 opens contacts 128 in circuit with address magnet 93 which releases armature 87, and tape feelers 43, 44 and 45 are released from engagement with tape 41 by the action of spring 91 (Figure 5, Sheet 2). Selected contacts 51 will however remain in contact with common bar 58. The sixth pulse now on wire 141 cannot at this time pass to relay 165 and transmitter operating magnet 63 over wire 141' and close contacts 132 of relay 121, since contacts 139 of relay 144 are open during the first sixth pulse interval. Selected contacts 51 will therefore remain in the set position after the first sixth pulse is received on wire 141 and the first code combination in tape 41, forming a part of the address of the message, will be transmitted over relays 148, contacts 152, wires 152', jack 14, plug 3, and through cable 28 to a bank of relays at the connected trunk. The second and following pulses passing over the sixth pulse circuit 141 and 141' will not operate relay 144 but operate relay 165 and magnet 63 through contacts 139 of relay 144, wire 141', contacts 132 of relay 121, and contact 133 of relay 145 to relay 165 and transmitter operating magnet 63 to negative battery, and step transmitting mechanism for tape 41 through transmitter 120. Relay 142 will also be operated but will close no circuits other than through contacts 154, lighting white lamp 5 with every sixth pulse through closed contacts 153 of relay 145, and 130 of relay 121, thus giving the switchboard operator an indication that the message is being transmitted.

The transmission of the full address and message continues until the message and signal combination in tape 41 reaches feeler pins 42. The message end signal combinations used for the purpose of this description of the invention are the code combination commonly used for carriage return comprising three spacing, one marking and one spacing signals followed by a blank code combination, that is, one containing five spacing signals. The carriage return code combination always sets relays 148 to close series contacts 155, closing a circuit from positive battery, contacts 164 of relay 165, wire 164', contacts 155, relay 156 to negative battery. Relay 165 opens this circuit during the sixth pulse interval to prevent relays 148 getting false impulses during the contact setting period. Relay 156 is sufficiently slow release to hold its armatures attracted over the sixth pulse interval. The closing of contacts 158 and 135 by relay 156 and the opening of contacts 166 will have no effect since the connected circuits are open at other points at this time. When however a blank code combination immediately follows a carriage return combination, all the relays 148 remain de-energized and series contacts 157 of relays 148 are closed before relay 156 releases its armatures and current now passes through contacts 158, operating coil 159 of relay 145, relay 156 to negative battery. Relay 145 is operated and held so by the energized holding coil 146, until the answer-back signal is received. Contacts 160 of relay 145 close a circuit over wire 160' from positive battery through relay 121, holding coil 122 of relay 126, contacts 151 to negative battery. Relay 121 operates to move armatures 123 from contacts 152 to contacts 150 transferring the circuits from contacts 51 to the address lamps 7. Relay 121 closes contacts 127 which close a self-locking circuit that remains closed until start key 13 is depressed. Relay 145 opens contacts 133 and closes contacts 134 transferring the circuit of relay 165 and magnet 63 from the outgoing trunk sixth pulse on wires 141 and 141' to an auto-pulsing circuit 172 through closed contacts 135. The auto-pulses periodically energize relay 165 and magnet 63, which impart step movements to the tape 41 over feeler pins 42 until a code perforation is reached. One or more of the relays 148 are then energized and the circuit through series contacts 157 interrupted, whereupon relay 156 is released and contacts 135 opened disconnecting the auto-pulsing circuit 172 and leaving transmitter 120 at rest, with feeler pins 42 pressed against tape 41. Contacts 166, relay 156 and closed contacts 170 of relay 145 close a circuit through red trouble lamp 6 which flashes by the periodic closing of contacts 154 of relay 142 until the answerback signal is received. Contacts 129 of relay 121 close to prepare the answerback circuit from wire 171. Contacts 128 of relay 121 close to prepare the circuit for address magnet 93. Contacts 130 of relay 121 open the circuit for white lamp 5. Contacts 132 of relay 121 open the sixth pulse circuit to relay 165 and magnet 63. Under normal conditions when no faults exist in either the circuits or apparatus, the answerback signal is received on wire 171 within one second after the message end signal is transmitted from contacts 51. The answerback signal when received passes through operating coil 161 of relay 126 and disconnect magnet 25 over wire 171'. Relay 126 when operated remains so until key 13 is depressed to start a new message. Magnet 25 releases plug 3, whereupon spring 15 ejects it from jack 14. Relay 126 opens contacts 125 de-energizing holding coil 146 and relay 145 is released. Contacts 147 of relay 126 connect negative battery to address lamps 7, 8, 11 and 12. When relay 145 is released, it closes the circuit to address magnet 93 through contacts 173, wire 173' and closed contacts 128 of relay 121. A combination of lamps 11 and 12 and certain of the lamps in groups 7 and 8 are now lighted in accordance with the code combinations of the address characters in the next waiting message. As before stated relays 126 and 121 remain operated. The switchboard operator now reads the address lamps for the destination of the message and inserts in jack 14 a plug 3 that is connected to an outgoing trunk that will carry the waiting message to its destination after which he depresses the key 13 to start transmission.

If an answerback signal is not received on wire 171, red trouble lamp 6 will flash and plug 3 will remain connected to jack 14. When this occurs the switchboard operator summons a service attendant who communicates with a service attendant at the receiving station. When the fault is located and repaired, transmission is restarted.

Contacts 129 of relay 121, which are open during message transmission, are provided to prevent an answerback impulse on wire 171 from operating relay 126 or disconnecting magnet 25 at any time other than after a message has been transmitted.

Preventing duplicate switchboard connections

For a switchboard arrangement where a series of incoming transmitter circuits, as shown in Figure 9, Sheet 3, will have different switchboard positions each connected to a jack 14 and attended by individual operators, I provide means

to make impossible the connection of more than one plug 3 to the same waiting message in the following manner: Referring to Sheet 1, Figures 3 and 16, each jack of a group connected to the same transmitter 120 is provided with a pair of contact springs 30 which are closed by a plunger 29 when a plug 3 is inserted in a jack 14. Each set of contacts 30 in such group is connected through a limiting resistance 102 to a multiple circuit 103 and positve battery. Relays 104, one for each jack, are connected in series circuit 105, to negative battery and to circuit 103 as shown in Figure 16. Relays 104 are wound so that current passing through one limiting resistance 102 will not operate them. When however two contacts 30 are closed at the same time current will pass through two limiting resistances at the same time and sufficient current will flow through series circuit 105 to operate all relays 104 which close contacts 106 (Figure 9) to close a circuit through disconnect magnet 25 which will prevent the locking in of any of the inserted plugs 3. When all of the plugs 3 except one are withdrawn the latter will lock in, whereupon the operator depresses start key 13 extinguishing all address lamps. Contacts 107 operated by relay 126, which is de-energized during message transmission, are provided to prevent closing of the circuit to disconnect magnet 25 during message transmission.

