April 15, 1941. A. WEAVER 2,238,142

TELETYPEWRITER SWITCHING SYSTEM

Filed July 14, 1939 3 Sheets-Sheet 1

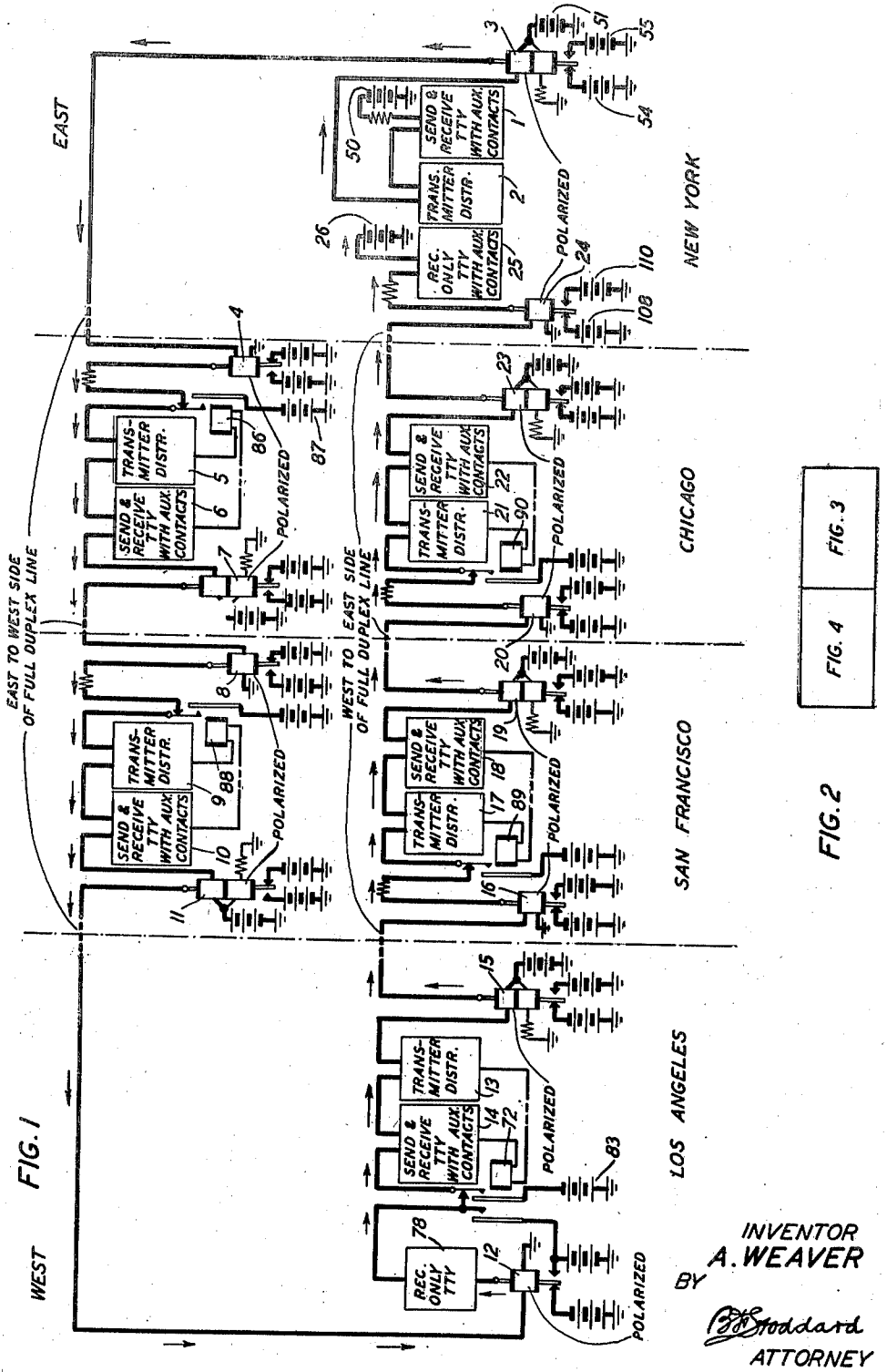

FIG. 1

FIG. 2

FIG. 4	FIG. 3

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TELETYPEWRITER SWITCHING SYSTEM

