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TELEGRAPH SYSTEM

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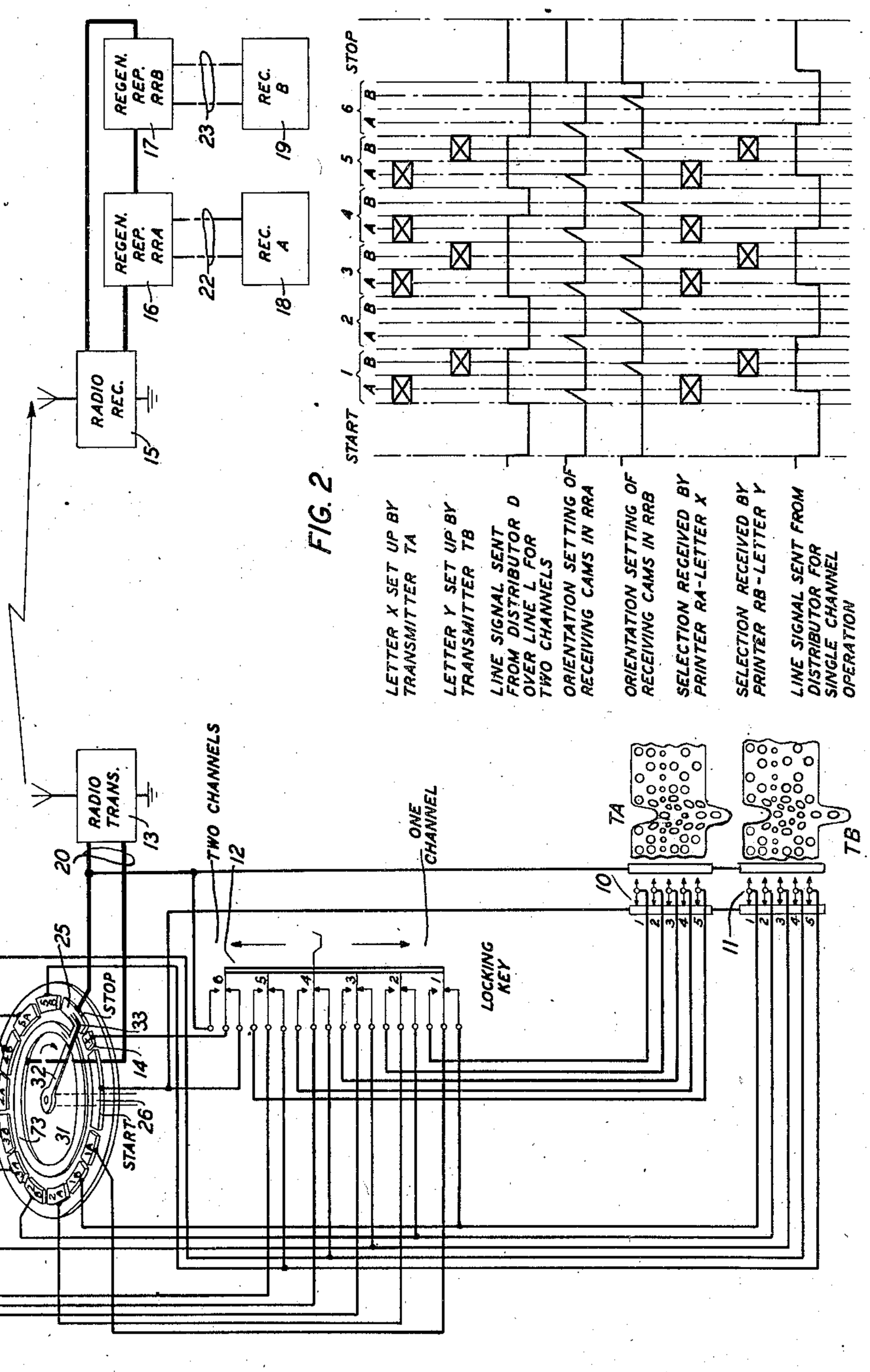

FIG. 1

FIG. 2

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TELEGRAPH SYSTEM

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This invention relates to an improved telegraph transmission system and more particularly to an improved multichannel telegraph transmission system.

