April 18, 1939. E. F. WATSON 2,154,592

TELETYPEWRITER AUTOMATIC SWITCHING SYSTEM

Filed Oct. 5, 1935 3 Sheets-Sheet 1

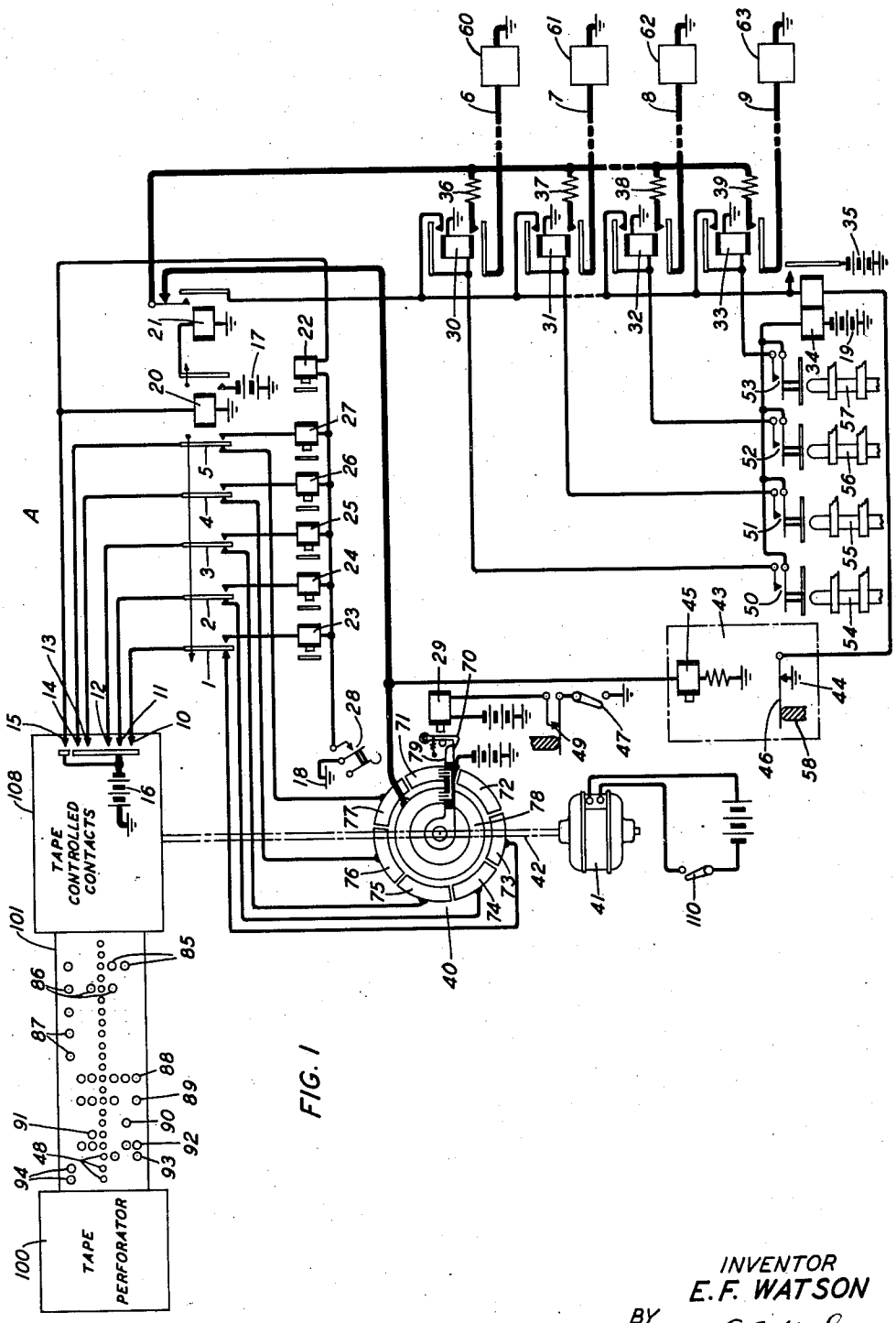

FIG. 1

INVENTOR
E. F. WATSON
BY
ATTORNEY

April 18, 1939. E. F. WATSON 2,154,592

TELETYPEWRITER AUTOMATIC SWITCHING SYSTEM

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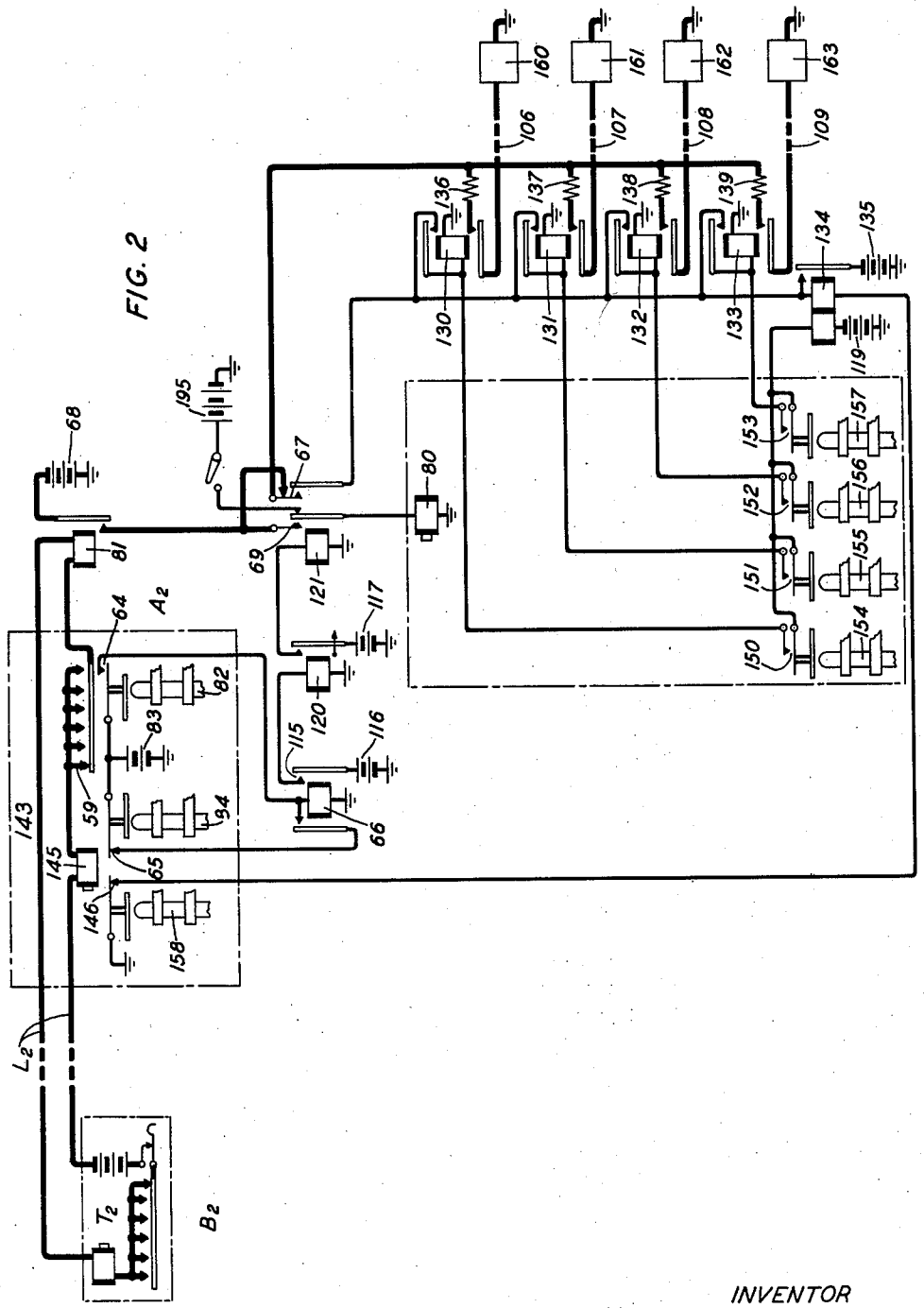
FIG. 2