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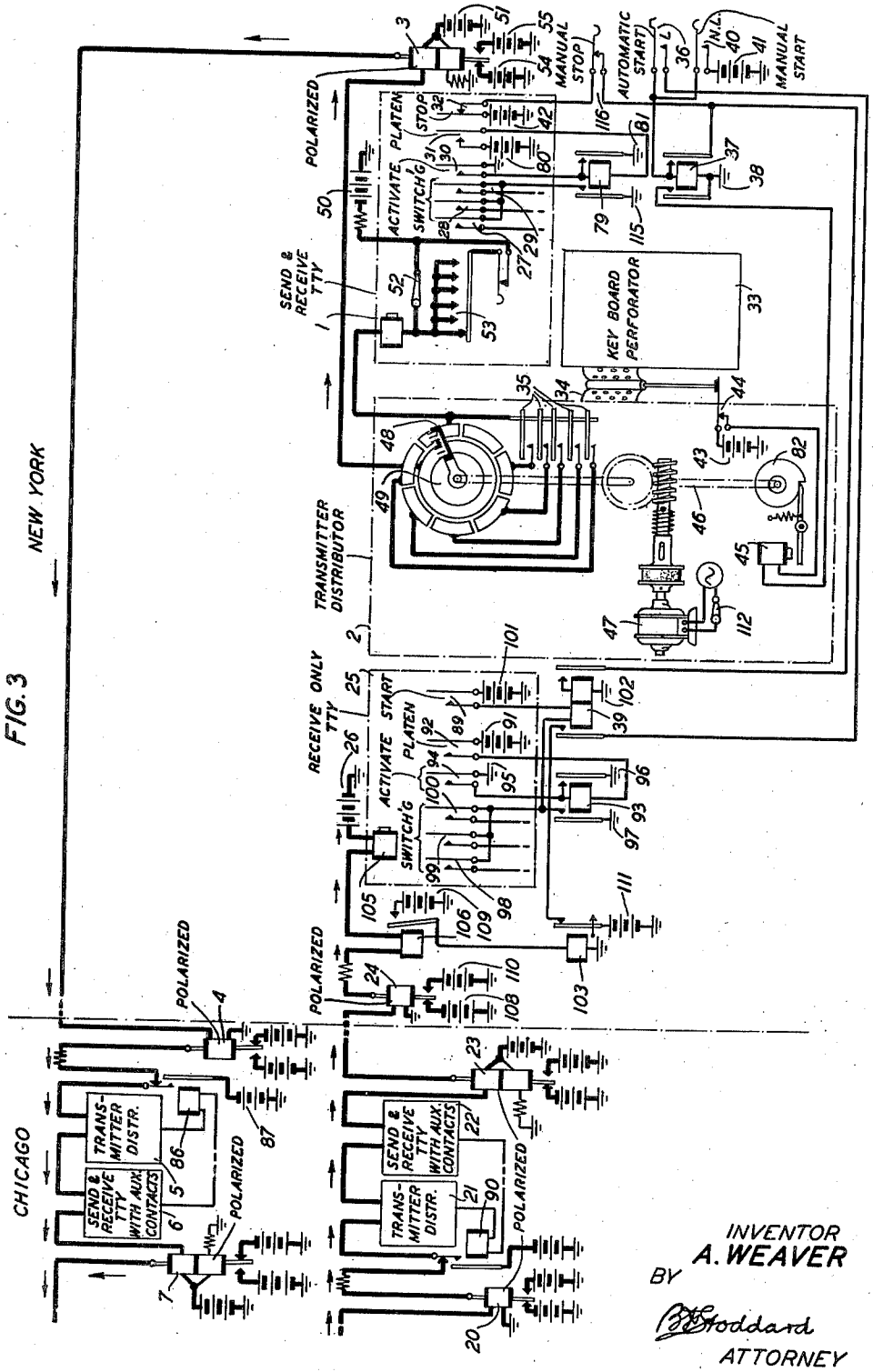

FIG. 3

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TELETYPEWRITER SWITCHING SYSTEM

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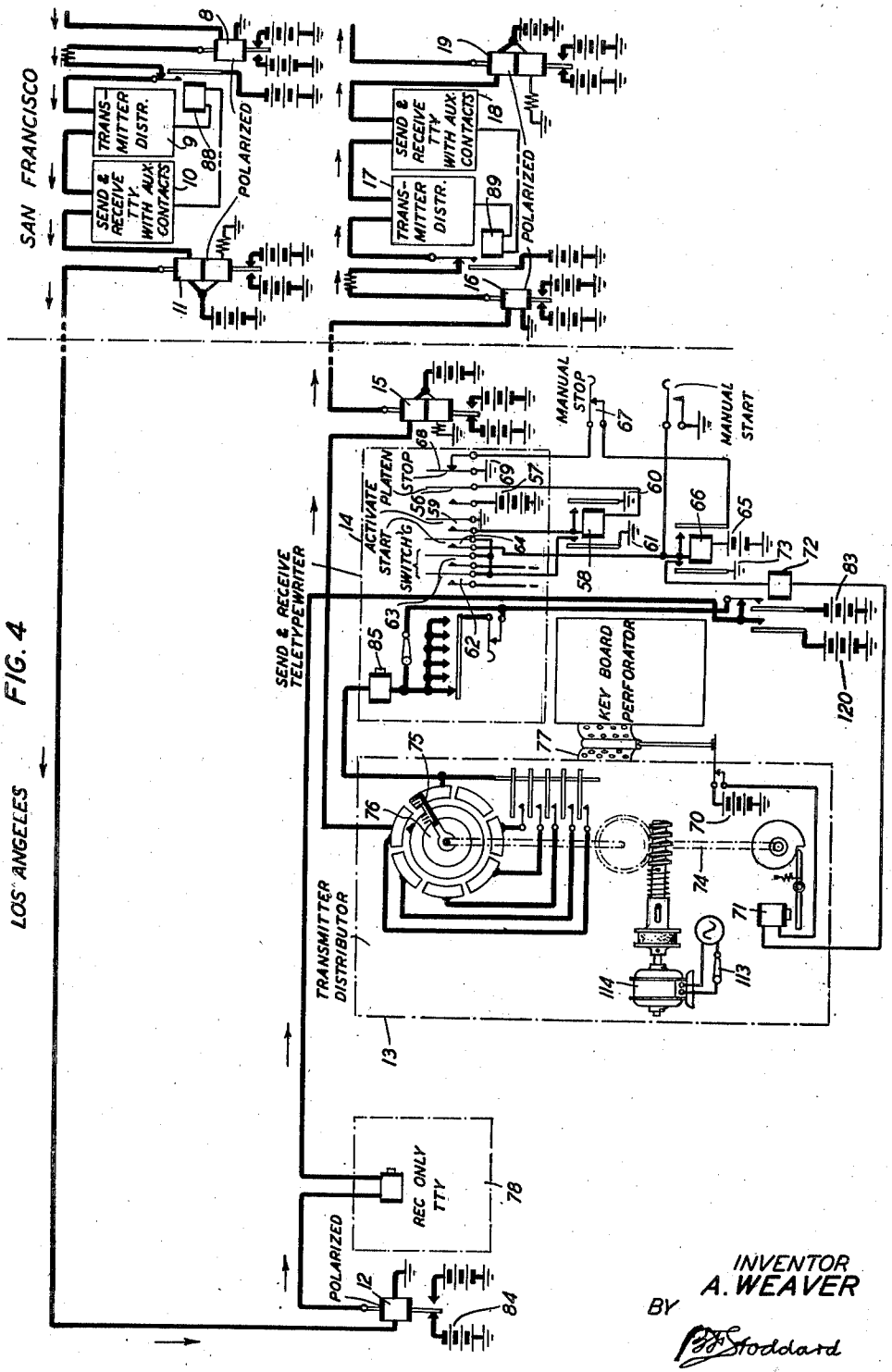

FIG. 4

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Patented Apr. 15, 1941

2,238,142

UNITED STATES PATENT OFFICE

2,238,142

TELETYPEWRITER SWITCHING SYSTEM

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Application July 14, 1939, Serial No. 284,404

13 Claims. (Cl. 178—2)

This invention relates to a teletypewriter switching system and, more particularly, to a full duplex teletypewriter system for providing simultaneous operation of two sequential switching circuits.