An object of the present invention is to provide an improved telegraph system of the type disclosed in my Patent 2,231,375, granted February 11, 1941.

In that patent, a multiplex start-stop system is disclosed in which two telegraph channels are provided in such a way that a single start-stop distributor is employed at the transmitting end and two of the usual start-stop printers are employed at the receiving end. The start-stop distributor transmits a single start-stop pulse for each revolution and transmits the signals for the two channels in such a manner that by properly orienting the receiving cams on the two receiving units the signals will be recorded by the proper and corresponding receiving unit. Consequently, when the transmission channel between the two ends of the system is suitable, considerable saving in equipment and time is realized by employing systems of this type.

However, when systems of this type are employed in cooperation with radio transmission channels betwen the two ends of the system, it is sometimes desirable to operate the system as a single-channel system and at other times as a multichannel system. For example, during periods of light load or during periods when the radio transmission path is subjected to interference, it may be desirable to operate the system as a single-channel system. At these times, it is very desirable to increase the operating margins of the single-channel so that they are substantially the same as the margins of the usual start-stop single-channel systems. Of course, the system disclosed in my above-identified patent can be operated as a single-channel system at any time by merely supplying perforated tape to only one of the transmitters. In this case, however, the operating margins of the channel are considerably less than the usual start-stop channel and no better than when both channels are in operation.

It is accordingly an object of the present invention to provide switching apparatus for changing the multichannel system disclosed in my above-identified patent into a single-channel system in such a way as to increase the operating margin of the single-channel system to substantially the same values as obtained in the usual single-channel start-stop systems.

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It is a further object of the present invention to improve the operating margins of the system without in any way changing or disturbing the orientation adjustments of the two-channel receiving instruments. In other words, it is unnecessary to make any adjustment of the orientation of the receiving instruments when the system is switched from a two-channel system to a single-channel system or vice versa. Consequently, if the orientation of the receiving devices is satisfactorily adjusted for the two-channel system, one of the receiving devices will also be properly adjusted to secure the greatest operating margins for single-channel operation.

A feature of the invention relates to switching apparatus for varying or lengthening the duration of the start pulse simultaneously with switching the system to a single-channel system from a multichannel system.

The foregoing and other objects and features of the present invention, the novel features of which are set forth in the claims appended hereto, may be more readily understood from the following description when read with reference to the attached drawing in which:

Fig. 1 shows an exemplary transmission system incorporating a typical emodiment of the present invention; and

Fig. 2 is a graphic representation of the operation of the system.

Referring now to Fig. 1, 10 represents the transmitter contacts of transmitter TA of the A channel, 11 represents the transmitter contacts of transmitter TB of the B channel of a two-channel start-stop multiplex system, 12 represents a manually operable switch for switching the system from a one-channel to a two-channel system, and 31 represents a start-stop distributor for transmitting the signals over the system.

The distributor arm 32 carrying brush 33 is rotated by means of a motor through the usual friction clutch, as set forth in my above-identified patent which patent is hereby made a part of the present application as if fully included herein. As set forth in greater detail in my above-identified patent, each of the transmitters

TA and TB are controlled mechanically from the shaft driving brush arm 32 and cause the respective transmitters to advance their respective perforated tapes and to sense the code combinations punched in them. Each of these transmitters is supplied with a controlling tape which in the exemplary embodiment of the invention set forth herein is a perforated or punched tape. These controlling tapes may be prepared by well-known keyboard apparatus located at the same station as the transmitters or these tapes may be prepared by a reperforator in response to received signals. Furthermore, in the latter case the signals for the different channels may but need not originate at the same station and need not originate at the station where the transmitters TA and TB are located. When reperforators are employed to prepare the controlling tapes they will usually be located adjacent the transmitters and record signals received over a line from a more remote point in either or both of the controlling tapes. In addition, the supply of perforated tape is employed to control the operation of the respective transmitters in the same manner as set forth in my said patent.