INVENTOR
E. F. WATSON

BY

ATTORNEY

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TELETYPEWRITER AUTOMATIC SWITCHING SYSTEM

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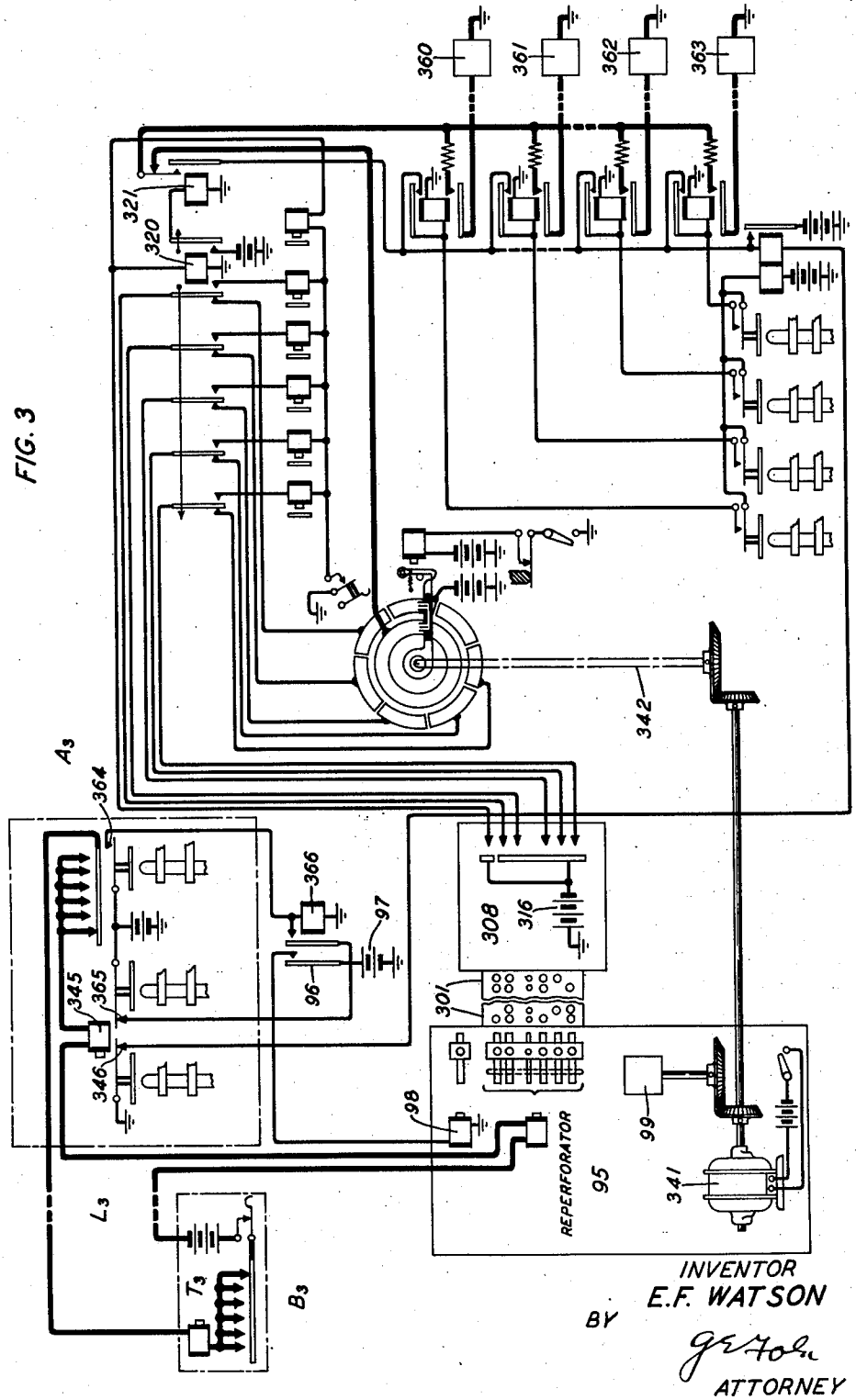
FIG. 3



INVENTOR
E.F. WATSON
BY
ATTORNEY

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UNITED STATES PATENT OFFICE

2,154,592

TELETYPEWRITER AUTOMATIC SWITCHING SYSTEM

Edward Fisk Watson, Larchmont, N. Y., assignor to American Telephone and Telegraph Company, a corporation of New York

Application October 5, 1935, Serial No. 43,790

23 Claims. (Cl. 178—4)

This invention relates to teletypewriter automatic switching systems, and, more particularly, to a communication system in which a transmitting teletypewriter may be automatically connected for signal transmission to a line or group of lines.