Accordingly, it is an object of this invention to automatically start the transmitting mechanism in more than one teletypewriter at a time in a teletypewriter switching system for simultaneous transmission of signals in opposite directions over the system.

It is also an object of this invention to provide a teletypewriter switching system with means for automatically starting the transmitting mechanism of the teletypewriters in any desired sequence through the use of contacts operated in response to the transmission of certain upper case permutation code signals, the effectiveness of the operation of the contacts being controlled by an activating contact to permit the aforementioned upper case signals to perform only their usual non-switching functions when no switching is desired.

These and other objects of the invention are attained by changing an earlier half duplex teletypewriter switching system into a full duplex switching system whereby messages can be simultaneously transmitted over the system in opposite directions.

Consequently, with optimum use of the system, approximately twice as many signals can be transmitted over this full duplex system in a given time as could be sent over the earlier half duplex system. This is a decided advantage to the subscriber who rents the system because the rent for a full duplex system instead of being twice that of a half duplex system is, in many cases, only about one and one quarter as expensive. Consequently, this invention provides a definitely substantial financial saving to the subscriber.

The sequential switching operations are accomplished by means of control contacts mounted in the teletypewriters for operation by the teletypewriter mechanism in response to the transmission of certain preassigned permutation code signals transmitted over the system. The teletypewriters are of the type disclosed in Patent 1,745,633 granted February 4, 1930, to S. Morton et al. and the control contacts are somewhat similar to those disclosed in Patent 2,120,235 granted June 14, 1938, to J. F. Beattie et al. The disclosures of the Morton et al. and the Beattie et al. patents are incorporated herein by reference as a part of this specification. Due to the use of a contact operated by the platen mechanism in each teletypewriter as described in the Beattie et al. patent, the operation of the control contacts will not be effective to perform any switching functions while the platens of the teletypewriters are in their lower case position. Accordingly, switching operations will be performed only in response to certain upper case signals.

In order that these preassigned upper case signals may perform their standard functions, such as typing characters, without performing switching functions after a connection has been established, the invention provides each teletypewriter with an activating contact connected in series with the platen contact and the winding of an activating relay. When the platen contact and the activating contact are both closed, the activating relay will operate its armatures to apply ground to the control contacts to condition them for effective operation as, without this ground, the operation of the control contacts would not accomplish any switching function.

After a communication connection has been established, the activating relay is deenergized to release its armatures to remove ground from the control contacts so that the preassigned signals for operating these contacts may be employed for performing their standard upper case functions. This is of advantage to the subscribers in that it provides them with a greater number of characters that are available for communicative purposes.

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

Fig. 1 is a view of the system as a whole;

Fig. 2 shows the relation of Figs. 3 and 4 and the manner in which they are to be connected;

Fig. 3 represents in detail one terminal station and one intermediate station in the system; and

Fig. 4 illustrates the switching apparatus at another intermediate station and also the equipment at the other terminal of the system.

For the purpose of illustrating the invention, Fig. 1 has been drawn to represent a specific full duplex teletypewriter system having terminal stations at New York and Los Angeles with intermediate stations at Chicago and San Francisco. These stations are connected by a full duplex line circuit which comprises an east-to-west path

and a west-to-east path extending over any suitable circuit, such as a two-wire line or a one-wire line. It is to be understood that the specific number and arrangement of stations shown in the drawings is presented purely for illustrative purposes and that the invention is not limited to the specific number of stations shown nor is it limited to the particular arrangement of the stations shown.

In Fig. 1, the New York terminal station is shown to include a teletypewriter 1 and a transmitter-distributor 2 connected to one winding of a polarized relay 3. The armature of relay 3 is connected to the east-to-west path of the full duplex transmission circuit extending to a polarized relay 4 at the Chicago station. Relay 4 has its armature connected into a circuit leading through a transmitter-distributor 5 and a teletypewriter 6 to a winding of another polarized relay 7. The armature of relay 7 is likewise connected to a winding of a polarized relay 8 at the San Francisco station. This relay 8 has its armature connected to a path traveling through a transmitter-distributor 9 and a teletypewriter 10 to one winding of another polarized relay 11. The armature of relay 11 is connected into a circuit extending through the winding of a polarized relay 12 at the Los Angeles station. This completes the east-to-west path.

The west-to-east path extends from the armature of relay 12 through the teletypewriter 78, transmitter-distributor 13, and teletypewriter 14 to one winding of polarized relay 15. This west-to-east transmission path continues from the armature of relay 15 to the winding of polarized relay 16 at the San Francisco station where it passes from the armature of relay 16 through the transmitter-distributor 17 and teletypewriter 18 to a winding of polarized relay 19. From the armature of relay 19, the circuit travels to the winding of a polarized relay 20 at the Chicago station. Here the circuit passes from the armature of relay 20 through the transmitter-distributor 21 and teletypewriter 22 to one winding of polarized relay 23. Traveling from the armature of relay 23, the circuit returns to the New York station where it passes through the winding of polarized relay 24. The circuit finally passes from the armature of relay 24 through the receiving-only teletypewriter 25 and terminates in grounded battery 26. It is to be noted that the two sides of this full duplex system are connected together at the Los Angeles terminal station but are kept separate at the New York terminal station.

With the system arranged as shown in Fig. 1, the teletypewriter and transmitter-distributor at each station are locally controlled by means of keys, such as keys 112 and 113 shown in Figs. 3 and 4, and have their motors, such as motors 47 and 114, running continuously during business hours. The subscriber at the New York station transmits messages over the east-to-west path and, when this transmission ends, the subscriber at the Chicago station will transmit over the east-to-west path after which the San Francisco subscriber will transmit to the Los Angeles subscriber. When the San Francisco subscriber finishes, the New York subscriber will start transmitting again.