Connection to multiplex system

Figure 10, Sheet 4, shows the sending section 210 and the receiving section 220 of one duplex multiplex channel of a multiplex distributor 200 and the connections associated therewith. The five transmitting wires from plug 3 are connected to five transmitting relays numbered 201 to 205 which are normally de-energized closing their upper contacts to transmit negative impulses through battery 226 from ground 221 to transmitting segments 222 of the multiplex distributor which during transmission are connected by rotating brush 223 to ring 224 and outgoing line 225. During the transmission of message characters one or more or relays 201 to 205 will be energized and move their armatures against the lower contact to transmit impulses from positive battery 227. Ring 230 connected to positive battery is connected by brush 231 to sixth pulse segment 232 after brush 223 has passed over the transmitting segments 222. Ring 237 is connected to contacts 238 of receiving relay 239 and by brush 242 to the receiving segments 243. Ring 233 connected to positive battery is connected by brush 234 to segment 228, receiving sixth pulse segment 235 and relay break segment 236 after brush 242 leaves receiving segments 243. As is well known in the operation of multiplex distributors, the brushes 223, 231, 234, and 242 revolve together as one unit and in synchronism with similar brushes 423, 431, 434 and 442 shown in Figure 11 forming part of a like multiplex distributor 400 at the distant end of the duplex circuit, and it is assumed that impulses from ground connection 221 will pass over line 225 to receiving relay 439. The arrangements of relays and circuits in Figure 11 are the same as in Figure 10 and bear the same numbers except that these are in the 400 and 500 groups.

The circuit arrangements and relays in Figures 10 and 11, Sheets 4 and 5, are shown in the normal unoperated position, and it is assumed that the brushes 222, 223, 231, 234 and 242 are rotating and in synchronism with brushes 422, 423, 431 and 442 at the distant end of the line, and that a switchboard operator is ready to insert plug 3 connected to relays 201 to 205 in a jack 14 connected to a waiting message. When the plug is inserted several sixth pulse impulses may be transmitted from positive battery ring 230, segment 232 and wire 232' to wire 141 and relay 142, Figure 9. At Figure 10 these impulses will pass through coils 327 and 328 of sixth pulse control relay 330 in opposite directions and relay 330 is therefore not operated at this time or during message transmission, the circuit from segment 232 to wire 141 being from positive battery ring 230, segment 232, wire 232' and in a divided circuit over wire 320' and contact 320 and over contacts 326 through coils 328 and 327 to wire 141. After inserting plug 3, the switchboard operator depresses start key 13 which starts the sending of message impulses from the transmitter 120 in the manner previously explained. These message impulses are received on relays 201 to 205 which connect either positive or negative battery to the transmitting segments in ring 222. As the distributor brushes revolve corresponding impulses are transmitted to line 225 in a manner well known in the art. Brushes 231 connect segment 232 to positive battery after the transmission of each group of character impulses and transmit a sixth pulse impulse over a wire 141 to the apparatus in Figure 9 operating the transmitter 120 periodically in the manner previously explained. At the end of the message, message end signal combinations are transmitted comprising a carriage return combination of three negative, one positive, and one negative impulses followed by a blank combination of all negative impulses. Transmission from transmitter 120, Figure 9 will then stop. The multiplex brushes, however, continue to rotate sending blank code combinations since all of the relays 201 to 205 will remain de-energized.

Multiplex distributor 200, Figure 10, Sheet 4, is connected to multiplex distributor 400, Figure 11, Sheet 5, by line 225 and, as is well known in duplex operation, signals from the sending section 210 operate relay 439 and signals from the sending section 410 operate relay 239. When a message is transmitted from sending section 210, relay 439 operates contacts 438 to open and close a circuit from ground and battery 461, contact 436, ring 437, brushes 442, segments 443, selecting magnets 460 to ground, also through relays 470 to 474 to ground. Relays 470 to 474 lock up when operated through contacts 475, the circuit being from ground, coil of a relay 470 to 474, contacts 475, contacts 476 of relay 477 to battery and ground 478. During each rotation of brushes 442 and 434, magnets 460 and relays 470 to 474 will be energized in accordance with the code combination received. After a code combination of impulses is received, brush 434 connects segment 435 to ring 433 closing a circuit from plus battery through perforator or printer operating magnet 462 over wires 463 through parallel connected contacts 503 and 484, series contacts 485, and negative battery 463'. Magnet 462 will record the code combination selected by magnets 460 in the record medium of the receiving apparatus. After brush 434 has passed over segment 435 it contacts with segment 436 to close the circuit through break relay 477 opening contact 476 and the locking circuits for relays 470 to 474 which thereupon assume their unoperated positions. Brushes 434 connect ring 433 to segment

428 at the same time that brushes 442 contact with the fifth selecting segment in group 443.

Reception of message code combinations continues until the end of message code combinations are received which are recorded in the following manner: Relays 470 to 474 operate as selecting relays to detect the unshift, shift, letter J, carriage return and blank code combinations, and their contacts are connected in series as to the relays in the manner shown. When at the end of a message the carriage return and blank code combinations are received in succession, a circuit is first closed by relays 470 to 474 through the carriage return row of series contacts 450, closing a circuit from battery 478, contacts 476, holding coil 451 of relay 452, contacts 453 which are closed when brushes 434 contact with segment 428 to energize relay 452 over wire 428', series contacts 450, slow release relay 454 and ground. The following blank code combination closes series contacts 455 closing a circuit from battery 478, contacts 476, coil 451, closed contacts 453, series contacts 455, closed contacts 456, contacts 459, operating coil 457, of answerback relay 458, relay 454, and ground. Relay 458 is operated and locks up by closing a circuit from negative battery through numbering stamp 515, holding coil 516, of relay 458, contacts 514, relay 517, contacts 518, wire 510, and positive battery. When relay 458 operates it closes self-locking contacts 514 before opening contacts 459 which are in its operating circuit. Contacts 459 open the circuit from blank series contacts 455 to slow release relay 454 allowing it to open contacts 456. Numbering stamp 515 prints a number on the message just received. It will be understood that an identifying number is also printed on the message at the receiving section 220 of the apparatus shown in Figure 10, when a blank code combination is received, by closing a similar circuit through holding coil 316 of relay 258 and numbering stamp 315, in the manner just described. Relay 517 is operated to start the transmission of an answerback message to transmitting channel 210 as will be described later.

The function of relay 452 is to hold the battery circuit to series contacts 576, 490, 570, 450 and 455 open while they are being set by relays 470 to 474. Relay 452 is energized at the time brushes 442 pass over the fifth segment in group 443. If at that time any of the series contacts operated by relays 470 to 474 close a circuit, relay 452 maintains the circuit closed by closing a locking circuit through contacts 453 and holding coil 451 energized until contacts 476 are opened.

Transmission of answerback signals

When an answerback message is started over a channel while a telegraph message is being transmitted, transmission of the telegraph message is stopped and an answerback message consisting of shift, J, and unshift code combinations is transmitted from an answerback transmitter and thereafter telegraph message transmission is resumed.

The automatic transmission of the answerback message from the sending section of channel 410 operates as follows: During the transmission of a telegraph message selective impulses are received from a transmitter 120 over a plug 3 on relays 401 to 405 as previously explained in connection with the sending channel 210 and sixth pulse impulses are transmitted from segment 432, wire 432' through contacts 526 of relay 530, coil 527, and through wire 520', contacts 520, wire 528', coil 528 to wire 141. Current passes through coils 527 and 528 in opposite directions neutralizing the magnetic effect and sixth pulse control relay 530 is not operated by the sixth pulse during message transmission. When, however, relay 517 is operated by an answerback signal from receiving channel 420, and contact 520 opened, no current can pass to coil 528. A sixth pulse coming through at this time or later will operate relay 530 closing contacts 532 and thereafter opening contacts 526 closing a holding circuit through coil 527 from plus battery 524, contacts 532, coil 527, wire 141, and transmitter operating magnet 63, Figure 9, Sheet 3, over contacts as previously explained, holding magnet 63 energized until contacts 532 of relay 530 are again opened which occurs after the answerback message is transmitted. It is to be noted here that when magnet 63 is energized all of the contacts numbered 51 are out of engagement with common bar 58 and therefore no current passes to relays 401 to 405 from this source at this time.