In certain types of teletypewriting service, a considerable volume of relatively short messages are transmitted from a central broadcasting teletypewriter station over individual telegraph lines to individual teletypewriter stations or groups of stations. With ordinary systems of operation, it is first necessary for an operator to connect the station or stations intended to receive the first message to her teletypewriter. Then the operator perforates the message on the tape by means of her perforator. As the tape passes through her transmitter-distributor, the operator watches it and, when the transmission of the message has been completed, she throws keys or performs other manual operations to select the next station or stations intended to receive the next message. All this consumes considerable operating time thereby reducing the efficiency of the operator.

Consequently, it is an object of this invention to provide an improved automatic teletypewriter switching system for automatically connecting a sending teletypewriter to a line or group of lines for the transmission of signal impulses.

In accordance with this invention, messages are transmitted by means of perforated tape in which each message is preceded by special signals, perforated in the tape, representing the station or stations to which each particular message is to be sent. When these special signals pass through the transmitter-distributor, they automatically cause the operation of electroresponsive switching instrumentalities for connecting the desired stations to the sending teletypewriter. This closes the telegraph lines leading to those stations and causes their teletypewriter motors to be started.

The message perforated in the tape is then transmitted to these receiving stations. Following each message, a stop signal is perforated in the tape to effect the stopping of the teletypewriter motors at the connected receiving stations and to restore the switching instrumentalities at the sending station to the condition in which no receiving stations are connected to the sending teletypewriter. This procedure is repeated for each message until all the messages have been transmitted.

These and other features of the invention will now be described in detail in connection with the description of the accompanying drawings in which:

Fig. 1 illustrates a teletypewriter switching system adapted to be controlled by perforated tape and having selecting mechanism operated by five magnets;

Fig. 2 illustrates a modification of the invention adapted to be controlled by a remote station and having selecting mechanism operated by a single magnet; and

Fig. 3 illustrates a further modification of the invention adapted to be controlled by a tape reperforator operated by signals sent from another station.

In Fig. 1, the tape perforator 100 at station A is arranged to make significant perforations in a transmitting tape 101 in accordance with a six unit code. The lower five units of the code shown on the tape 101 are used to operate selecting mechanism in teletypewriters at outlying teletypewriter stations, such as 60, 61, 62 and 63. The top, or sixth, unit of the code shown on the tape 101 is employed for controlling the switching of the normally open transmission channels 6, 7, 8 and 9. In the middle of the tape 101 are feed holes 48 for enabling tape 101 to be fed by a sprocket wheel feeding mechanism (not shown).

Station A has a signal sending device, such as a transmitter-distributor, the operation of which is controlled by the perforations in tape 101. This signal sending device is shown to comprise a transmitter 108 having six contacts 10 to 15, inclusive. The contacts 10 to 14 correspond to the five selecting units of the code perforated in tape 101. The contact 15 corresponds to the sixth code perforation in tape 101. Contacts 10 to 14 of transmitter 108 are connected to armatures 1 to 5, respectively, of slow-to-release relay 20. Normally, relay 20 is unoperated and its armatures 1 to 5 connect contacts 10 to 14 to segments 73 to 77 of distributor 40.

When relay 20 is operated, armatures 1 to 5 connect contacts 10 to 14 to selecting magnets 23 to 27 of a printer type of mechanism, such as that described in Patent 1,665,594 granted April 10, 1928, to H. L. Krum, which is hereby incorporated and made a part of this specification. These five magnets operate selecting mechanism (not shown) for selecting any one of up to thirty-one pull bars represented schematically by pull bars 54 to 57 for operation by control magnet 22. As shown in the drawings, transmitter 108 is mechanically connected to distrib-

utor 40 by means of shaft 42 driven by motor 41.

The transmitter-distributor also comprises a distributor 40 with a rotatable brush arm 79 and a face-plate having a common ring 78 and a segmented ring having seven segments 71 to 77, inclusive. Of the seven segments of this segmented ring, segment 71 is the stop segment, 72 is the start segment, and 73 to 77 are selecting segments. The brush arm 79 of distributor 40 is secured to a friction driven shaft (not shown) and is normally engaged by detent 70 on the armature of the start magnet 29.

When start magnet 29 is energized, such as by manually closing switch 47, it operates its armature and causes the detent 70 to release brush arm 79 which rotates until it is stopped by deenergizing magnet 29, either by manually opening switch 47 or by automatic operation of the tape control lever 49 when the tape between perforator 100 and transmitter 108 becomes taut. This method of operation is described in Patent 2,055,567, issued to me on Sept. 29, 1936. Arm 79 rotates in a clockwise direction and connects the segments 71 to 77 seriatim to the common ring 78. During each revolution of the rotatable brush arm 79, a set of contacts 28 is closed at the time when the brush arm 79 is sweeping over segment 77 of the distributor face-plate.

The common ring 78 of distributor 40 is connected to both the receiving magnet 45 of the local teletypewriter 43 and to a contact of relay 21 which is designed to make before breaking to insure that the line will be kept closed when desired. Normally, relay 21 is unenergized and its contact connects ring 78 to resistances 36 to 39, inclusive. When relay 21 is energized, it operates its armature to close its make-before-break contact to prepare resistances 36 to 39 to be connected to battery 35 as soon as relay 34 is energized as will be described subsequently.

Each of relays 30 to 33 has an armature connected to an individual teletypewriter station 60, 61, 62, and 63, respectively, as shown in the drawings. As many as thirty-one of these individual teletypewriter stations may be connected to the control station. However, for purposes of illustration, only four of these stations have been shown and it is to be understood that stations 60 and 61 represent the first and second stations, respectively, and that stations 62 and 63 represent the thirtieth and thirty-first stations, respectively.

In starting the transmission of a message from station A, switch 47 is closed for energizing magnet 29 and the tape 101 is perforated with the call letters of the teletypewriter stations which are to be connected to the sending station A for receiving that particular message. These call letter perforations include the sixth unit of the code and are illustrated by call letter perforations 85 and 86 in tape 101.