Similarly and simultaneously, the Los Angeles subscriber can transmit messages over the west-to-east path and, at the completion of this transmission, the San Francisco subscriber will transmit signals over part of the same full duplex path. When transmission from the San Francisco station ceases, the Chicago subscriber will transmit messages to the New York station after which the Los Angeles subscriber will again start transmission over the west-to-east path and the same cycle of transmission will be repeated. The transmission from each subscriber's station may be limited to one message or it may be limited to a definite period of time, such as one minute.

When the system is being operated on an automatic basis, the first signal transmitted from the New York station will serve to start the transmitter-distributor 13 at the Los Angeles station. The transmitter-distributors 2 and 13 at the New York and Los Angeles stations, respectively, will be provided with a supply of signals perforated in their transmitting tape for transmission over the system. After a predetermined number of these signals have been transmitted, certain preassigned signals will be transmitted to cause the transmitter-distributors 2 and 13 to stop while effecting the starting of the transmitter-distributors 5 and 17 at the Chicago and San Francisco stations, respectively. This procedure is then repeated until all stations have had their turn at transmitting messages after which the first two stations will again be started.

During the transmission of signals, the line circuit at each station where a transmitter-distributor is being operated is cut in two by a circuit arrangement provided at each station for that purpose. This cutting of the line is necessary on the west-to-east circuit to prevent interference that would otherwise be caused by signals originating in the east-to-west path. Although this trouble would not occur on the east-to-west path, cutting of the line will avoid trouble that might be caused by various causes, such as line hits and swings, originating in the inactive portion of the path. This trouble will also be minimized by cutting the west-to-east path. Furthermore, due to the length of the circuit (from New York to California), in a system with a large number of stations, it would be possible to transmit messages from more than one station in the same direction at the same time on each side of the full duplex circuit. When a particular transmitter-distributor is stopped, the line circuit will always be connected through the station at which this transmitter-distributor is located with the exception of the New York station at which point the circuit is always cut. This arrangement permits two transmitter-distributors to be operated simultaneously over the system in opposite directions.

As was stated above, the circuit arrangement at the New York terminal station differs from that of all the other stations in that at the New York station, the line circuit is always cut; that is, the east-to-west channel is separated from the west-to-east channel and the two halves of the repeater set are used as terminating telegraph sets. This circuit arrangement at the New York station is shown in detail in Fig. 3. The teletypewriter 1 is shown in Fig. 3 to be provided with a plurality of control contacts 27 to 32, inclusive, each of which is operated in response to a preassigned operation of the teletypewriter 1 in the manner described in the Beattie et al. patent mentioned above. Most of the contacts 27 to 32 are operated in response to the operation of a preassigned pull-bar but contact 31 is closed when the teletypewriter 1 is shifted to its "figures" position and is opened when the teletypewriter 1 is shifted to its "letters" position in a

manner similar to the platen contact described in the Beattie et al. patent.

In addition to the equipment mentioned above, the New York station is also provided with a keyboard perforator 33 of any suitable design. Perforator 33 is used for perforating permutation code signals in a transmitting tape 34 which is fed into the transmitter-distributor 2. The transmitter-distributor 2 is somewhat similar to the transmitter-distributor shown in Patent 2,055,567 granted September 29, 1936 to E. F. Watson except that, instead of employing six contact tongues as shown in the Watson patent, transmitter-distributor 2 is equipped with five tongues 35. The disclosure of this Watson patent is incorporated herein by reference as a part of this specification.

To obtain maximum use of the allotted line time, it is desirable that the messages to be transmitted be already perforated in the tape 34 before the station begins to transmit. If this is done, the subscriber would maintain the switch 52 closed in order to shunt out the sending contacts 53 in teletypewriter 1 but, if transmission is to take place from teletypewriter 1, then the subscriber would open switch 52.

To initiate transmission of messages in an automatically rotating sequence, the subscriber at the New York station, which is the control station, manually operates the automatic start control key 36, which is a locking key. This prepares an energizing circuit for relay 37 by closing a path from ground 38 through the winding of relay 37 to the left armature of relay 39 for a purpose to be described hereinafter. The subscriber then manually closes the local start key 40 which is of the non-locking type and is only closed momentarily. This closes a path for current to pass from battery 41 over key 40 and through the winding of relay 37 to ground 38 thereby energizing relay 37.

Relay 37 operates its armatures and locks up over its right armature, over the manual stop key 116, and then over the stop contact 32 to battery 42. The operation of this armature also applies ground 38 to the right armature of relay 39 for a purpose to be described hereinafter. At the same time, the operation of the left armature of relay 37 closes a path for current from battery 43 to pass over the tape control contact 44 and through the winding of the start magnet 45 to ground 38 thereby energizing start magnet 45 which attracts its armature to release the distributor shaft 46 for rotation by motor 47. This causes the brush 48 to travel over the segments of the distributor face-plate 49 for transmitting signals originating in the perforator 33.

The transmission path extends from battery 50 through the teletypewriter 1, transmitter-distributor 2, and then through the upper winding of polarized relay 3 to battery 51. The armature of relay 3 is accordingly operated back and forth between its contacts in accordance with the transmitted signals to apply either negative current from battery 54 or positive current from battery 55 to the east-to-west transmission path extending to the Chicago station thereby transmitting the signals to the Chicago station.

For efficient operation, the transmitter-distributor 13 at the Los Angeles station should be started shortly after the transmitter-distributor 2 at the New York station has been started. This is accomplished by perforating certain preassigned switching signals in the tape 34 for transmission out over the east-to-west channel. The first of these preassigned switching signals is a conditioning, or "prepare," signal which may be the permutation code signal that is known as a "figures" signal and which causes the platens of the connected teletypewriters to be shifted to their upper case positions in a manner described in the Morton et al. patent mentioned above.