The sixth pulse just described also passes through answerback stepping magnet 533 over closed contacts 522 operating same to step ratchet 536 the space of one tooth. When relay 517 is operated during a sixth pulse interval and only a part of the sixth pulse is received, relay 530 will be operated as explained and a supplemental circuit over wires 533' is closed to magnet 533 through contact 560 of relay 530 and contacts 556 of answerback apparatus 525 and closed contacts 521 of relay 517 to insure its operation. Contacts 556 are again opened when contact lever 555 leaves the rise on cam 548 at the end of the first operation of armature 534 of stepping magnet 533. Magnet 533 of answerback instrument 525, when operated, attracts armature 534 which is retracted by spring 534'. A pawl 535 attached to armature 534 engages an eight toothed ratchet 536 to step same the space of one tooth in each operation of the armature. A detent 537 operated by spring 537' is provided to hold the ratchet in the stepped position. Ratchet 536 and seven cams numbered 542 to 548 are fixed to a shaft 538 and rotate together as one unit. Cams 542 to 546 are provided with notches arranged so that during the successive stepping movements by the operation of armature 534, contact levers 550 which cooperate with cams 542 to 546 will be set in positions to successively set up connections for the shift, J, unshift and blank code combinations. Contact levers 550 are connected by wires 551 to transmitting relays 401 to 405 as shown, and engage contacts connected to plus battery 552 when operated by a rise in the associated cam. Normally they are resting in notches of their associated cams as shown. At the first operation of armature 534 during the transmission of an answerback message, cams 542 to 548 are moved the distance of one step operating the selected contact levers 550 to transmit plus battery current to the connected transmitting relays 401 to 405 over wires 551 setting them to transmit the shift code combination over transmitting segments 422, brushes 423, ring 424, line 225 from batteries 426, 427, and ground 421. After brushes 423 have passed over the segments 422, brush 431 will connect sixth pulse segment 432 to plus battery through ring 430. This, the second sixth pulse impulse will pass through contacts 522, and magnet 533 again operates armature 534 to step the ratchet 536 into the next position which will cause cams 542 to 546 to set the contact levers 550 into a position to send the letter "J" code

combination to line 225 in the manner as previously explained. The next sixth pulse steps ratchet wheel 536 to set the contact levers 550 in a manner to transmit the unshift code combination to line 225. The next sixth pulse again energizes magnet 533 as previously explained, setting the ratchet wheel 536 in the fourth position which is the same as shown in the drawing except that cams 542 to 548 have moved one hundred and eighty degrees. All of the contact levers 550 will now open the connection to plus battery 552. Contact lever 555 is operated by cam 548 to close contacts 556 while contact lever 557 drops into a notch in cam 547 to open contacts 519. As will be noted this occurs at the end of the downward movement of lever 534, when the part 539 thereof, at its extreme operated position, opens contacts 518. The simultaneous opening of contacts 518 and 519 opens the holding circuit through relay 517, holding coil 516 of answerback relay 458, and numbering stamp 515, which thereupon assume their unoperated positions. When relay 517 is de-energized contacts 521 and 522 are opened and 520 closed so that the sixth pulse impulse now passes through coils 527 and 528 of relay 530 in opposite directions neutralizing the magnetic effect, whereupon relay 530 releases its armatures to the position shown in the drawing. Transmitter operating magnet 63, Figure 9, is now disconnected from continuous plus battery current by the opening of contacts 532 so that upon the cessation of operation of this sixth pulse impulse transmitter magnet 63 is de-energized to set the transmitter contacts for the next letter of the wating telegram and message transmission continues in the normal manner. The sixth pulse circuit 141 is connected to negative battery through resistance 212 so that sixth pulse impulses from segment 232 will have a complete circuit over wires 232' and 141 and transmission from answerback transmitter 325 will function correctly when plug 3 of the channel is not connected and no messages are being transmitted.

Reception of answerback signals

The answerback message just transmitted is received on receiving section 220 of distributor 200. The first shift code combination will be recorded on selecting magnets 260 and on selecting relays 270 to 274, which close a circuit through series contacts 290, from positive battery 278, holding coil 251, closed contacts 253, series contacts 290, operating coil 291 of relay 292, coil 293 of relay 294, and negative battery. Relay 292 operates, closing a self-locking circuit through contacts 297 from positive battery, contacts 295 of relay 331, holding coil 296, contacts 297, holding coil 298 of relay 300, and negative battery. Holding coil 298 of relay 300 is composed of a few windings so that when the circuit to it is closed, it will not energize relay 300 sufficiently to attract armature 302 but will hold same attracted when relay 300 is operated by current passing through coil 306. Contacts 303 open when relay 294 is energized. Contacts 304 of relay 292 close a trifle later so that no current will pass through coil 306 of relay 300 at this time. Relay 292 also closes contacts 308.

The following J combination will close series contacts 370 closing a circuit from battery 278 through contacts 370, contacts 308, operating coil 371 of relay 372, relay 375, wire 171 to disconnect magnet 25, and relay 126, Figure 9 releasing connected plug 3. Relay 375 remains energized through resistance 385 and ground after the reception of the letter J combination and until contacts 276 of break relay 277 are opened, so that contacts 285, included in the sixth pulse circuits 263 to perforator or printer operating magnet 262, will be open when brushes 234 connect positive battery to sixth pulse segment 235 and the letter J set up on selector magnets 260 will therefore not be recorded. It is to be noted that while the letter J answerback combination is not recorded on either the printer or perforator it does however transmit an answerback signal to the associated sending channel.

The following unshift combination is received on series contacts 376 of relays 270 to 274 which close a circuit from battery 278, closed contacts 253, series contacts 376, relay 380 and ground. Relay 380 operates to close contacts 387 which connect battery 384 in series with condenser 383, charging the latter. When relay 277 opens the holding circuit at contacts 276 for relays 270 to 274, and relay 252, relay 380 will be de-energized and close contacts 390 allowing condenser 383 to discharge through relay 381 which then operates to open contacts 235 to take plus battery current off the holding circuits to relays 292, 300, and 372, thus restoring relays 292, 300 and 372 to their normal unoperated condition.

Cancelling unshift signal combinations

When, before the reception of the answerback message, the printer or perforator is in the shifted position, that is, recording figures or punctuations, and an answerback message comes through at this time, it will pass through circuits and relays so arranged that the unshift code combination forming a part of the answerback message will not be recorded on either the printer or perforator. These circuits and relays operate in the following manner.