When these call letter perforations pass through the transmitter 108, contact 15 closes a path for current from battery 16 to energize slow-to-release relay 20 which operates its armatures. The right armature of relay 20 closes a path for current from battery 17 to energize relay 21. The left armatures 1 to 5 of relay 20 open the circuits from contacts 10 to 14 of transmitter 108 to the segments 73 to 77 of distributor 40 and switch contacts 10 to 14 to selecting magnets 23 to 27 of a printer type of mechanism. As was mentioned above, this printer mechanism is similar to a teletypewriter except that the pull bars 54 to 57, corresponding to each character to be printed, are arranged so that each pull bar 54 to 57 closes one of up to thirty-one electrical contacts represented by contacts 50 to 53, instead of operating a type bar to print a character.

Assume that the station 60 is to be connected for receiving the message. Then a call letter, such as call letter 85, is transmitted. The contact 15 of the transmitter 108 closes and causes relay 20 to become energized. Operation of relay 20 causes the operation of relay 21 and transfers the left armatures of relay 20 from the circuits leading to distributor 40 to the selecting magnets 23 to 27. The call letter 85 also effects the selection of a mechanically operated pull bar 54 in this modified printer mechanism.

By this time, start magnet 29 has been energized by the closure of switch 47 and effects the release of brush arm 79 for rotation. As arm 79 sweeps over segment 77 of distributor 40, the end of arm 79 will strike against the contacts 28 and momentarily close them. This closes a path from ground 18 through contacts 28, magnet 22, contact 15 of transmitter 108, and then to grounded battery 16. Magnet 22 will now be energized and will cause the selected pull bar 54 to momentarily close contact 50. Closure of contact 50 establishes a circuit from grounded battery 19 through the left winding of relay 34, contact 50, winding of relay 30, and then to ground thereby energizing relays 30 and 34. Relay 34 locks-up over a circuit extending from ground 44 at the local teletypewriter set 43, over contact 46, through the right winding of relay 34, over the operated armature of relay 34, and then to grounded battery 35.

Relay 30 locks-up over a circuit extending from ground through the winding of relay 30, the operated top armature of relay 30, the operated armature of relay 34, and then to grounded battery 35. Operation of relay 30 closes a circuit leading from the outlying teletypewriter station 60 over line conductor 6, operated bottom armature of relay 30, resistance 36 which controls the current flow in line 6, operated armature of relay 21, operated armature of relay 34, and then to grounded battery 35. Since the motor of the teletypewriter at station 60 is designed to start when communication path 6 becomes closed, it now starts and conditions station 60 for the reception of messages.

During the rotation of brush arm 79 at this time, the circuits leading from segments 73 to 77 of the distributor face-plate are open at the left contacts of operated armatures 1 to 5 of relay 20 and, under these conditions, the call letter 35 is not transmitted to the local teletypewriter 43. If it is desired to record this call letter 85 on the local teletypewriter 43, this may be accomplished by omitting the left contacts of relay 20 and connecting segments 73 to 77 directly to the armatures 1 to 5 of relay 20.

In accordance with the usual operation of the transmitter-distributor 108 and as is described in my Patent 2,055,567 mentioned above, the tape 101 will be advanced one step as brush arm 79 completes its rotation. Advancement of the tape 101 places the next code signal combination 86 in engagement with the transmitting contacts 10 to 15 of transmitter 108 for operating the mechanically operated instrumentalities (the selected pull bar and its associated contact) for automatically connecting the next station desired. Relay 20 is now energized again and, since its armature did not release immediately after call

letter 85 was sent because it is of the slow-to-release type, is maintained operated thereby maintaining relay 21 energized during this time. Another pull bar 55 is now selected and operated to momentarily close contact 51. This energizes relay 31 in a manner similar to that described for the operation of relay 30. Relay 31, in operating its armatures, locks-up and connects outlying teletypewriter station 61 to the common transmitting point at the armature of relay 21 in a manner similar to that in which station 60 was connected.

In a similar fashion, the control instrumentalities may be operated to connect any desired number, up to the maximum, of outlying teletypewriter stations 60 to 63 in any desired combination to the sending station A for simultaneously receiving a particular message sent by the transmitter-distributor at station A. In the teletypewriter system illustrated, the maximum capacity is limited only by the use of a five unit permutation code selecting mechanism which affords the possible use of thirty-two lines.

In the preferred embodiment of the invention, only thirty-one lines are used as the thirty-second code combination is used for providing a time delay interval for giving the motors of the teletypewriters at stations 60 to 63 sufficient time to start and attain full operating speed before transmission of the message. This thirty-second code combination is preferably that combination shown on tape 101 at point 87 and consists only of the sixth unit of the code. During the passage of these signals 87 through transmitter 108, relay 20 remains operated, but no further action takes place. Thus, selecting magnets 23 to 27, pull bars 54 to 57, contacts 50 to 53, and relays 30 to 33 may be considered as being, in effect, a mechanically operated unattended, or automatic, switchboard.

After a sufficient number of signals 87 have been sent to allow the motors to reach their operating speed, a preparatory signal, or signals is transmitted. One of these preparatory signals is represented at point 88 on tape 101 where it can be seen that it does not contain a sixth unit. Therefore, during the transmission of these preparatory signals 88, contact 15 will remain open thereby causing relay 20 to release. The release of the left armatures 1 to 5 of relay 20 connects segments 73 to 77 of the distributor 40 to the sending contacts 10 to 14 of transmitter 108. Release of the right armature of relay 20 opens the energizing circuit of relay 21 and causes it to release its armature which closes a circuit from the common distributor ring 78 over the selected telegraph lines 6 to 9 to the desired stations 60 to 63.

The message signals, such as that shown at point 89 on tape 101, can now be transmitted to the selected stations 60 to 63 and also to receiving magnet 45 of the local teletypewriter set 43. These message signals include not only the various letter combinations, such as that shown at 89, but also the carriage return combination 90, the line feed combination 91, the shift signal 92, and after the end of a message, the motor stop combination 93.

Following the transmission of the message perforated in tape 101, a motor stop signal, as indicated at 93 on tape 101, is transmitted. This serves to stop the motors of the selected teletypewriters at stations 60 to 63. The motor stop signal 93, by means of the selecting apparatus of the teletypewriter, also effects the momentary opening of contact 46 in the local teletypewriter set 43 by stunt bar 58. The opening of contact 46 opens the locking-up circuit of relay 34 which releases. This, in turn, opens the locking-up circuit of relays 30 to 33 and causes them to release their armatures and thereby open the selected lines 6 to 9. The system is thus restored to its normal condition.