As shown in the drawing, switch 12 is operated to its lower position where the system will operate as a single-channel system as will be described hereinafter. When switch 12 is manually operated to its upper position, the system will operate as a two-channel system in the same manner as described in my said patent. The transmission path 20 leading from the distributor 31 extends to a radio transmitter 13 of any one of the usual well-known types of radio transmitters suitable for the transmission of telegraph signaling impulses. The following United States patents disclose typical telegraph transmitting and receiving arrangements suitable for cooperating in applicant's improved transmission system: 2,012,407 granted to Schmitt on August 27, 1935; Figs. 15 and 16 of 2,046,328 granted to Kleinschmidt et al. on July 7, 1936; Re. 16,485 granted to Brady, November 23, 1926; 1,523,377 granted to Brady January 13, 1925; and 1,582,331 granted to Brady on April 27, 1926.

Each of the above-identified patents is hereby made a part of the present application as if fully included herein. The present invention is not in any way limited to the systems shown in the above-identified patents and may cooperate with many other radio or wire communication transmission systems.

15 represents the radio receiving device which cooperates with the transmitting device 14. Radio receiver 15 may be of any type suitable for receiving radio telegraph signals and may be similar to the radio receiving arrangements set forth in the above-identified patents. The output of the radio receiver 15 extends to two or more receiving devices 16 and 17 connected in series. As set forth in my above-identified patent, these receiving devices comprise two different start-stop printers. The receiving devices 16 and 17 in the present application may also comprise two different telegraph printers, reperforators or they may include regenerative repeaters as well as printers and other suitable equipment. As specifically disclosed in the drawing, the receivers 16 and 17 are represented as regenerative repeaters from which lines 22 and 23, respectively, extend to receiving printers 18 and 19. More specifically for example, distributor 31 may be connected to the radio transmitter shown in Fig. 1 of the Schmitt patent in place of the transmitting distributor 10 shown therein. Also the control magnets of the two receiving devices 16 and 17 may be connected in series with the armature 50 of the relay 39 of Fig. 2 of the Schmitt patent in place of the printer magnet 55 shown therein.

Exemplary regenerative repeaters and other receivers suitable for connection in series with the output of the radio receiver 15 and also at the end of the transmission paths 22 and 23 are described in detail in United States Patents 2,104,251 granted to Zenner on January 4, 1938; 2,104,273 granted to Potts January 4, 1938; 2,105,173 granted to Zenner et al. on January 11, 1938; 1,745,633 granted to Morton et al. on February 4, 1930; 1,904,164 granted to Morton et al. on July 11, 1933; 2,247,408 granted to Reiber on July 1, 1941; 2,296,874 granted to Reiber on September 29, 1942; 2,273,909 granted to Swan on February 24, 1942; and 2,318,026 granted to Swan May 4, 1943.

The foregoing patents are hereby made a part of the present application as if fully included herein.

The transmission channels 22 and 23 have each been represented in the drawing by two conductors. It will be appreciated by persons skilled in the art that any suitable type of transmission channel may extend from the regenerative repeaters 16 and 17 to the respective receiving devices 18 and 19. For example, these transmission channels may be open-wire lines, cable conductors, telegraph channels of composite telephone and telegraph lines, channels of voice frequency or high frequency carrier current systems, radio transmission channels, channels of time division multiplex systems and other well-known types of telegraph transmission channels. In addition, the transmission paths may include any combination of the foregoing types of transmission channels and the associated terminal and repeater equipment for the transmission of signals thereover. In addition any suitable type of transmission may be employed over the respective channel. Inasmuch as the operation of such types of transmission channels and combinations thereof are well understood by persons skilled in the art and since they operate in their usual manner in cooperation with applicant's present invention detailed description thereof need not be repeated herein.