A shift combination received on selecting relays 270 to 274 operates as previously explained to energize and lock up relay 292 and energize holding coil 298 of relay 300. Relay 294 will also operate since contacts 303 open before contacts 304 close. If an answerback message arrives while relay 292 is locked up by a previously received shift code combination, the first code combination of the answerback message, which is a shift combination, will be received on selecting relay 270 to 274, and current will again pass through coil 291 of relay 292 and through coil 293 of relay 294. However, since contacts 304 were closed by the preceding shift combination, current will also pass through coil 307 and operating coil 306 of relay 300 through contacts 304. Current now flows through coils 293 and 307 in opposite directions, neutralizing the magnetic effect and contacts 303 remain closed to permit current to flow through operating coil 306 of relay 300 which remains operated after this second shift code combination is received, due to the energization of holding coil 298. The next code combination (letter J) will close series contacts 370, energizing relays 372 and 375 which operate to send an answerback signal to the apparatus in Figure 9 connected to the associated sending channel over disconnect wire 171. Relay 372 when operated locks up through contacts 373 and opens contact 294. The last code combination (unshift) closes contacts 376 to operate relay 380 which closes contacts 387 to charge condenser 383. The circuit to negative battery 263' from printer or perforator operating magnet 262 over wires 263 is now open at contacts 282, and

284 so that when brush 234 contacts with segment 235 no current will flow to magnet 262 and the unshift code combination just received on relays 270 to 274 will not be registered on either the printer or perforator and therefore the character receiving apparatus remains in the shifted position. When relay 277 opens break contacts 278, relay 380 is released opening contacts 397 and closing contacts 390 which connect condenser 383 in circuit with relay 381 to discharge therethrough. Relay 381 opens contacts 295 to release relays 292 and 372. It is to be noted that the circuit arrangement just described is effective to prevent recording of the unshift combination on printer or perforating receiving apparatus only when this receiving apparatus is in the shifted position before the reception of an answerback or service message.

Service signals

It is the practice in types of well known multiplex and simplex telegraph systems to provide an apparatus commonly known as an auto control to transmit service messages which are usually received on a bell at the character receiving apparatus. Such service messages consist of one or more groups of shift, letter J and unshift code combinations. It is contemplated that such service messages may be used in the system herein described for communication between service men in correcting faults. When the auto control apparatus is to be used in this manner, the service men first operate the switch 391 at their respective stations to open the disconnect circuit and disable relays 372 and 375. Letter J code combinations will then be received on the bell at the character receiving apparatus and no impulses will pass to disconnect wire 171.

Control of trunk circuits by answerback signals

The method of checking the reception of a transmitted message over a circuit by stopping transmission from a sending station after a message has been sent, under control of a transmitted message end signal and returning an answerback signal to the sending station from the receiving station to restart transmission, under control of a received message end signal, and further to operate an alarm at the sending station if an answerback signal is not received after the message end signal is transmitted, can be applied to various types of transmission systems to check the correct operation thereof. I have shown and described an application of this method to a system for switching telegraph messages to their points of destination. I will now describe how the above stated method is applied to automatic transmission circuits. The apparatus in Figure 12, Sheet 4, now to be described is shown connected to the apparatus of Figure 10 by dotted lines. When the two are connected plug 3 is not used. Referring to Figure 12, 110 is a type of perforated tape transmitter commonly used in permutation code message transmission of which only the transmitting contacts 111, common contact bar 112 and operating magnet 113 are shown. Common bar 112 is connected to positive battery, contacts 111 are individually connected through relays 115, 116, 117, 118, and 119 to relays 201, 202, 203, 204, and 205, then to a common wire 206 connceted to negative battery. All of the apparatus is shown in the normal unoperated position. Brushes 223, 231, 234, and 242 of distributor 200 are revolving in synchronism with brushes 423, 431, 434, and 442 of distant distributor 400 which is connected to distributor 200 by line circuit 225. As brushes 231 pass over sixth pulse contact 232 an impulse is transmitted from positive battery to relay 114 and transmitter operating magnet 113 and negative battery over contacts 175 of relay 183, wire 141, and contacts and relays in Figure 10 as previously explained. Magnet 113 will step the transmitting tape forward and contacts 111 will be set in accordance with perforations in the tape on each de-energization of magnet 113. When the message end indication comprising a carriage return code combination followed by a blank code combination is reached, the carriage return code combination will set relays 115 to 119 to close the series connected contacts 176 to close a circuit from plus battery contacts 177 of relay 114, series contacts 176, relay 178, to negative battery. Relay 178 is sufficiently slow release to hold its contacts closed over the sixth pulse interval. The following blank code combination will set relays 115 to 119 to close series connected contacts 180 closing a circuit from positive battery, contacts 177, series contacts 180, closed contacts 181 of relay 178, contacts 182 of relay 185, relay 183, relay 178 and negative battery. Relay 183 will open the sixth pulse circuit at contacts 175. Contacts 111 remain set in accordance with the blank code combination in the transmitting tape and relays 115 to 119 maintain series contacts 180 closed. Further transmission from tape transmitter 110 is now stopped.

The message end code combinations are transmitted to the distant station where they are interpreted, and operate apparatus to start an answerback message in the same manner as previously described. The answerback message when received sends an impulse on wire 171 from positive battery to relay 185 and negative battery. Relay 185 thereupon opens contacts 182 releasing relays 183 and 178. Contacts 175 are now closed so that the next sixth pulse can operate transmitter operating magnet 113 and transmission of messages resumes in the normal manner until another message end code combination reaches relays 115 to 119. Relay 114 opens the battery circuit to series contacts 176 and 180 so that during the changing of contact positions of contacts 111 any false closing of series circuits 176 and 180 will have no effect.

Under normal conditions, when a message end signal is transmitted and message transmission stopped, an answerback signal is received at the sending station within one second of time. An alarm is operated, if, due to the non-reception of a message, or some other fault, the answerback message is not received. For this purpose I have provided an interpreting device consisting of normally energized slow release relay 187 connected with relay 183 at contacts 175', and an alarm circuit 188 including alarm apparatus 189. During the interval between the transmission of a message end signal and the returning of an answerback signal, relay contacts 175' are open and no current passes to slow release relay 187. If an answerback signal is received, the circuit to relay 187 is again closed before its armature is released. If, however, no answerback signal is received, relay 187 releases its armature closing contacts 190 operating the alarm 189 to call service attendants who will correct whatever fault existed and retransmit any messages not received at the receiving station.

The carriage return and blank message end signal combinations as well as the shift, J, and

unshift code combinations which as shown in Figures 10 and 11 are received by selecting relays, can of course be received through contacts applied to and operated by the selections of the receiving printer or perforator. If this is done, the message end and answerback code combinations will serve to test the correct operation of the receiving apparatus.

An important feature of this invention is that all of the signal combinations used to perform service functions are also used in normal message transmission and no additional service function code combinations need be provided for this purpose.

Answerback control of simplex circuits

A further adaptation of the method of controlling the transmission of messages by an answerback signal from the distant receiving apparatus as applied to a simple transmitting circuit is shown in Figure 13, Sheet 3, in which a standard permutation code printer is represented by its operating magnet 600. A standard tape transmitter 601 provided with transmitting contacts 602 and an operating magnet 603 is controlled by contacts 604 in a manner well known in the art. The transmitter contacts connect selectively under control of a perforated tape to a common bar 605 connected to battery 606 and ground 607. A line 610 connects the transmitting apparatus and printer magnet 600 to a receiving printer or perforator operating magnet 612 and to ground 613 through contacts 614 by wire 615 forming a normally closed circuit in accordance with the normal practice of setting up a standard simplex transmitting circuit for permutation code start-stop printers except that the contacts 614 are included in the circuit. Code combinations of signals from transmitter 601 operate magnets 600 and 612 to control the starting and stopping as well as the selecting operations of either printer or perforator, or apparatus to both print and perforate the received message on the tape, in accordance with standard practice and in a manner well known in the art.

To control the operation of the transmitting apparatus from the receiving apparatus I have provided the following circuit arrangements; contacts 620, 621 and 622 are operated by the code selections of a printer which may be performed by the operation of a pull bar or any other operative device that is set in accordance with the received code combinations of signals. Contacts 620 are closed on the reception of a carriage return code combination comprising three spacing, one marking and one spacing signals. Contacts 621 are closed on the reception of blank code combination comprising five spacing signals. Contacts 622 are opened on the reception of a line feed code combination comprising one spacing, one marking and three spacing signals. At the distant receiving apparatus contacts 640 and 641 are likewise operated by the receiving printer or perforator. Contacts 640 close on the reception of a carriage return code combination and contacts 641 close on the reception of a blank code combination.