In the preferred embodiment of the invention, it is desirable to follow the motor stop signal 93 with a few signals 94, corresponding to signals 87, to allow sufficient time for relays 30 to 33 to release and to restore the system to normal before beginning the selection of stations for receiving the next message.

The selection of stations for receiving the next message is effected in a manner similar to that just described above. This procedure is repeated for all messages which are to be sent.

In Fig. 2, control station B_2, which may be either a central office or a subscriber's station, is located at a remote point and is connected to station A_2 by line L_2. Station A_2 has a receiving magnet 145, corresponding to the magnet 45 in Fig. 1, for receiving signals sent from the teletypewriter T_2 at the remote station B_2. Station A_2 also has sending contacts 59, instead of the tape controlled contacts in Fig. 1, for transmitting signals to the teletypewriter T_2 at station B_2. The teletypewriter 143 at station A_2 is provided with two contacts 64 and 65, one of which is normally open and the other normally closed, for controlling the operation of an electro-responsive instrumentality, such as relay 66. Relay 66, in turn, controls the operation of a slow-to-release relay 120 corresponding to relay 20 of Fig. 1. As in Fig. 1, relay 120 controls the operation of a relay 121 corresponding to relay 21 of Fig. 1.

Relay 121 is provided with two armatures one of which is designed to operate a make-before-break contact 67 and the other is connected to a selecting relay 80 in a printer type of mechanism similar to that disclosed in Patent 1,745,633, granted February 4, 1930, to S. Morton et al. which is hereby incorporated and made a part of this specification. Relay 80 corresponds to relay 27 shown in Fig. 1 of the Morton et al. patent. This printer type of mechanism has contacts 150 to 153, comparable to contacts 50 to 53 of Fig. 1, which are closed by pull bars 154 to 157, similar to pull bars 54 to 57 of Fig. 1, all of which comprise what may be termed an unattended automatic, or mechanical switchboard.

When an operator at the remote station B_2, desires to operate this unattended switchboard, she transmits a preassigned permutation code combination, such as that for J, from her teletypewriter T_2, over line L_2, through receiving magnet 145, sending contacts 59, relay 81, and then back over line L_2 to station B_2. This code combination operates the teletypewriter 143 at station A_2 which actuates its selecting mechanism to elevate a pull bar 82, such as that for upper case J, which momentarily closes contact 64. By the term "upper case J" is meant the permutation code combination for "J" preceded by the permutation code combination for shifting the platen of the teletypewriter into its upper case position. A path is now closed for current from battery 83 to pass over contact 64, through relay 66, and then to ground. Relay 66 operates its armatures and locks-up over a path through contact 65 to battery 83.

In operating, relay 66 also closes its contact 115 thereby closing a circuit for current from bat-

tery 116 to pass over contact 115, through relay 120, and then to ground. Relay 120 operates to connect battery 117 to relay 121 which becomes energized and operates its armatures. The outer armature of relay 121 prepares a circuit for energizing the selected lines 106 to 109, and the inner armature prepares a circuit for energizing relay 80 from battery 68.

Since relay 81 is in the line circuit, its armature will follow the significant current variations transmitted from station B_2 and will intermittently apply current from battery 68 to the common transmitting point at contact 67 of relay 121. In addition, current from battery 68 will pass over the operated armature of relay 81 and also over the contact 69 and operated inner armature of relay 121 and will energize selecting relay 80 in accordance with the signals transmitted from station B_2. Thus, the signals sent from station B_2 will operate relay 80 and will cause the desired contacts to be closed in the selecting mechanism.

For example, if the operator at station B_2 wishes to be connected to station 160, she transmits the call letter assigned to station 160. This effects the selection of pull bar 154 which, when operated, closes contact 150 thereby closing a path for current from battery 119 to energize relays 134 and 130. Current from battery 135 locks up relays 130 and 134 subject to the opening of key 146 by a pull bar 158 in the local teletypewriter 143. The operation of relay 130 connects line 106 and station 160 to the common transmitting circuit and closes a path for negative current from battery 135 to pass over the operated outer armature of relay 121 and then over line 106 to station 160 thereby starting the motor of the teletypewriter at station 160 in a manner well known in the art. Any of the other stations 161 to 163 may be connected to this common transmitting point in a similar manner for simultaneously receiving a message transmitted from station B_2.

When the desired number of stations have been connected to the common transmitting point, the operator at station B_2 sends a preassigned permutation code combination, such as that for upper case X. The receipt of this signal combination causes a pull bar 84 to momentarily open the normally closed contact 65 which opens the locking-up circuit of relay 66. As a result, relay 66 releases its armatures thereby causing the release of relays 120 and 121. When the inner armature of relay 121 is released, it disconnects battery 68 from relay 80 and substitutes battery 195. The release of the outer armature of relay 121 closes contact 67 and connects the common transmitting circuit over the armature of relay 81 to battery 68.

As was stated above, relay 81 follows the significant current variations transmitted from station B_2 and opens and closes its armature contact in accordance with the signals. This causes battery 68 to be intermittently applied to the common transmitting circuit thereby repeating the signals sent over line L out over the lines 106 to 109, which were selected, to the connected stations 160 to 163.

Following the transmission of the message signals from station B_2, a motor stop signal is sent as was mentioned in the description of the operation of the circuit shown in Fig. 1. The motor stop signal actuates pull bar 158 in the local teletypewriter 143 for opening contact 146 thereby opening the locking-up circuit of relay 134 which, upon releasing, opens the locking-up circuits of the selected relays 130 to 133. This restores the circuit to its normal condition as shown in the drawings.

The above procedure can be repeated for other messages in accordance with the wishes of the operator at station B. Since it is necessary to use three code combinations, upper case J and X and the motor stop signal, for controlling the operation of the mechanical switchboard and since the use of a five-unit selecting mechanism offers 32 permutations, without using upper and lower case discrimination, a maximum of 29 lines 106 to 109 leading to 29 stations 160 to 163 may be used although only four of each have been shown in the drawings for purposes of explanation. If a larger number of lines are desired, a different type of selecting mechanism utilizing upper and lower case discrimination or a code of more than five units may be used.