Movement of the platens to their upper case positions causes the platen contacts, such as the contact 31 at the New York station and the contact 56 (see Fig. 4) at the Los Angeles station, to be closed in the manner described in the Beattie et al. patent. At the Los Angeles station, closure of contact 56 prepares a path for current from battery 57 to pass through the winding of relay 58 to the activating contact 59. At the New York station, closure of platen contact 31 applies current from battery 80 through the winding of relay 79 to the activating contact 30. A similar function is performed at each of the other stations.

The second of the preassigned switching signals is an activating signal, such as the code combination for "Q." Transmission of this signal effects the momentary closure of the activating contact 59 at the Los Angeles station thereby completing the energizing path from battery 57 through relay 58. Accordingly, relay 58 operates its armatures and locks up over its right armature to ground 60. The operation of the left armature of relay 58 applies ground 61 to the start contact 64 and also to the switching contacts 62 and 63 thereby conditioning them for effective operation. Likewise, closure of the activating contact 30 at the New York station completes the path from battery 80 through relay 79 thereby energizing relay 79 which operates its armatures and locks up over its right armature to ground 81. Operation of the left armature of relay 79 activates the control contacts 27, 28 and 29 by applying to them ground 115. Similar functions are performed at each of the other stations.

The third preassigned signal is a start signal which is individual to only one station, that station being the one that is to be conditioned for transmission. In the case of the Los Angeles station, this start signal may be the code combination for "A" which, after traveling over the east-to-west transmission path and being received at the Los Angeles station, effects the momentary closure of contact 64 thereby completing a path for current from battery 65 to pass through the winding of relay 66, over contact 64, and then over the operated left armature of relay 58 to ground 61. This serves to energize relay 66 which operates its armatures and locks up over its right armature and over the manual stop key 67 and stop contact 68 to ground 69.

At this time, the left armature of relay 66 is operated to close a path for current to pass from battery 70, through the winding of the start magnet 71, winding of relay 72, and then over the left armature of relay 66 to ground 73 thereby energizing relay 72 and the start magnet 71. When relay 72 operates its armatures, the inner armature cuts the circuit from battery 84 through printer magnet 85 and applies battery 83 to the printer magnet 85 to keep teletypewriter 14 running closed while the outer armature applies battery 120 to the teletypewriter 78 to keep it running closed. This serves to separate the east-to-west path of the duplex line from the west-to-east path. At the same time, the start magnet 71 attracts its armature to release the shaft 74

of the transmitter-distributor 13 for rotation. This causes the brush 75 to travel over the faceplate 76 of transmitter-distributor 13 to transmit signals perforated in the tape 77 out over the west-to-east transmission channel.

The subscriber at the New York station having thus conditioned the Los Angeles station for transmission, now transmits his own message signals. The message signals sent out from the transmitter-distributor 2 consist of neutral signals which pass through relay 3 and cause it to transmit signals over the east-to-west path. These messages are recorded by the teletypewriters 6, 10 and 78 at the Chicago, San Francisco and Los Angeles stations, respectively. These message signals cannot travel over the west-to-east path at this time because this path is separated from the east-to-west path at the operated armatures of relay 72. Usually, these messages contain at least one, and generally more than one, "letters" shift code signal for moving the platens of the connected teletypewriters back to their lower case positions. This causes the platen contacts to open thereby opening the locking-up path for relay 79 and also opening the locking-up path of relay 58 and a similar relay at each of the other stations. These relays release their armatures to deactivate their respective associated control contacts so that operation of these contacts at this time will be ineffective to perform any switching function.

At the end of each transmission period, there is perforated in tape 34 a group of preassigned permutation code signals. The first of these preassigned permutation code signals is preferably a "figures" signal the reception of which causes the platens in the connected teletypewriters to move to their upper case positions to close their platen contacts. This is followed by the activating signal for activating the other contacts in the manner described above.

The subscriber at the New York station now transmits a preassigned permutation code signal which will stop his transmitter-distributor 2 while starting the transmitter-distributor 5 at the Chicago station which is equipped with apparatus similar to that at the Los Angeles station. This is accomplished due to the stop-start signal, which may be the code combination for "B," effecting the momentary opening of the stop contact 32 at the New York station and the closure of a start contact at the Chicago station which is similar to the start contact 64 at the Los Angeles station. Opening of stop contact 32 disconnects battery 42 from the locking-up circuit of relay 37 which releases its armatures. Release of the left armature of relay 37 disconnects ground 38 from the energizing circuit of start magnet 45 which, accordingly, releases its armature to engage with cam 82 thereby stopping the distributor shaft 46 and brush 48 from further rotation at this time. Consequently, the transmitter-distributor 2 at the New York station cannot transmit signals until the relay 37 is again energized to effect the energization of start magnet 45.

At this time, the closure of the start contact at the Chicago station effects the energization of a relay, similar to relay 66, which locks up and, in turn, effects the energization of relay 86 which is similar to relay 72 and also effects the energization of a start magnet which is like magnet 71. This start magnet effects the release of the distributor shaft in the transmitter-distributor 5 thereby conditioning it for operation. The operation of relay 86 cuts the east-to-west transmission channel at that point and applies battery 87 to the circuit through the transmitter-distributor 5 and teletypewriter 6 to keep the teletypewriter 6 running closed. Accordingly, the transmitter-distributor 5 now transmits the signals perforated in its tape.

At the end of the transmission period, there will be punched in the tape at the Chicago station a "figures" signal and the activating signal which will perform the functions described above. These will be followed by a preassigned permutation code signal, such as "C," which will effect the opening of the energizing circuit of the start magnet at the Chicago station thereby stopping the transmitter-distributor 5 from further operation at this time. At the same time, the circuit through relay 86 is opened so that relay 86 releases its armature to restore the line circuit.

This start-stop signal will also effect the closure of a start contact at the San Francisco station which is similar to the start contact 64. This station, like the Chicago station, is equipped with apparatus similar to that shown in detail at the Los Angeles station. Closure of this start contact results in the starting of the transmitter-distributor 9 in a manner similar to that described for the Los Angeles station. At the same time, relay 88 is energized and operates its armature to cut the east-to-west channel in a manner similar to that of relay 86. The circuit is thus conditioned for messages to be transmitted from the San Francisco station to the Los Angeles station.