The transmission channels extend from the repeaters 16 and 17 to the reeciving devices 18 and 19 which may be located at the same or different places. It will also be obvious to persons skilled in the art that one of the receiving devices 16 or 17 may be a printer and the other a regenerative repeater. It is also evident that more than two receiving devices may be connected to the output of the radio receiver in which case certain of the receiving devices will respond the signals from one of the channels and other of the receiving devices will respond signals from another channel.

As set forth in my above-identified patent, the orientation of the receiving devices 16 and 17 whether they be printers, regenerative repeaters or other monitoring devices are adjusted as set forth in my above-identified patent.

Fig. 2 has been included in the drawing to show more clearly the manner of operation of the system. The first horizontal line of Fig. 2 shows the contacts 10 of the transmitter TA which are closed for the transmission of the letter X signal by the transmitter TA over the A channel of the system. The second line shows the particular contacts 11 of the transmitter TB which

are closed for transmission of the letter Y signal over the B channel by transmitter TB. The third line shows the signal as actually transmitted by the transmitting distributor 31 during this revolution during which the letter X signal is transmitted over the A channel and the letter Y signal is transmitted over the B channel. The fourth line from the top of Fig. 2 shows the orientation setting of the receiving cams in the receiving devices 16 designated RRA in Fig. 2. The next line shows the orientation setting of the receiving cams of the receiving device 17 designated RRB in Fig. 2. The next two lines show that the selection received by the respective receiving devices corresponds to the characters transmitted by the respective transmitters. For the operation of the system, as described above and as set forth in my above-identified patent, as a two-channel system it has been assumed that the manual key 12 has been operated to the two-channel position. The key 12 is a locking key and will remain either in the two-channel position or the single-channel position. When the key is in the two-channel position the transmitters are connected to the respective segments of the distributor 31 in the same manner as set forth in my above-identified patent.

As will be apparent to those skilled in the art, the possible variation of the orientation setting of the receiving cams of the receiving devices during operation in the two-channel system is only half of that possible in a single-channel system. In other words, the orientation setting of the receiving cams of the device RRB extends only between three vertical lines of Fig. 2. That is, it extends only from the position shown as far as the next line on either side thereof. In the usual single-channel start-stop system the possible orientation adjustments for an ideal transmission system would extend for two vertical lines on each side of the usual orientation position selected for the receiving printer. It is thus apparent that the operating margins of the receiving devices and of the transmission channel is less for the two-channel system than for a single-channel system.

The smaller operating margins are acceptable at times when traffic is particularly heavy and/or the transmission channel is better than usually provided for in single-channel systems.

However, radio channels at times vary so that it may be possible to operate a two-channel system thereover and at other times the margins of the transmission channel will be insufficient to permit the operation of a two-channel system. Also traffic over such a system varies widely from time to time so that during periods of heavy traffic it may be necessary to accept the margins of a two-channel system in order to be able to transmit the traffic load.

If, during the times of light traffic or poor transmission or single-channel operation the tape is only inserted in one of the transmitters and the system operated as one channel of a two-channel system, the margins of the operating channel will not in any way have been improved and at the same time the other channel of the system is idle.

In accordance with the present invention switch 12 is provided for totally disabling the second channel and rearranging the connections so that the single remaining channel will occupy substantially the entire channel time and will have substantially the same margins of operation as the usual single-channel start-stop telegraph

system. Upon the operation of key 12 to the one-channel position, the A and the B segments of the distributor 31 are connected together and connected to the transmitting contacts 11 of the transmitter TB of the B channel. Consequently, the B channel will operate as a usual single-channel start-stop system in which the transmitter TB controls the potential supplied to the A and B segments of the transmitter which are connected together and thus are essentially equivalent to the usual distributor of a single-channel start-stop system. The operation of the switch 12 to its lower position as shown in the drawing in addition to connecting the A and the B segments together and to the transmitting contacts 11 of the transmitter TB also transfers the X segment 14 from connection with the stop segment 25 and connects it to the start segment 26 of the distributor 31. In the exemplary embodiment of the invention described in detail herein, the X segment is one-quarter the length of the usual start-stop distributor selection segments and one-half the length of the segments 1A and 1B, 2A, 2B, etc.