Fig. 3 illustrates a modification of the invention adapted to be controlled by a tape reperforator operated by signals sent from another station. The transmitter 308 is comparable to the transmitter 108 of Fig. 1 and battery 316 and shaft 342 correspond, respectively, to battery 16 and shaft 42 of Fig. 1. Likewise, relays 320 and 321 and stations 360 to 363 correspond to relays 20 and 21 and stations 60 to 63 of Fig. 1. Transmitter 308 is controlled by tape 301 perforated by a reperforator 95. This reperforater 95 is similar to the reperforator disclosed in Patent 1,884,743 granted October 25, 1932, to E. E. Kleinschmidt which is hereby incorporated and made a part of this specification. Motor 341 corresponds to motor 41 in Fig. 1 but has been provided with a gear arrangement to enable it to drive the punch mechanism 99 as well as distributor shaft 342.

The reperforator 95 operates in response to significant current variations transmitted from the teletypewriter station B_3 over line L_3 to station A_3. Station B_3 has been shown to be a sending and receiving station for purposes of illustration, but it is to be understood that station B_3 may be a central office or any other type of teletypewriter station as desired. In order to provide the sixth, or control pulse, it is necessary to use an arrangement somewhat similar to that shown in a portion of Fig. 2. Therefore, relays 345 and 366 and contacts 346, 364, and 365 correspond to relays 145 and 66 and contacts 146, 64, and 65 shown in Fig. 2. Relay 366 has been provided with an extra armature 96 which controls a circuit from battery 97 through magnet 98.

The operation of this form of the invention is as follows: for ordinary messages significant current variations are transmitted from the teletypewriter station B_3 and travel over the line L_3 to the reperforator 95 at station A_3 where they cause reperforator 95 to perforate tape 301 in accordance with the signals transmitted from station B_3. The perforated tape 301 operates the tape controlled contacts of transmitter 308 in the same manner that the contacts of transmitter 108 in Fig. 1 are operated by the perforated tape 101.

When it is desired to operate the switching mechanism for connecting one of the stations 360 to 363, the operator at station B_3 transmits a preassigned code combination which causes contact 364 to close the energizing circuit for relay 366 in the manner described above for relay 66. Relay 366 locks-up through its inner armature subject to the opening of contact 365. The outer armature of relay 366 closes the energizing circuit for magnet 98 which causes the sixth perforation

to be made in tape **301**. Now, when the operator at station B_3 transmits a five-unit code combination for selecting one of the stations **360** to **363**, the sixth perforation will also be made in the tape **301** at this time because magnet **98** is energized as long as relay **366** remains locked-up. This procedure is repeated for each of the station selecting code combinations, after which the operator transmits the code combination for opening contact **365**. This unlocks relay **366** and deenergizes magnet **98**. Communication can now take place between station B_3 and the selected stations **360** to **363** on a five-unit code basis in the manner described above. Following the transmission of the message signals from station B_3, a motor stop signal is sent as was described in the operation of the circuit shown in Fig. 1. The motor stop signal actuates a pull bar in the teletypewriter at station A_3 for momentarily opening contact **346** thereby opening the locking-up circuit of the relay similar to relay **34** in Fig 1. This opens the locking-up circuits of the relays similar to relays **30** to **33**, shown in Fig. 1, thereby restoring the circuit of Fig. 3 to its normal condition as is shown in the drawings.

It is to be understood that the above apparatus and circuit arrangements have been shown and described in order to illustrate the invention and that various changes and modifications may be made therein without departing from the scope of this invention which is to be limited only by the claims appended hereto.

What is claimed is:

1. A communication system including in combination a first teletypewriter station having a signal sending device, a plurality of other teletypewriter stations each of which has a communication channel leading to the first station, said communication channels being normally disconnected from the signal sending device at the first station, and switching apparatus at the first station including a printer type of mechanism having a plurality of pull bars for automatically effecting the connection of any of the communication channels to the signal sending device in any combination that may be desired for enabling a selective plurality of the stations to simultaneously receive a message sent by the signal sending device.

2. A communication system including in combination a first teletypewriter station having a transmitter-distributor and a mechanically operated switchboard, a plurality of other teletypewriter stations, each of which has a communication channel extending to the switchboard, said communication channels being normally disconnected from the transmitter-distributor at the first station, said mechanically operated switchboard including electro-responsive means and a printer type of mechanism having a plurality of pull bars for operating said electro-responsive means for automatically connecting any of the communication channels to the transmitter-distributor in any combination that may be desired for the transmission by the transmitter-distributor of a message simultaneously to each of the stations intended to receive it.

3. A communication system including in combination a first teletypewriter station having a perforator for perforating permutation code combinations in a transmitting tape, and a transmitter-distributor the operation of which is controlled by the perforations in the tape, a plurality of other teletypewriter stations each of which has a normally open communication channel leading to the first station, and control means controlled by the perforations in the tape for closing the communication channels in any desired combination for enabling a selective plurality of the stations to simultaneously receive a message sent by the transmitter-distributor, said control means including a printer type of mechanism having a plurality of pull bars and selecting mechanism responsive to the permutation code combinations for selectively operating said pull bars.

4. A communication system including in combination a first teletypewriter station having a perforator for making significant perforations in a transmitting tape and a transmitter-distributor the operation of which is controlled by the perforations in the tape, a plurality of other teletypewriter stations each of which has a normally open communication channel leading to the first station, and control means including a printer type of mechanism having a plurality of pull bars for effecting the closing of a plurality of the communication channels in any desired combination for enabling a selective plurality of the stations to simultaneously receive a message sent by the transmitter-distributor, the particular combination of channels closed for the transmission of a message being determined by some of the perforations in the tape.

5. A transmission system comprising a first transmission station having a teletypewriter and a perforator for making code perforations in a transmitting tape, a plurality of other transmission stations each of which has both a teletypewriter and a transmission path leading to the first station, each of said paths being normally open, a transmitter-distributor at the first station for transmitting significant current variations to both the teletypewriter at the first station and to any of the teletypewriters at the other stations, mechanically operated instrumentalities for automatically determining which of said other stations shall receive a particular message, a printer type of mechanism having a plurality of pull bars, and selecting mechanism for selectively operating certain of the pull bars for selectively operating said instrumentalities in accordance with certain code perforations in the tape.