At the conclusion of this transmission period, there is punched in the tape at the San Francisco station a "figures" signal, the activating signal, and another start-stop signal which may be any suitable preassigned permutation code signal, such as "D." This "D" signal causes the transmitter-distributor 9 to stop and deenergizes relay 88 which restores the line circuit, but does not effect the starting of any transmitter-distributor. The transmitter-distributor 2 at the New York station will soon be started in a manner to be described hereinafter and messages will then be sent again over the east-to-west path. In the meantime, the line circuit through the east-to-west path remains in a marking condition.

During this time, the subscriber at the Los Angeles station has been transmitting messages over the west-to-east path for reception by the teletypewriters 18, 22 and 25 at the San Francisco, Chicago, and New York stations, respectively. At the end of this transmission period, there is perforated in the tape 77 a "figures" signal, the activating signal, and a start-stop signal, such as "E." This start-stop signal effects the opening of the stop contacts 68 thereby removing ground 69 from the locking-up circuit of relay 66 which thereupon releases its armatures. Release of the left armature of relay 66 disconnects ground 73 from the energizing circuit of relay 72 and start magnet 71. This restores the line circuit and stops the shaft 74 of transmitter-distributor 13 from further rotation to prevent it from transmitting any more signals at this time. This same start-stop signal effects the energization of a relay at the San Francisco station that is similar to relay 66 thereby resulting in the starting of the transmitter-distributor 17 and the operation of the armature of relay 89 which cuts the line circuit at this point. This shift from the Los Angeles station to the San Francisco station as a point of origin for message transmission is

independent of the shift from New York to Chicago as a similar point of origin; that is, the switch from Los Angeles to San Francisco may be performed before, after, or at the same time as the switch from New York to Chicago.

Messages are now transmitted by the transmitter-distributor 17 and are received by the teletypewriters 22 and 25 at the Chicago and New York stations, respectively. This transmission period terminates with the transmission of a "figures" signal, the activating signal, and another start-stop signal, such as "F." This causes relay 89 to release its armature to restore the line circuit and energizes relay 90 at the Chicago station which operates its armature to cut the line circuit at that point. At the same time, transmitter-distributor 17 is stopped and the transmitter-distributor 21 at the Chicago station is started for transmitting messages to the teletypewriter 25 at the New York station. This switch from the San Francisco station to the Chicago station as a point of origin for message transmission is independent of the shift from the Chicago station to the San Francisco station in the east-to-west path of the full duplex line.

The messages sent from the Chicago station over the west-to-east path end with a "figures" signal, the activating signal, and another start-stop signal, such as "G". At the Chicago station this start-stop signal stops the transmitter-distributor 21 and deenergizes relay 90 to restore the line circuit. The transmission of this start-stop signal "G" is independent of the switching of any of the points of origin in the east-to-west side of the full duplex line.

At the New York station, the "figures" and activate signals close a path for current from battery 91 to pass over the platen contact 92, through the winding of relay 93, and then over the activating contact 94 to ground 95 thereby energizing relay 93 which operates its armatures and locks up over its right armature to ground 96. Closure of the left armature of relay 93 applies ground 97 to contacts 98, 99 and 100 and also to the left winding of relay 39. Reception of the start-stop signal "G" results in the closure of the start contact 89 which closes a path for current from battery 101 to pass over contact 89, through the left winding of relay 39, and then over the left armature of relay 93 to ground 97 thereby energizing relay 39 which operates its armatures.

As was described above, relay 37 is now deenergized due to the stop contact 32 having been opened momentarily. Since stop contact 32 was only opened momentarily, it is now closed. Consequently, operation of the right armature of relay 39 closes a path for current from battery 42 to pass over the stop contact 32 and through the right winding of relay 39 to ground 102 thereby holding relay 39 operated. Also, as was described above, the automatic start key 36 was closed at the beginning of transmission and, as it is of the locking type, it remains closed. Accordingly, operation of the left armature of relay 39 closes a path from ground 38, through the winding of relay 37, over the automatic start key 36, and then over the left armature of relay 39 to the contact of the slow-release relay 103.

Normally, when no signals are being transmitted over the west-to-east channel, positive current from battery 26 flows through the printer magnet 105, through the winding of relay 106 and then over the armature of relay 24 to negative battery 108. Under this condition, relay 106 would be energized and would hold its armature operated to prevent relay 103 from being energized by current from battery 109. However, when signals are being sent over the line, the armature of relay 24 fluctuates between negative battery 108 and positive battery 110. During the intervals that the armature of relay 24 is connected to positive battery 110, no current will pass through the winding of relay 106 with the result that relay 106 would release its armature for the duration of this condition. This would connect battery 109 to relay 103 thereby energizing relay 103 and causing it to operate its armature.

Later, when negative battery 108 is again applied to the armature of relay 24, relay 106 will operate its armature to disconnect battery 109 from the winding of relay 103. However, due to its inherent time delay, relay 103 will release its armature only in accordance with its slow-to-release characteristic. The length of this time delay is such that the armature of relay 103 will not be released during ordinary message transmission over the west-to-east channel because the armature of relay 24 will fluctuate between batteries 108 and 110 at a sufficiently fast rate of speed to insure that each period of deenergization of relay 103 will be shorter than its inherent time delay.

When the transmitter-distributor 21 at the Chicago station is stopped, there will be a cessation in the transmission of signals over the west-to-east channel and relay 90 will restore the line circuit. Now, if and when, the transmitter-distributor 9 in the east-to-west path at the San Francisco station stops, there will be a long marking condition on the line which will cause relay 24 to move its armature to its left contact thereby energizing relay 106 which will operate its armature to disconnect battery 109 from slow-release relay 103 for a period in excess of its inherent time delay. Consequently, relay 103 will now release its armature to apply positive current from battery 111 to the circuit over the left armature of relay 39, over the operated automatic start key 36, and then through the winding of relay 37 to ground 38. This causes relay 37 to operate its armatures and to lock up and energize the start magnet 45 for starting the transmitter-distributor 2 in the manner described above.