As in the previously described arrangements, a carriage return code combination followed by one or more blank code combinations are used to indicate the end of a message. When such signals follow a completed message at transmitter 601, the carriage return contacts 620 are closed and immediately thereafter blank contacts 621 are closed. Closing contacts 620 energize slow release relay 625 which closes contacts 626. These are held closed for a short interval after contacts 620 open due to the slow release feature of this relay. When the next following code combination closes contacts 621, relay 630 is energized and locks up over closed contacts 631 and 622. It also opens contacts 632 and 633. Contacts 632 open the circuit to transmitter operating magnet 603 leaving the transmitter in the set position with the five transmitting contacts open, thus stopping transmission.

At the distant station contacts 640 and 641 operate in the same manner as contacts 620 and 621, first energizing relay 645 and then relay 646 through closed contacts 647. Relay 646 when operated closes contacts 648 to energize omnigraph magnet 651 and start the operation of omnigraph transmitter 650 to send over line 610 a line feed code combination comprising one spacing, one marking and three spacing signals. The omnigraph transmitter 650 comprises two cams 652 and 653 which contact with contact levers 654 and 655, respectively. Cams 652 and 653 are connected together mechanically and electrically and are frictionally driven at a speed corresponding to the speed of operation of contacts 602. They are normally held stationary and released for a single revolution when magnet 651 is energized. The construction of such apparatus is well known in the art. When omnigraph transmitter operates on the energization of magnet 651, it transmits the line feed code combination as described from cam 652. Cam 653 contacts with contact lever 655 immediately after it starts rotation. Contact lever 655 is connected to line 610 by wire 615 and contact lever 654 is connected through a resistance 657 to ground 658. When contact lever 655 is operated it closes contacts 660 and opens contacts 614. Opening of contacts 614 disconnects printer or perforator receiving magnet 612 from line 610. Contacts 660 which close before contacts 614 are opened preserve an energizing circuit for the receiving printer or perforator magnet 612 from ground 661 and battery 662, contacts 660, wire 615', magnet 612 and ground 613. Since magnet 612 is cut off from the line during the transmission of the answerback signal from omnigraph 650, the answerback signal will not be recorded on the receiving apparatus at this distant end of the circuit, and since it is not recorded on the record medium used for retransmission of the received message only the carriage return and blank code combinations appearing at the end of the message can be transmitted to further circuits. If the answerback line feed code combination were recorded in the perforated tape record medium at this time it would be added to the carriage return blank code combinations and cause a false start signal to be transmitted when the record medium passes through a retransmitter, as in the previously described applications of the method of controlling transmission from the transmitting station by answerback signals transmitted by the receiving station under control of message end signals. The answerback signals are not recorded at the station from which they are transmitted.

To give an alarm at the transmitting station when, due to incorrect or non-reception of a message at the receiving station, an answerback signal is not received at the transmitting station, I have provided a slow release relay 670 and alarm apparatus 671. Slow release relay 670 is energized over closed normally engaged contacts

633 of relay 630. When relay 630 is operated by the message end signals, it locks up over contacts 631 and 622. If the answerback signal is not received to open contacts 622, contacts 633 remain open and after a time interval relay 670 will release its armature to close alarm contacts 672 and alarm 671 is operated to call an attendant who will repair any existing fault and restart transmission.

High frequency answerback system

A further method of automatically supervising a duplexed transmission system by answerback signals is shown in Figure 14, Sheet 6. In this arrangement answerback signals of relative high frequency, which are separated from message transmission signals by inductive and filter devices, are used. Referring to Figure 14, multiplex distributor 700 is shown equipped with transmitting and receiving connections for one operating channel. Transmitting segments 701 are connected to armature levers 702 of transmitting relays 703. Armature levers 702 connect either positive battery 704 or negative battery 705 to transmitting segments 701 in accordance with the selective setting of relays 703. Brushes 706 connect segments 701 to ring 707 and impulses are transmitted from ground 708 through receiving relay 709 to line 710. Transmitting contacts 715 of a standard tape transmitter 716 are set in accordance with the perforations in a tape, to selectively energize relays 703. Brushes 717 connect segment 718 to ring 720, connected to positive battery, after brushes 706 have passed over segments 701 closing a circuit through perforator operating magnet 721 and relay 722, contacts 723 to negative battery. Receiving segments 730 are connected through selecting magnets 731 to relays 732 which are connected to negative battery. Brushes 733 connect segments 730 to ring 734 which is connected to contact 735 of relay 709. The armature of relay 709 is connected to positive battery. Selecting magnets 731 and relays 732 are set in accordance with impulses received by relay 709 while brushes 733 pass over segments 730. Brushes 740 connect segment 741 to ring 742, connected to positive battery, after brushes 733 have passed over segments 730 to close a circuit through printer or perforator operating magnet 743 and break relay 744 to negative battery. Operating magnet 743 when energized records the selections made by magnets 731 on a printer or in a perforated tape in a manner well known in the art.

At the distant end of line 710 a like distributor 750 is represented by box 751 containing the sending equipment, and is connected to transmitting battery and ground. Box 752 connected to contact 755 of relay 756 and negative battery contains the receiving equipment. All of the sending and receiving equipment is the same as described in connection with distributor 700 with the exception that the answerback sending and receiving devices are shown separately.

During message transmission, signal combinations set by tape transmitter 716 are transmitted to relay 756 and recorded on the receiving apparatus at box 752 and signal combinations from the transmitter at box 751 are received by relay 709 and recorded on receiving apparatus shown at distributor 700, as explained. When the end message combination comprising a carriage return code combination followed by a blank code combination passes through transmitting relays 703, the carriage return row of series contacts 760 will close and slow release relay 761 will be energized. The following blank combination will close series contacts 762 and close a circuit from positive battery through contacts 763, contacts 762, contacts 764 of relay 765, contacts 766 and relay 761 to negative battery. Relay 761 remains operated until contacts 764 are opened by the answerback signal. Contacts 767 close to connect relay 765 to line 710 through circuit 770 which includes condenser 771, filter 772, amplifier 773, and rectifier 774. Contacts 723 open the circuit from negative battery to relay 722 and transmitter operating magnet 721. Magnet 721 and relay 722 now remain unoperated when brushes 717 contact with segment 718 and the blank selection remains set in relays 703. Contacts 776 open the circuit to slow release alarm relay 777.

The circuits are now set to receive the answerback signal which will be transmitted to line 710 through condenser 780, from transformer 781 which produces a relatively high frequency of A value, when contacts 782 are closed. The arrangement for closing contacts 782 at distributor 750 will be understood from the following explanation of the same arrangement used for closing contacts 785 which when closed connect transformer 786 to line 710 at distributor 700.

Message and message end signals are received on relays 732 which lock up when operated through contacts 790 included in a circuit from positive battery contacts 791 of relay 792, contacts 790, relays 732 and negative battery. When brushes 740 connect positive battery to segment 741 magnets 743 and 744 are energized and relay 744 closes contacts 793 to connect battery 794 in series with condenser 795 charging the latter. When brushes 740 leave segment 741, relay 744 is de-energized, contacts 793 are closed and condenser 795 discharges through relay 792 which then opens contacts 791 to release the selecting relays 732. When the message end signal combinations are received on relays 732 the carriage return combination closes series contacts 800 and slow release relay 801 is energized when relay 744 is operated. The following blank combination closes series contacts 802 closing a circuit, when relay 744 is operated, from positive battery contacts 803, contacts 802, relay 804, contacts 805, relay 801 and negative battery. Relay 804 attracts hook lever 806 to release sending cam 807, which is driven at a slow rate of speed by any desirable means, for one revolution during which it depresses contact lever 808 to close contacts 785 which connect transformer 786 from ground to line 710 through condenser 810. Transformer 786 produces a relatively high frequency of B value.