6. A communication system comprising in combination a first teletypewriter station having a perforator for making code perforations in a transmitting tape and a transmitter-distributor the operation of which is controlled by the code perforations in the tape, a plurality of other teletypewriter stations each having a communication path extending to the first teletypewriter station, each of said communication paths being normally disconnected from the transmitter-distributor at the first station by a normally unenergized electro-responsive device individual to each line, each of said electro-responsive devices having an energizing circuit which is normally opened by control contacts, a printer type of mechanism having a plurality of pull bars, a plurality of normally unenergized electric relays for effecting the operation of the pull bars, and control means operable by certain of the code perforations in the tape for selectively energizing said electric relays to selectively operate some of said pull bars to close certain of the control contacts to operate certain of said devices for selectively connecting certain of said communication paths to the transmitter-distributor for communication.

7. A communication system comprising in combination a first teletypewriter station having a perforator for making code perforations in a transmitting tape and a transmitter-distributor the operation of which is controlled by the code perforations in the tape, a plurality of other teletypewriter stations each having a communication path extending to the first teletypewriter station, each of said communication paths being normally disconnected from the transmitter-distributor at the first station by a normally unenergized electro-responsive device individual to each line, each of said electro-responsive devices having an energizing circuit which is normally opened by control contacts, and control means operable by certain of the code perforations in the tape for selectively closing certain of said energizing circuits to operate certain of said devices for selectively connecting certain of said communication paths to the transmitter-distributor for communication, said control means including the pull bars of a printer type of mechanism.

8. A communication system comprising in combination a first teletypewriter station having a perforator for making code perforations in a transmitting tape and a transmitter-distributor the operation of which is controlled by the code perforations in the tape, a plurality of other teletypewriter stations each having a communication path extending to the first teletypewriter station, each of said communication paths being normally disconnected from the transmitter-distributor at the first station by a normally unenergized electro-responsive device individual to each line, a modified printer type of mechanism having pull bars adapted to operate control contacts, each of said electro-responsive devices having an individual energizing circuit, a plurality of normally open control contacts each of which is connected into a different one of said energizing circuits, selecting mechanism responsive to certain of the code perforations in the tape for selectively operating certain of the pull bars to operate their control contacts to close the energizing circuits of the selected electro-responsive devices whereby selected stations are connected to the transmitter-distributor for communication.

9. A communication system including in combination a first teletypewriter station, a second teletypewriter station having a signal sending device, a communication channel connecting the the two stations, a plurality of other teletypewriter stations each having a communication channel leading to the second station, said communication channels being normally disconnected from the signal sending device at the second station, switching apparatus for automatically connecting any of the communication channels to the signal sending device in any combination that may be desired for simultaneously receiving a message, a plurality of control contacts for controlling the operation of said switching apparatus, a printer type of mechanism having a plurality of pull bars for operating said control contacts, and selecting mechanism at the second station responsive to significant current variations transmitted from the first teletypewriter station to the second teletypewriter station for operating said pull bars.

10. A communication system including in combination a first teletypewriter station, a second teletypewriter station having a signal sending device and a reperforator, a communication channel connecting the two stations, a plurality of other teletypewriter stations each having a communication channel leading to the second station, said communication channels being normally disconnected from the signal sending device at the second station, switching apparatus for automatically connecting any of the communication channels to the signal sending device in any combination that may be desired for simultaneously receiving a message, a plurality of control contacts for controlling the operation of said switching apparatus, a printer type of mechanism having a plurality of pull bars for operating said control contacts, and selecting mechanism at the second station responsive to significant current variations transmitted from the first teletypewriter station to the reperforator at the second station for operating said pull bars.

11. A communication system comprising in combination a first teletypewriter station having a transmitter-distributor and a perforator for making six-unit permutation code perforations in a tape, means for operating the transmitter-distributor in accordance with five of the six units of the permutation code perforated in the tape, a plurality of other teletypewriter stations each having a communication path extending to the first teletypewriter station, switching means including a printer type of mechanism having pull bars for selectively connecting said communication paths to the transmitter-distributor for the transmission of five-unit permutation code signal impulses, and an instrumentality at the first station for controlling the operation of the printer type of mechanism in response to the passage through the transmitter-distributor of a sixth unit of the permutation code perforated in the tape.

12. A communication system comprising in combination a first teletypewriter station having a transmitter-distributor and a perforator for making six-unit permutation code perforations in a tape, means for operating the transmitter-distributor in accordance with five of the six units of the permutation code perforated in the tape, a plurality of other teletypewriter stations each having a communication path extending to the first teletypewriter station, switching means including a printer type of mechanism having pull bars for selectively connecting said communication paths to the transmitter-distributor for the transmission of five-unit permutation code signal impulses, control means for preparing a circuit leading from the transmitter-distributor to each of said communication paths in response to the passage through the transmitter-distributor of a sixth unit of the permutation code perforated in the tape, and an instrumentality at the first station for controlling the operation of the printer type of mechanism in response to the passage through the transmitter-distributor of a sixth unit of the permutation code perforated in the tape.

13. A communication system comprising in combination a communication line, a first station having a teletypewriter for transmitting permutation code signals over the communication line, a second station having a receiving device responsive to permutation code signals transmitted over the communication line by the teletypewriter at the first station, repeating means at the second station for transmitting a repetition of the permutation code signals received by the receiving device, a plurality of other teletypewriter stations each having a communication path extending to the second station, switching means at the

second station including a printer type of mechanism having pull bars for selectively connecting said communication paths to the said repeating means, and control means for operating the pull bars in accordance with permutation code signals transmitted by the teletypewriter at the first station and received by the receiving device at the second station.

14. A teletypewriter system having in combination a teletypewriter station provided with a teletypewriter having a plurality of pull bars, a plurality of telegraph lines, a plurality of other teletypewriter stations connectible to the first station by the telegraph lines and normally disconnected from each other, instrumentalities for enabling an operator at one of the teletypewriter stations to connect his teletypewriter through the first station to one of the other teletypewriter stations, said instrumentalities including control means at the first station, and operating means for operating the control means only in response to the reception by the teletypewriter at the first station of a preassigned permutation code signal that has been preceded by a different preassigned code signal, said operating means including certain of the pull bars in the teletypewriter at the first station.

15. A teletypewriter system having in combination a teletypewriter station provided with a teletypewriter having a plurality of pull bars, a plurality of telegraph lines, a plurality of other teletypewriter stations connectible to the first station by the telegraph lines and normally disconnected from each other, instrumentalities for enabling an operator at one of the teletypewriter stations to connect his teletypewriter through the first station to one of the other teletypewriter stations, said instrumentalities including control means at the first station, operating means for operating the control means only in response to the reception by the teletypewriter at the first station of a preassigned permutation code signal that has been preceded by a different preassigned code signal, said operating means including certain of the pull bars in the teletypewriter at the first station, control means for discontinuing the operation of said control means in response to the reception by the teletypewriter at the first station of another preassigned permutation code signal, said control means including one of the pull bars in the teletypewriter at the first station.