The transmitter-distributor 2 at the New York station is thus started again for transmitting messages over the east-to-west transmission channel. As was described above, the first signals transmitted from the New York station should be the signals for starting the Los Angeles transmitter-distributor 13 in the manner described above. Simultaneous transmission of messages can now take place over the system in opposite directions with the initiating points rotating in a predetermined sequence as described above throughout business hours.

At the close of the day, the New York subscriber will operate the automatic start key 36 to open the energizing circuit for relay 37 so that the previously described energization of relay 39 and deenergization of relay 103 will not be able to energize relay 37 for starting the transmitter-distributor 2. The New York subscriber will also open the manual stop key 116. All the subscribers will now shut down their teletypewriters and shut off the motors of their transmitter-distributors by opening keys similar to keys 112 and 113.

If the system were to be used for ordinary message transmission, then the subscriber at the

New York station would not operate the automatic start key 36 but would let it remain open. Under this condition, closure of the manual start key 40, which is only momentary as it is a non-locking key, will start the transmitter-distributor 2 but, as long as key 36 remains open, the transmitter-distributor 2 cannot be started by remote control thereby preventing the initiation of the transmission of messages from rotating sequentially around the system more than once.

Various other switching operations, such as adding or disconnecting intermediate stations, can be performed by effecting the operation of the other control contacts, such as switching contacts 27, 28, 29, 62, 63, 96, 99 and 100, after they have been activated by the application of grounds 61, 97 and 115 in the manner described above. Various suitable preassigned permutation code signals may be assigned for effecting the operation of these contacts.

To prevent any of these other switching operations from being unintentionally performed after these control contacts have been activated and one of the start contacts operated, it is advisable to immediately follow each preassigned start-stop signal with the permutation code combination for "letters." This "letters" signal causes the platens to move to their lower case positions to open the platen contacts thereby effecting the deactivation of the control contacts by causing the deenergization of relays such as 58, 79 and 93. Later, when it is desired to effect one of the special switching functions, the contacts are activated in the manner described above and the proper preassigned signal is sent for effecting the closure of the particular control contact that will effect the desired switching operation.

It is to be understood that this specific embodiment of the invention has been shown and described for purposes of explaining the principles and features of operation of the invention and that various changes may be made in the system without departing from the scope of the invention. Additional switching contacts may be added whenever desired to perform any other functions that may be required. Likewise, the circuit connections of the various subscribers' stations may be varied as desired to meet the requirements of any particular communication system. It is also to be understood that the particular character code combinations assigned for operating the switching contacts need not always be used as other character code combinations may be employed. Also, the order of sequence in which the transmission of messages is rotated from station to station may be readily varied. Consequently, the scope of the invention is to be limited only by the claims appended hereto.

What is claimed is:

1. A permutation code system having a station equipped with a transmitter-distributor for transmitting permutation code signals and a telegraph machine having a plurality of instrumentalities, means for selectively and individually operating said instrumentalities, starting means for starting the transmitter-distributor, a control circuit extending from the telegraph machine and normally open at more than one point, preparatory means for closing at least one of the normally open points of the control circuit, means for operating said preparatory means in response to the operation of a preassigned group of said instrumentalities, and control means for completing the closure of the control circuit for causing the starting means to start the transmitter-distributor after at least one normally open point of the control circuit has been closed by the preparatory means.

2. A permutation code system having a station equipped with a transmitter-distributor for transmitting permutation code signals and a telegraph machine having a plurality of instrumentalities, means for selectively and individually operating said instrumentalities, a normally open control circuit extending from the telegraph machine, preparatory means for preparing the normally open circuit for closure, means for operating said preparatory means in response to the operation of a preassigned group of said instrumentalities, control means for closing the control circuit after it has been prepared by the operation of the preparatory means, means for operating the control means in response to the operation of a preassigned instrumentality other than the instrumentalities in said preassigned group, starting means for starting the transmitter-distributor in response to the closure of said control circuit, means for opening the control circuit in response to the operation of another preassigned instrumentality other than the instrumentalities in said preassigned group, and means for stopping the transmitter-distributor in response to the opening of the control circuit.

3. A permutation code system including in combination a transmitter-distributor for transmitting permutation code signals and a telegraph machine having a plurality of instrumentalities, means for selectively and individually operating said instrumentalities, a start magnet for starting the transmitter-distributor, a normally open energizing circuit for energizing the start magnet, a first relay for closing said energizing circuit, a normally open energizing circuit for energizing said first relay, a second relay for preparing the energizing circuit of the first relay for closure, a normally open energizing circuit for said second relay, means for closing the normally open energizing circuit of the second relay in response to the operation of a preassigned group of said instrumentalities, control means for completing the closure of the energizing circuit for energizing the first relay after this energizing circuit has been prepared by the energization of the second relay whereby the first relay and the start magnet become energized to effect the starting of the transmitter-distributor, and operating means for operating said control means in response to the operation of a preassigned instrumentality other than the instrumentalities in said preassigned group.

4. A teletypewriter station including in combination a transmitter-distributor and a teletypewriter having a plurality of instrumentalities, means for selectively and individually operating said instrumentalities, a start magnet for starting the transmitter-distributor, a normally open energizing circuit for energizing the start magnet, a first relay for closing said energizing circuit, a normally open energizing circuit for energizing said first relay, a locking-up circuit for said first relay, a second relay for preparing the energizing circuit of the first relay for closure, a normally open energizing circuit for said second relay, a locking-up circuit for said second relay, means for closing the normally open energizing circuit of the second relay in response to the operation of a preassigned group of said instrumentalities whereby said second relay becomes energized and locks up over its locking

circuit, control means for completing the closure of the energizing circuit for energizing the first relay after this energizing circuit has been prepared by the energization of the second relay whereby the first relay becomes energized and locks up over its locking circuit and the start magnet becomes energized to effect the starting of the transmitter-distributor, and operating means for operating said control means in response to the operation of a preassigned instrumentality other than the instrumentalities in said preassigned group, means for opening the locking circuit of the second relay in response to the operation of an instrumentality in said preassigned group, and means for opening the locking circuit of the first relay in response to the operation of another preassigned instrumentality other than the instrumentalities in said preassigned group whereby the first relay is deenergized to open the energizing circuit of the start magnet for stopping the transmitter-distributor.