I have left the transmitting apparatus at distributor 700 in stopped condition awaiting an answerback signal from the receiving apparatus at distributor 750. This, when the message end signal is received, will be sent from transformer 781 on the closing of contacts 782 and received through filter 772 which passes the A frequency and rejects the B frequency then through amplifier 773 and rectifier 774 and relay 765 which is operated to open contacts 764 releasing slow release relay 761 which closes the transmitter operating circuit through contacts 723 to restart message transmission. The circuit to slow release alarm relay 777 is again closed and the high frequency receiving apparatus is disconnected from line 710 at contacts 767. If through some fault the message end signals are not received at

distributor 750, contacts 782 will not be closed and no answerback returned to distributor 700. When this occurs slow release relay 777 will after a fixed period release its armature and a circuit will be closed through contacts 814 to operate alarm 815 which will summon an attendant to correct the existing fault.

Distributor 750 is provided with high frequency receiving apparatus consisting of filter 820 which passes a relatively high frequency of B value and rejects a frequency of A value, an amplifier 821, a rectifier 822 and a relay 823 operating contacts 824 which control the restarting of transmitter 751. The high frequency receiving apparatus is connected from ground through contacts 825 and condenser 826 to line 710.

While filters 772 and 820 will effectively differentiate between frequencies in continuous wave form, it is probable that kicks from reversals of message transmission signals will pass through condener 810 to relay 765. Such kicks would act the same as static in radio reception and will cause short opening and closing of contacts 764. The resulting short breaks in the circuit of relay 761 will have no effect due to the slow release nature of this relay. The continuous application of an A value frequency will however open contacts 764 for a sufficiently long period to permit the full de-energization of relay 761 so that its armature will be released.

From the foregoing it will be seen that I provide a system of telegraphic communication primarily controlled from a manually operable switch board, requiring a minimum of manual supervision and having means for indicating the ultimate destination address as well as the character of a particular message being transmitted over a selected trunk line. Also at the switch board means is provided to prevent removal of the trunk line plug from the jack during transmission of a message, with means for automatically disconnecting the plug when the message is correctly transmitted to the receiving station; and means to prevent the connection of the plug to a busy circuit.

My invention further includes the novel feature of transmitting answerback signals from the receiving station to the transmitting apparatus under control of a message end signal after the message is received at the receiving station, together with means for disabling the circuits and operating a trouble alarm in the event that the answerback signals are not correctly received. Also when the message includes figures or punctuations recorded in the shifted position of the message character recorder, means automatically operates to prevent registration of the answerback or service signals and the recording in the message of unshifted signal combinations, which may be included therewith.

Another desirable feature of the invention herein disclosed is that when, owing to some operational fault in the system, the answerback signal arrives at the receiving station in the body of the message, the message transmitting functions of the apparatus are automatically disabled until the fault is corrected.

Other novel features of the invention as heretofore described include the transmitter having means for automatically controlling operating circuits for the switch board indicators which apprise the attendant of the ultimate destination of the message being transmitted, as well as whether the message is one of an ordinary, deferred or urgent character.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a system of telegraphic communication, signal transmitting and receiving apparatus, said transmitting apparatus including means to transmit a variable group of word signals and message end signals; and means responsive to the transmission of a message end signal to automatically disable the transmitting apparatus and prevent the further transmission of messages and means controlled by the receiving apparatus and automatically responsive to the reception of a message end signal to condition the transmitting apparatus for message transmission.

2. In a system of telegraphic communication, signal transmitting and receiving apparatus, said transmitting apparatus including means to transmit a variable group of word signals and message end signals; and means responsive to the transmission of a message end signal to automatically disable the transmitting apparatus and prevent the further transmission of messages and means controlled by the receiving apparatus and automatically responsive only to the correct interpretation and reception of a message end signal to condition the transmitting apparatus for message transmission.

3. In a system of telegraphic communication having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines and switching means for selectively connecting the incoming and outgoing lines; means for transmitting a message which includes an address portion, a message portion and a message end indicating portion from the transmitting apparatus to the receiving apparatus, means responsive to signals indicating the message end to disable the transmitting apparatus, answerback message sending devices at the receiving apparatus, and means also controlled by the message end signals to first operate said devices and to thereafter condition the message transmitting apparatus for message transmission.

4. In a system of telegraphic communication having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines and switching means for selectively connecting the incoming and outgoing lines; means for transmitting a message which includes an address portion, a message portion and a message end indicating portion from the transmitting apparatus to the receiving apparatus, means responsive to signals indicating the message end to disable the transmitting apparatus, answerback message sending devices at the receiving apparatus, and means also controlled by the message end signals to first operate said devices and to thereafter condition the message transmitting apparatus for message transmission, an alarm device at the transmitting apparatus, and means automatically responsive, in the event of non-reception of an answerback message after transmission of the message end indicating signals, to operate said alarm device.

5. In a system of telegraphic communication

having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines, a switchboard, switching means on said board for connecting an incoming to an outgoing line, a key on said board to start transmission over the outgoing line, message destination and classification indicating means on said board, and said transmitting apparatus including means for controlling operation of said message destination and classification indicating means; means for transmitting a message which includes an address portion, a message portion and a message end indicating portion from the transmitting apparatus to the receiving apparatus, means responsive to signals indicating the message end to disable the transmitting apparatus, answerback message sending devices at the receiving apparatus, and means also controlled by the message end signals to first operate said devices and to thereafter condition the transmitting apparatus for message transmission.

6. In a system of telegraphic communication having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines, a switchboard, switching means on said board for connecting an incoming to an outgoing line, a key on said board to start transmission over the outgoing line, message destination and classification indicating means on said board, and said transmitting apparatus including means for controlling operation of said message destination and classification indicating means; means for transmitting a message which includes an address portion, a message portion and a message end indicating portion from the transmitting apparatus to the receiving apparatus, means responsive to signals indicating the message end to disable the transmitting apparatus, answerback message sending devices at the receiving apparatus, and means also controlled by the message end signals to first operate said devices and to thereafter condition the transmitting apparatus for message transmission; and means automatically operative after complete reception of a transmitted message by the receiving apparatus to actuate said switching means and disconnect the outgoing line from the incoming line.

7. In a system of telegraphic communication having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines, a switchboard, switching means on said board for connecting an incoming to an outgoing line, a key on said board to start transmission over the outgoing line, message destination and classification indicating means on said board, and said transmitting apparatus including means for controlling operation of said message destination and classification indicating means; means for transmitting a message which includes an address portion, a message portion and a message end indicating portion from the transmitting apparatus to the receiving apparatus, means responsive to signals indicating the message end to disable the transmitting apparatus, answerback message sending devices at the receiving apparatus, and means also controlled by the message end signals to first operate said devices and to thereafter condition the transmitting apparatus for message transmission; additional indicating devices on said board, respectively operative to indicate transmission and non-reception of a message, also operatively controlled by said transmission apparatus; and means automatically operative after complete reception of a transmitted message by the receiving apparatus to actuate said switching means and disconnect the outgoing line from the incoming line.