Thus, with the switch 12 set in the one-channel position a slightly longer start pulse is transmitted preceding each of the code combinations. The last line in Fig. 2 shows the corresponding signal as transmitted by the transmitting distributor 31. It will be noted that the start pulse is now slightly longer than the start pulse shown in the third line which is transmitted during the two-channel operation of the system.

Inasmuch as the rotation of the receiving cams is initiated in the beginning of the start pulse, the orientation setting of the receiving cams shown in the fourth and fifth lines of Fig. 2 with respect to the received signals remains unaltered. However, the selecting or significant pulses of the signals as transmitted during single-channel operation have been advanced a quarter of a pulse length to the right as shown in Fig. 2. Consequently, the orientation setting of the receiving cams of the receiver RRB is in the middle of the respective impulses of the received signals. Thus the receiving cams of the printer RRB are properly oriented with respect to the received signals and have substantially the full margin of the usual single-channel in a start-stop telegraph system. In other words, the orientation setting of the receiving cams are such that the selection is made substantially in the middle of the received pulses. Furthermore this selection interval may be moved through substantially the same distance as in the standard start-stop system without causing errors.

Another way of considering the operation of the transmission system is that during the two-channel operation the margin of operation or orientation setting of the received signals is substantially half of the margin usually available in single-channel start-stop systems. If only one of the two channels is operating and the other channel is idle the operating margins of the remaining channel are substantially the same as before and at the same time one-half of the available transmitting channel or line is idle. If the connections to the transmitting distributor are changed so that the operating channel employs the entire line time then the range of orientation setting is substantially the same as for a single-channel system. However, without some additional change such as changing the orientation of the receiving selection cams, the selection is not made in the center of the received signals. In-

stead it is made near the end of each of the signal pulses. In order to eliminate the necessity for realigning or readjusting the orientation setting of the receiving selector mechanisms of all or at least one of the channels every time the system is switched from a single channel to a multichannel, or vice versa, the length of the start pulse is altered as described above by sending a longer start pulse preceding each of the code combinations when the system is operated as a single-channel system. The orientation setting of the receiver cams in one of the receiving devices, viz., RRB, with respect to the received signals will then be correct to select substantially the middle interval of the received signals both during single-channel operation and multichannel operation. It will be quite apparent to persons skilled in the art that it is much easier to shift the connection of the short X segment of the transmitting distributor 31 each time a change is made from the one-channel to the two-channel operation, or vice versa, than it is to realign and reorient either or both of the receiving devices at the receiving end so that they will properly receive the transmitted signals with the least possible number of errors even during adverse transmission conditions.

In the exemplary embodiment of the invention described herein the B channel has been selected as the channel to be operated during single-channel operation. During single-channel operation the receiving equipment of the A channel will in all probability print unintelligible letters and characters because the orientation of the receiving cams of this machine are set at the transition point of the received signals. Consequently, depending upon the distortion of the signals due to the transmission medium the selection in the receiving device 16 may be in accordance with either one or the other of the two adjacent pulses and in general will not be consistently in accordance with either the end of the preceding pulse or the beginning of the next succeeding pulse. The operator or attendant at the receiving station upon noting the unintelligible characters being printed by the receiving device 16 or repeated thereby to the receiving device 18 may cause the operation of these devices to be suspended either by short-circuiting the repeating relays or control magnets thereof or by removing the source of power therefrom. Then when the system is transferred back to a two-channel system it will be necessary to so inform the operator or attendant at the receiving station and instruct him to condition the other channel for reception of the signals.

As will be readily apparent to persons skilled in the art, if it is desired to employ the A channel for single-channel operation, instead of the B channel as described above, the start pulse would be shortened instead of being lengthened. If the start pulse is shortened one quarter pulse length then the received signals will be received relative to the orientations of the receiving devices such that RRA will select the center portion of each of the pulses of each code group of pulses.

Thus, by varying the length of the start pulse it is possible, in effect, to change the orientation of the receiving cams of the receiving devices.