5. A permutation code system including in combination a first station having a telegraph machine with a platen assembly provided with an upper case position and a lower case position, shift mechanism for shifting the platen from one of said positions to the other, a plurality of telegraph lines, a plurality of other stations connectable to the first teletypewriter station by the telegraph lines, switching means for placing the first station in condition for transmitting signals to at least one of the other stations, a normally open circuit at the first station for effecting the conditioning of said switching means for effective operation, a control contact located in the telegraph machine at the first station for preparing said normally open circuit for closure, means for operating said control contact in response to the shifting of the platen assembly to a particular one of its case positions, an activating contact in said telegraph machine at the first station connected in series in said normally open circuit with said control contact, an instrumentality in the telegraph machine at the first station for operating said activating contact for completing the closure of said normally open circuit for effecting the conditioning of the switching means for effective operation, and means for operating said switching means in response to the transmission of a preassigned permutation code signal after said switching means has been conditioned for effective operation.

6. A permutation code switching system including in combination a plurality of subscribers' stations each having a telegraph machine and a transmitter-distributor for transmitting permutation code signals, a full duplex transmission system for connecting the telegraph machine at the subscribers' stations for the transmission of permutation code combinations of signal impulses simultaneously from more than one transmitter-distributor, switching means for providing simultaneous operation of two automatically rotating transmission systems over the two channels of the full duplex system, said switching means including instrumentalities for stopping a transmitter-distributor in each channel while starting another transmitter-distributor in each channel, and operating means for operating said instrumentalities in response to the transmission of preassigned permutation code combinations of signal impulses over the system.

7. A permutation code switching system including in combination a plurality of subscribers' stations each having at least one device for emitting permutation code signal combinations, a full duplex transmission system having a first channel and a second channel for connecting the signal emitting devices at the subscribers' stations for the transmission of permutation code combinations of signal impulses simultaneously from more than one device at a time, and switching means for providing simultaneous operation of two automatically rotating sequential transmission circuits over the two channels of the full duplex system.

8. A permutation code switching system including in combination a plurality of subscribers' stations each having at least one device for emitting permutation code signal combinations, a full duplex transmission system having a first channel and a second channel for connecting the signal emitting devices at the subscribers' stations for the transmission of permutation code combinations of signal impulses simultaneously in different directions over the system, switching means for providing simultaneous operation of two automatically rotating sequential transmission circuits over the two channels of the full duplex system, and means for operating said switching means in response to the transmission of certain preassigned permutation code combinations of signal impulses over the system.

9. A permutation code switching system including in combination a plurality of subscribers' stations each having at least one device for emitting permutation code signal combinations, a full duplex transmission system having a first channel and a second channel for connecting the signal emitting devices at the subscribers' stations for the transmission of permutation code combinations of signal impulses simultaneously from more than one device at a time, switching means for providing simultaneous operation of two automatically rotating sequential transmission circuits over the two channels of the full duplex system, and cutting means at certain of said stations for cutting a channel of the full duplex system under certain conditions.

10. A permutation code switching system including in combination a plurality of subscribers' stations each having at least one device for emitting permutation code signal combinations, a full duplex transmission system having a first channel and a second channel for connecting the signal emitting devices at the subscribers' stations for the transmission of permutation code combinations of signal impulses simultaneously in different directions over the system, switching means for providing simultaneous operation of two automatically rotating sequential transmission circuits over the two channels of the full duplex system, said switching means including a first group of instrumentalities for conditioning a signal emitting device for operation over said first channel while discontinuing the operation of another signal emitting device over this channel, said switching means also including a second group of instrumentalities for conditioning a signal emitting device for operation over said second channel while discontinuing the operation of another signal emitting device over this channel, and operating means for operating said groups of instrumentalities in response to the transmission of certain preassigned permutation code combinations of signal impulses over the system.

11. A permutation code switching system including in combination a plurality of subscribers' stations each having at least one device for emit-

ting permutation code signal combinations, a full duplex transmission system having a first channel and a second channel for connecting the signal emitting devices at the subscribers' stations for the transmission of permutation code combinations of signal impulses simultaneously in different directions over the system, switching means for providing simultaneous operation of two automatically rotating sequential transmission circuits over the two channels of the full duplex system, said switching means including a first group of instrumentalities for conditioning a signal emitting device for operation over said first channel while discontinuing the operation of another signal emitting device over this channel, said switching means also including a second group of instrumentalities for conditioning a signal emitting device for operation over said second channel while discontinuing the operation of another signal emitting device over this channel, operating means for operating said groups of instrumentalities in response to the transmission of certain preassigned permutation code combinations of signal impulses over the system, cutting means at certain of said stations for cutting a channel of the full duplex system, operating means for operating the cutting means at a station in response to the conditioning of the signal emitting device at that station for transmission over that channel, and restoring means for discontinuing the effect of said cutting means after said transmission has terminated.

12. A permutation code system having a full duplex transmission line comprising two one-way channels for the transmission of permutation code signals in opposite directions, a station connected into at least one of said channels and having a device for transmitting permutation code signals, means in said system other than at said station for emitting permutation code combinations, and means at said station selectively effective under the control of said permutation code combinations according to the permutation thereof to effect the initiation of transmission of permutation code signals by said device.

13. A permutation code system having a full duplex transmission line comprising two one-way transmission channels, a station connected into at least one of said channels, said station having a tape controlled transmitter for transmitting permutation code signals over one of said transmission channels according to the storage of its tape, means for transmitting permutation code combinations over the other of said transmission channels from a point remote from said station, and means at said station selectively effective under the control of said permutation code combinations according to the permutation thereof to change said transmitter from a non-transmitting to a transmitting condition.

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