8. In a system for transmitting telegraph messages, a plurality of incoming and outgoing circuits, switch means to selectively interconnect individual circuits of said plurality of incoming and outgoing circuits with each other to transmit a message thereover which comprises an address portion, a message portion and a message end indicating portion; means associated with the switch means to control the transmission of signals indicating the address and message end portions of the message, and means controlled by the signal control means for the message end indicating portion to stop further transmission from the incoming circuit while maintaining the interconnection between said incoming and outgoing circuits.

9. In a system for transmitting telegraph messages, a plurality of incoming and outgoing circuits, switch means to selectively interconnect individual circuits of said plurality of incoming and outgoing circuits with each other to transmit a message thereover which comprises an address portion, a message portion and a message end indicating portion; means associated with the switch means to control the transmission of signals indicating the address and message end portions of the message, means controlled by the signal control means for the message end indicating portion to stop further transmission from the incoming circuit while maintaining the interconnection between said incoming and outgoing circuits; and additional signal controlled means responsive only to the prior transmission of a message end signal to automatically disconnect the incoming and outgoing circuits at the switch means.

10. In a system for transmitting telegraph messages having a plurality of incoming and outgoing circuits, transmitting and receiving apparatus and means for selectively inter-connecting individual incoming and outgoing circuits, said transmitting apparatus including means to transmit message end signals; means controlling the transmitting functions of said transmitting apparatus, means operatively responsive to the effective operation of said message end signal transmitting means to stop operation of said control means and render the transmitting apparatus inoperative to transmit further messages; and means automatically responsive to the reception of a message end signal by the receiving apparatus to condition said controlling means and again render said transmitting apparatus operative for the transmission of messages.

11. In a system for transmitting telegraph messages having a plurality of incoming and outgoing circuits, transmitting and receiving apparatus and means for selectively inter-connecting individual incoming and outgoing circuits, said transmitting apparatus including means to transmit message end singals; means controlling the transmitting functions of said transmitting apparatus, operatively responsive to the effective operation of said message end signal transmitting means, to render the transmitting apparatus inoperative to transmit further messages; answerback message sending devices at the receiving apparatus, means controlled by the message end signal transmitting means to operate said devices and to condition said first-named controlling means to again render said transmitting apparatus operative for the transmission of messages,

and means to prevent the recording of answerback signals at the last named receiving apparatus.

12. In a system for transmitting telegraph messages having a plurality of incoming and outgoing circuits, transmitting and receiving apparatus and means for selectively inter-connecting individual incoming and outgoing circuits, said transmitting apparatus including means to transmit message end signals; means controlling the transmitting functions of said transmitting apparatus, operatively responsive to the effective operation of said message end signal transmitting means, to render the transmitting apparatus inoperative to transmit further messages; answerback message sending devices at the receiving apparatus, and means controlled by the message end signal transmitting means to operate said devices and to condition said first-named controlling means to again render said transmitting apparatus operative for the transmission of messages; and additional means automatically controlled by said message end signalling means, after transmission of the message end signal, and cooperating with said interconnecting means to disconnect said incoming and outgoing circuits.

13. In a system for transmitting telegraph messages having a plurality of incoming and outgoing circuits, transmitting and receiving apparatus and means for selectively inter-connecting individual incoming and outgoing circuits, said transmitting apparatus including means to transmit message end signals; means controlling the transmitting functions of said transmitting apparatus, operatively responsive to the effective operation of said message end signal transmitting means, to render the transmitting apparatus inoperative to transmit further messages; answerback message sending devices at the receiving apparatus, and means controlled by the message end signal transmitting means to operate said devices and to condition said first-named controlling means to again render said transmitting apparatus operative for the transmission of messages; additional means automatically controlled by said message end signalling means, after transmission of the message end signal, and cooperating with said interconnecting means to disconnect said incoming and outgoing circuits; and means to prevent effective operation of said last-named means by an answerback signal at any other time than after the complete transmission of a message.

14. In a system of telegraphic communication having transmitting apparatus connected to an incoming line and receiving apparatus connected to outgoing lines; a switchboard, jacks on said board connected with the transmitting apparatus, trunk line plugs for selective connection with said jacks in accordance with message addresses, locking means to retain the plugs in connected relation with the jacks and means effective to render the locking means inoperative when more than one trunk line plug is connected with said jacks at the same time.

15. In a system of telegraphic communication having transmitting apparatus including a permutation code transmitter connected to incoming lines and printing telegraph receiving apparatus connected to outgoing lines; a switchboard, jacks on said board connected with the transmitting apparatus, trunk line plugs for selective connection with said jacks in accordance with message addresses, means operatively controlled by a start key for retaining said plugs in locked connection with the jacks during message transmission, and means automatically controlled by the permutation code transmission apparatus to actuate said locking means upon completion of message transmission and release the plug for disconnection from the jack.

16. In a system of telegraphic communication having transmitting apparatus connected to an incoming line and receiving apparatus connected to outgoing lines; a switchboard, jacks on said board connected with the transmitting apparatus, trunk line plugs for selective connection with said jacks in accordance with message addresses, means for locking the plugs in connected relation with the jacks and means operatively controlled by the individual plugs to prevent the effective operation of said locking means when more than one plug is connected to the same circuit.

17. In a system of telegraphic communication having transmitting apparatus connected to an incoming line and receiving apparatus connected to outgoing lines; a switchboard, jacks on said board connected with the transmitting apparatus, trunk line plugs for selective connection with said jacks in accordance with message addresses, means operatively controlled by the individual plugs to prevent the effective connection of more than one trunk line plug with said jacks at the same time, said last-named means including locking devices for the individual plugs associated with the respective jacks, means automatically operative when more than one plug is inserted in the jacks at the same time to prevent effective operation of said locking devices, and means for ejecting the inserted plugs from the jacks.

18. In a system of telegraphic communication having transmitting apparatus connected to an incoming line and receiving apparatus connected to outgoing lines; a switchboard, jacks on said board connected with the transmitting apparatus, trunk line plugs for selective connection with said jacks in accordance with message addresses, means operatively controlled by the individual plugs to prevent the effective connection of more than one trunk line plug with said jacks at the same time, said last-named means including locking devices for the individual plugs associated with the respective jacks, means automatically operative when more than one plug is inserted in the jacks at the same time to prevent effective operation of said locking devices, means for ejecting the inserted plugs from the jacks, and means automatically controlled by the transmission apparatus to cause actuation of an individual locking device upon completion of message transmission and the disconnection of the trunk line plug from the associated jack by said ejecting means.

19. In a system of telegraphic communication having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines and switching means for selectively connecting the incoming and outgoing lines; means controlling transmission of message signals over a transmission channel from the transmitting to the receiving apparatus, means at the receiving apparatus for transmitting an answerback signal over a channel carrying message signals differing in character from those carried by said transmitting channel and means operatively dependent upon operation of said last-named means to discontinue transmission of message signals over said last named channel during transmission of the answerback signal.

20. In a system of telegraphic communication

having transmitting apparatus connected to incoming lines, receiving apparatus connected to outgoing lines and switching means for selectively connecting the incoming and outgoing lines; means controlling transmission of message signals over a transmission channel from the transmitting to the receiving apparatus, means at the receiving apparatus for transmitting an answerback signal over a sending channel, means operatively dependent upon operation of said last-named means to discontinue transmission of message signals over said transmission channel during transmission of the answerback signal; means at the transmitting apparatus for recording answerback code signal combinations, and means for selectively differentiating between different code combinations, operative to prevent recording of the selected combination without affecting transmission thereof over the associated sending channel.