What is claimed is:

1. In a multichannel start-stop multiplex system, a telegraph transmitting station, a start-stop multiplex distributor, connections extending therefrom to a plurality of transmitters, apparatus for sending a single synchronizing pulse for

each revolution of said distributor, switching apparatus for transferring the connections from said distributor to said multiplicity of transmitters to a single one of said transmitters, apparatus operative incident to the operation of said switching apparatus for varying the length of said synchronizing pulse.

2. In a multiplex start-stop telegraph system, a telegraph transmitting station, a start-stop multiplex distributor, connections extending therefrom to a plurality of transmitters, apparatus for sending a synchronizing pulse for each revolution of said distributor, and switching equipment for varying the length of said synchronizing pulse in accordance with the number of channels operative during the succeeding revolution of said distributor.

3. In a multichannel start-stop multiplex system, a telegraph transmitting station, a start-stop multiplex distributor, connections extending therefrom to a plurality of transmitters, apparatus for sending a start pulse at the beginning of each revolution of said distributor, switching apparatus for transferring the connections from said distributor to said multiplicity of transmitters to a single one of said transmitters, apparatus operative incident to the operation of said switching apparatus for increasing the length of said start pulse.

4. In a multiplex start-stop telegraph system, a telegraph transmitting station, a start-stop multiplex distributor, connections extending therefrom to a plurality of transmitters, apparatus for sending a start pulse for each revolution of said distributor and switching equipment for transmitting a start pulse of varying length, and apparatus operative incident to the operation of the particular channels operative during the succeeding revolution of said distributor to determine the length of start pulse transmitted during that revolution.

5. In a multiplex start-stop system, a telegraph transmitting station, a start-stop multiplex transmitting distributor thereat, connections extending from said distributor to a plurality of transmitters, apparatus for sending a single start pulse for each revolution of said distributor, a receiving station, a transmission channel extending from said distributor to said receiving station, a receiving device individual to each of said transmitters connected to said channel at said receiving station, one of said receiving devices including regenerative repeating apparatus, equipment for supplying start pulses individual to permutation code signal combinations regenerated in said repeating apparatus, apparatus for causing each of said receiving devices to respond to each of said start signals at a first time, apparatus for causing one of said receiving devices only to respond to each of said start signals at a second time and means including a switch connected to said distributor for transmitting over said channel permutation code signal combinations having signal elements of half normal duration at said first time and of full normal duration at said second time.

6. In a multiplex start-stop telegraph system, a telegraph transmitting station, a start–stop multiplex transmitting distributor thereat, apparatus for transmiting a single start pulse for each revolution of said distributor, a plurality of telegraph transmitters, apparatus for connecting said transmitters to said distributor, apparatus operative incident to a change in the number of said transmitters connected to said distributor to vary the length of the start pulse transmitted by said

distributor, a receiving station, a plurality of regenerative repeaters at said receiving station connected to said channel including apparatus responsive to said start signal, equipment at said receiving station for separating the signals transmitted during one revolution of said distributor into a plurality of independent trains of signals, means for regenerating and transmitting said trains of signals, and apparatus for translating said single start pulse into a start pulse before each of said trains so regenerated and repeated.

7. A signaling system comprising a transmitting terminal provided with start-stop distributor means for transmitting two code combinations each belonging to a different sub-channel per start-stop cycle, switching means for lengthening the duration of the individual signal elements of a combination and lengthening the duration of the start pulse of said distributor means to transmit one code combination belonging to one of said sub-channels upon each start-stop cycle of said distributor means in combination with receiving means comprising two regenerative repeaters correctly orientated for regenerating and retransmitting signals from the respective sub-channels when said distributor means is transmitting two code combinations per start-stop cycle and one of which without switching is correctly orientated for regenerating and retransmitting signals from said one sub-channel when said transmitter means is rearranged to transmit one code combination, and separate outgoing channels for said regenerative repeaters.