16. A teletypewriter system having a teletypewriter station provided with a teletypewriter having a plurality of pull bars, a plurality of other teletypewriter stations connected to the first station by a plurality of telegraph lines, normally unoperated switching apparatus at the first station operable in response to certain preassigned permutation code signals for switching said telegraph lines, control means at the said station for conditioning the switching apparatus for effective operation and operating means for operating the control means in response to the reception by the teletypewriter at the first station of a preassigned permutation code signal, said operating means including one of the pull bars in the teletypewriter at the first station.

17. A teletypewriter system including in combination a first station, a second station, a third station, each station being provided with a teletypewriter having permutation code selector mechanism and also having sending mechanism and receiving mechanism together with recording mechanism, a transmission line connecting the first station and the second station, a transmission line extending between the second station and the third station, contacts at the second station controllable by the permutation code selector mechanism thereat for switching the third station into and out of circuit relation with the first and second stations for intercommunication with any one of said stations to the other when connected into operative circuit relation, means for operating said contacts from either the first or second stations to connect the third station into operative circuit relation, instrumentalities for switching said third station out of operative circuit relation with the other stations, and means for operating said instrumentalities from any of said three stations.

18. A printing telegraph system comprising in combination a first teletypewriter station, a second teletypewriter station, a telegraph line extending between said stations, a second telegraph line extending away from said second station, at least one additional teletypewriter station remotely connected to said second telegraph line, each of said stations being provided with contacts and mechanism for transmitting permutation code signals and having permutation code selector mechanism and recording mechanism, switching contacts in said second station for switching said second telegraph line into and out of circuit relation with said first telegraph line for intercommunication between said lines, means for operating said switching contacts under the control of said permutation code selector mechanism, means for connecting said first and second stations into operative circuit relation independently of said switching contacts, means for operating said switching contacts from either the first or second stations for effecting the switching of said second telegraph line into operative circuit relation with said first telegraph line, means for disconnecting said second telegraph line from operative circuit relation with said first telegraph line, and operating means at said additional station for effecting the operation of said last-mentioned means.

19. A teletypewriter system including in combination a teletypewriter central office having a teletypewriter with a plurality of pull bars, a plurality of telegraph lines, a plurality of teletypewriter stations normally disconnected from each other and connectible to the central office by the telegraph lines for the transmission and reception of permutation code signals, switching apparatus at the central office for enabling an operator at one of the teletypewriter stations to connect his teletypewriter through the central office to a second teletypewriter station, a control relay at the central office for conditioning the switching apparatus for effective operation, and means in the teletypewriter at the central office for enabling the operator at the first teletypewriter station to control the energization of the control relay, said means including one of the pull bars of the teletypewriter at the central office.

20. A communication system including in combination a first teletypewriter station, a second teletypewriter station having a teletypewriter, a communication channel connecting the two stations, a plurality of other teletypewriter stations each having a communication channel leading to the second station, said communication channels being normally disconnected from the teletypewriter at the second station, a plurality of switching relays for automatically connecting a plurality of the communication

channels to the teletypewriter at the second station in any combination that may be desired for simultaneously receiving a message, a control relay at the second station for controlling the operation of said switching relays, a plurality of pull bars in the teletypewriter at the second station for controlling the energization of said control relay, and selecting mechanism in the teletypewriter at the second station responsive to significant current variations transmitted from the first teletypewriter station to the second teletypewriter station for operating said pull bars.

21. A communication system including in combination a first teletypewriter station, an intermediate teletypewriter station provided with a teletypewriter having a plurality of pull bars and also provided with a signal sending device and a reperforator, a main transmission line for connecting the two stations, a plurality of other teletypewriter stations each having a communication channel extending to the intermediate station, said communication channels being normally disconnected from the signal sending device at the intermediate station, switching apparatus for selectively connecting any of the communication channels to the signal sending device for receiving a message transmitted from the signal sending device at the intermediate station in accordance with signals transmitted from the first station and received by the reperforator at the intermediate station, operating means located at the intermediate station for operating the switching apparatus in accordance with signals transmitted from the first station, and control means for controlling the operation of said operating means, said control means including one of the pull bars in the teletypewriter at the intermediate station.

22. A communication system including in combination a first teletypewriter station, an intermediate teletypewriter station provided with a teletypewriter having a plurality of pull bars, said intermediate station also being provided with a signal sending device and a reperforator for perforating five-unit permutation code signals in a transmitting tape, a main transmission line for connecting the two stations, a plurality of other teletypewriter stations each having a communication channel extending to the intermediate station, said communication channels being normally disconnected from the signal sending device at the intermediate station, means for operating said signal sending device in accordance with the five-unit permutation code signals perforated in the tape by the reperforator, operating means for operating the reperforator in accordance with signals transmitted from the first station to the intermediate station, switching apparatus for selectively connecting any of the communication channels to the signal sending device in any combination that may be desired for simultaneously receiving a message, operating means for operating said switching apparatus, control means for controlling the operation of the operating means, said control means including instrumentalities at the intermediate station for perforating a sixth unit in the transmitting tape.

23. A communication system including in combination a first teletypewriter station, an intermediate teletypewriter station provided with a teletypewriter having a plurality of pull bars and also provided with a signal repeating device, a main transmission line for connecting the two stations, a plurality of other teletypewriter stations each having a communication channel extending to the intermediate station, said communication channels being normally disconnected from the signal repeating device at the intermediate station, switching apparatus for selectively connecting any of the communication channels to the signal repeating device in any combination that may be desired for simultaneously receiving a message transmitted from the signal repeating device at the intermediate station in accordance with signals transmitted from the first station and received at the intermediate station, operating means located at the intermediate station for operating the switching apparatus in accordance with signals transmitted from the first station, and control means for controlling the operation of said operating means, said control means including one of the pull bars in the teletypewriter at the intermediate station, and instrumentalities for discontinuing the operation of the switching apparatus, said instrumentalities including another of the pull bars in the teletypewriter at the intermediate station.

EDWARD FISK WATSON.