21. In a system of telegraphic communication, signal conducting means, sending and receiving apparatus at each of two stations, means to transmit messages in two directions simultaneously and means associated with the receiving apparatus at each station to automatically transmit signals to control the transmission of message signals in one direction by the sending apparatus at a station to said receiving apparatus at the other station over said signal conducting means including means to interpose such controlling signals with message signals transmitted in the opposite direction.

22. In a system of telegraphic communication, message transmitting apparatus and message receiving apparatus, said transmitting apparatus adapted to transmit messages to the receiving apparatus in permutation code including a message end portion comprising a plurality of permutation code combinations, means responsively controlled by transmission of said message end indicating portion of the message to stop message transmission, and means to restart message transmission, including means associated with the receiving apparatus and responsive to the reception thereby of said message end indicating portion to transmit a single one of said message end permutation code combinations to the transmitting station to condition said transmitting apparatus to restart message transmission.

23. In a method of telegraphic communication between sending and receiving stations, establishing a message transmission connection between said stations, transmitting an end of message indicating signal after transmission of a message and then stopping further transmission while maintaining said established connection; interpreting the transmitted message at the receiving station and, in response to correct reception of said message end indicating signal, disestablishing the message transmission connection between said stations.

24. In a system of telegraphic communication in which message characters are transmitted and received in permutation code combinations and in which characters are recorded in the shifted and unshifted positions of character receiving apparatus under control of transmitted shift and unshift code combinations, said system including means to transmit and receive answerback or service signals comprising shift, service and unshift code combinations; means automatically operative during message transmission to interpose such answerback or service signals, and means associated with the character receiving apparatus to selectively discard such service or answerback code combinations as would alter the construction of a transmitted message.

25. In a system of telegraphic communication in which message characters are transmitted and received in permutation code signal combinations and in which characters are recorded in the shifted and unshifted positions of character receiving apparatus under control of shift and unshift code combinations; service and answerback devices at a transmitting station, means to transmit to said devices at all times, service and answerback signals from a receiving to a transmitting station, said signals including shift, service and unshift code combinations, and means associated with said receiving apparatus to prevent the recording of the unshift portion of such service or answerback signal combinations in the character receiving apparatus when the receiving apparatus is positioned to print characters in the shifted position.

26. In a system of telegraphic communication in which messages are transmitted in permutation code combinations to message character receiving apparatus, answerback and service indicating devices at a sending station, means to transmit service or answerback signals from a receiving to a sending station to operate said devices at all times, said signals comprising shift, service and unshift code combinations, and means associated with the receiving apparatus at said receiving station to cancel the recording of such service or answerback signal combinations in the said message character receiving apparatus.

27. A system of telegraphic communication including means by which message characters are transmitted and received in permutation signal code combinations and in which two of such signal combinations are used to indicate the end of a message, and means for differentially distinguishing the effective operation of such two code signal combinations when used in the body of a message from their effective operation when used to indicate the end of a message.

28. In a communication system, means for transmitting message signals from a sending station to be recorded at a receiving station at permutation code frequency, means for transmitting and receiving service signals at service impulse frequency, and means at said sending and receiving stations to automatically differentiate between said message and service impulse frequencies and prevent recording of service signal impulses with the permutation code message signals.

29. In a communication system for transmitting messages from a sending to a receiving station, means for transmitting an end-of-message signal to the receiving station at permutation code frequency, means at the sending station for restarting transmission of messages, high frequency signal transmission means at the receiving station controlling said restarting means, said high frequency transmitting means being normally disconnected from the transmission means at both the transmitting and receiving stations and means operatively controlled by said end-of-message signal to connect the high frequency transmitting and receiving means to the transmission means at both stations, and means to stop further transmission of messages from the sending station and energize said high frequency signal transmission means to operate said restarting means and restart the transmission of messages.

30. In a system of telegraphic communication, signal conducting means, sending and receiving apparatus at each of two stations, means to transmit messages in two directions simultaneously, means associated with the receiving apparatus at each station to transmit signals to control the transmission of message signals in one direction by the sending apparatus at a station to said receiving apparatus at the other station over said signal conducting means, including means to interpose such controlling signals with message signals transmitted in the opposite direction, and means responsive only to such control signals operative to prevent recording thereof with the recorded message signals.

31. In a system of telegraphic communication, sending and receiving apparatus at each of two stations, means at each station for transmitting and recording message signals at Baudot permutation code frequency and for transmitting and recording answerback or checking messages at high frequencies of different values for each station, and means at each station for differentiating the aforesaid frequencies.

32. In a switching system for interconnecting circuits carrying telegraph message signals in permuation code, a switch-board comprising visual message address indicating means in permutation code, jacks provided with locking-in means, plugs provided with locking-down means, circuits and relay means to prevent the effective use of a jack connected to a busy line or a plug connected to a busy line, a start key to automatically start message transmission after a plug and jack connection is made, means to lock the plug and jack connection during message transmission, and means to automatically disconnect said plug from said jack when a message has been transmitted.

33. In a communication system, signal conducting means, permutation code transmitting and receiving apparatus at terminal stations and means to control the continued transmission from one station by the receiving apparatus at the other station, comprising high frequency transmitting and receiving apparatus at each station operatively disconnected from said signal conducting means during permutation code message transmission, and means operatively responsive to the transmission and reception of selected code combinations to connect the high frequency transmitting and receiving apparatus to the signal conducting means after a group of word signals comprising a message have been transmitted over said signal conducting means.

34. In a communication system, signal conducting means, permutation code transmitting and receiving apparatus at terminal stations and means to control the continued transmission from one station by the receiving apparatus at the other station, comprising high frequency transmitting and receiving apparatus at each station operatively disconnected from said signal conducting means during permutation code message transmission, and means operatively responsive to the transmission and reception of selected code combinations to connect the high frequency transmitting and receiving apparatus to the signal conducting means after a group of word signals comprising a message have been transmitted over said signal conducting means, and means automatically operative when the signal conducting means includes multiple channels of permutation code message transmission, to prevent interference between permutation code signal impulses

carried by said channels and the high frequency continuous wave impulses on the high frequency receiving apparatus, including a relay associated with the high frequency receiving apparatus and a slow acting relay in a local circuit effectively operative in response to the prolonged operation of the first named relay to control the continued transmission of permutation code messages.

35. In a system of telegraphic communication, a signal channel; automatic signal transmitting apparatus connected to said channel including means to transmit a message end signal after variable groups of word signals; distant receiving apparatus associated with said channel and controlled by said transmitting apparatus; means responsive to transmission of a message and signal to stop said transmitting apparatus and to sever operative association of said receiving apparatus with said channel; and means responsive to reception of said message end signal by said distant receiving apparatus to transmit control signals over said channel, to restore operative association of said receiving apparatus with said channel and to condition said transmitting apparatus for message transmission.

36. In a system of telegraphic communication, a pair of signal channels; automatic signal transmitting apparatus connected to each of said channels including means to transmit message end signals after variable groups of word signals; distant receiving apparatus associated with each of said channels and controlled by the transmitting apparatus connected to its associated channel; means responsive to transmission of a message end signal on either channel to stop said transmitting apparatus on both channels; and means responsive to reception of said message end signal at the distant receiving apparatus to transmit control signals, to restore operative association of said receiving apparatus with the respective channels, and to condition said transmitting apparatus for message transmission.

EDWARD E. KLEINSCHMIDT.

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