8. In a start-stop telegraph communication system, a telegraph transmission path, a plurality of receiving devices each including means for selecting a different portion of each of the code pulses received thereby for the control thereof, transmitting apparatus for transmitting code groups of pulses to said receiving devices, and equipment for operating said transmitting apparatus to control selectively which portion of the transmitted pulses are selected by said receiving devices by transmitting different length of start pulses before said code groups of pulses.

9. In a start-stop telegraph system, a telegraph line, a receiving device connected thereto including means for selecting a portion of each of the code pulses received thereby for the control thereof, a second receiving device also connected to said line and including means for selecting a portion of each of the code pulses received thereby for the control thereof which portion is different from the portion of each of the code pulses selected by said first receiving device, transmitting apparatus also connected to said telegraph line and apparatus for controlling the length of the start pulse transmitted by said transmitting apparatus preceding each group of code pulses.

10. In a telegraph system, a telegraph line, a first start-stop receiving device connected to said line including apparatus for selecting a portion of each of the code pulses received thereby for the control thereof, a second receiving device also connected to said telegraph line and including means for selecting a portion of each of the code pulses received thereby for the control thereof, which portion is different from the portion of the code pulses selected by said first receiving device; start-stop telegraph transmitting apparatus also connected to said channel for transmitting to both of said receiving devices groups of code pulses preceded by start pulses; apparatus for selectively directing messages to said receiving devices comprising apparatus for controlling the length of the start pulse preceding said groups of code pulses transmitted by said transmitting apparatus.

11. In a start-stop telegraph system, a telegraph transmission line, a receiving device connected thereto for receiving start pulses followed by code pulses, a second receiving device also connected to said line each of said receiving devices including apparatus set into operation by start pulses, each of said receiving devices also including selective apparatus operative at predetermined intervals of time after the reception of said start pulses, apparatus for adjusting said predetermined intervals of time differently for said receiving devices, transmitting apparatus for transmitting code pulses preceded by start pulses and apparatus for selectively directing said code pulses to said receiving devices comprising apparatus for varying the length of the start pulse preceding each of said groups of code pulses.

12. In start-stop transmitting apparatus, a distributor having a stop segment, a start segment, a special segment, and a plurality of code segments, said special segment normally being connected to said stop segment, a pair of tape transmitters each connected to half of said code segments of said distributor in alternate sequential order, means to alter the connections between said tape transmitters and said distributor whereby one of said tape transmitters will be disconnected from said distributor and the other of said tape transmitters will be connected to all of said code segments, and means operating conjointly to cause said special segment to be disconnected from said stop segment and connected to said start segment.

13. In a telegraph transmission station, a pair of tape transmitters, each of said transmitters including signal forming means for forming permutation code signals, means for simultaneously operating said signal forming means, a distributor for transmitting the permutation code signals, said distributor having a plurality of code segments, a plurality of circuits connecting said first transmitter to alternate code segments of said distributor, a plurality of circuits connecting said second tape transmitter to alternate code segments on said distributor, successive code segments on said distributor associated with said second tape transmitter being interspaced by at least one of said code segments associated with said first tape transmitter, and means to alter said electrical circuits whereby one of said tape transmitters is disconnected from its associated code segments of said distributor and the other of said tape transmitters is connected to all of said code segments of said distributor.

14. Telegraph transmitting apparatus comprising a pair of tape transmitters, a distributor having a plurality of code segments thereon half of which are connected to each of said tape transmitters in alternate sequential order, and means to alter the connections between said distributor and said tape transmitters whereby one only of said tape transmitters is connected to all of said code segments of said distributor, the other of said tape transmitters being simultaneously entirely disconnected from said code segments of said distributor.

15. In start-stop transmitting apparatus, a distributor having a plurality of code segments, a pair of tape transmitters each connected to half of said code segments of said distributor in alternate sequential order, and means to alter said

connections whereby one of said tape transmitters is disconnected from said code segments of said distributor and the code segments disconnected therefrom are connected to adjacent code segments connected to the other of said tape transmitters whereby the other of said tape transmitters is connected to all of said code segments of said distributor, each connection being to two of said code segments.

EDWARD F. WATSON.

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