

April 15, 1947.

W. R. GEMMEL
TELEGRAPH SYSTEM AND APPARATUS FOR SELECTIVE SINGLE OR
DOUBLE CHANNEL OPERATION
Filed Nov. 4, 1944

2,418,928

3 Sheets-Sheet 1

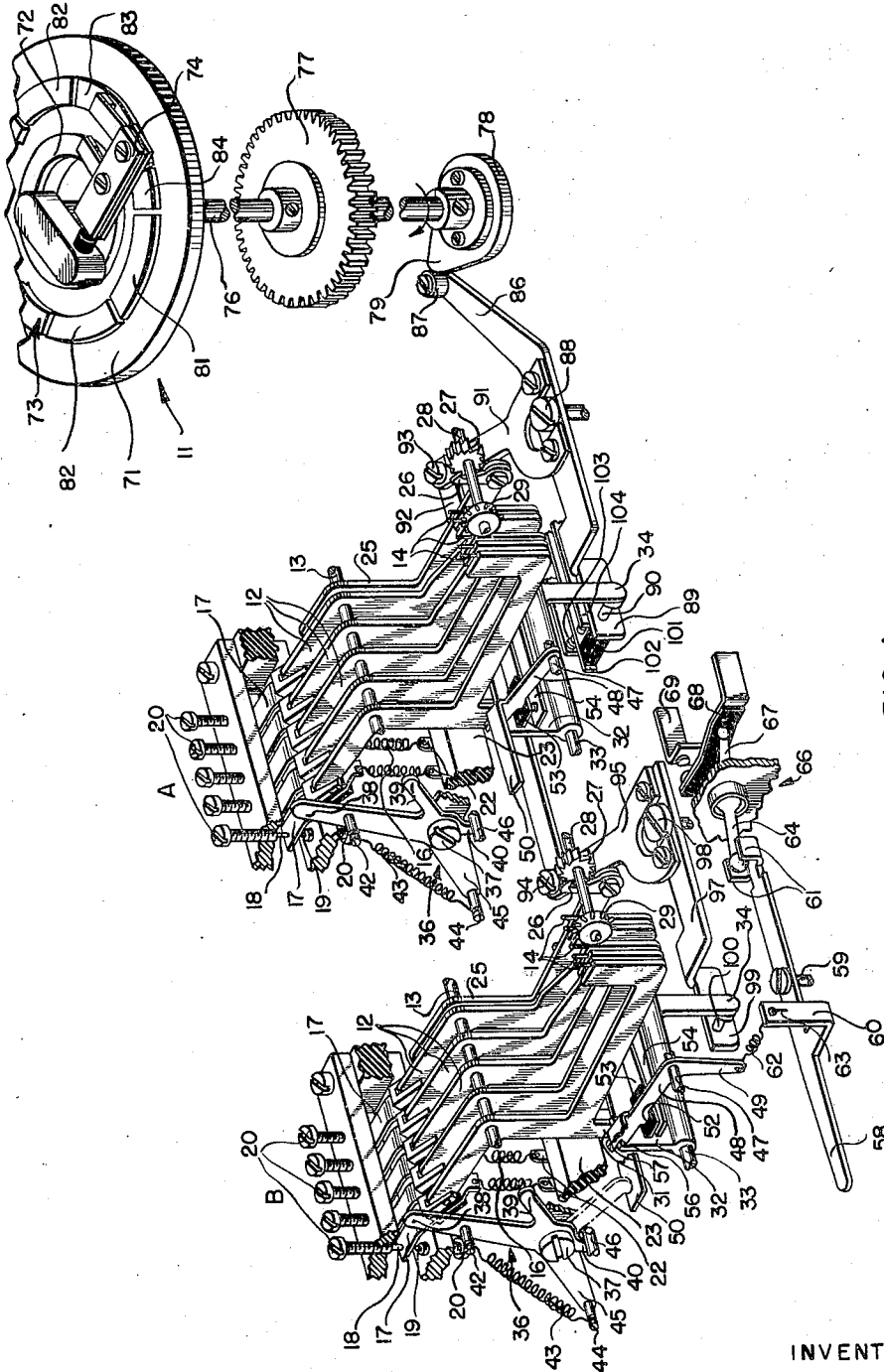


FIG. 1

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3 Sheets-Sheet 2

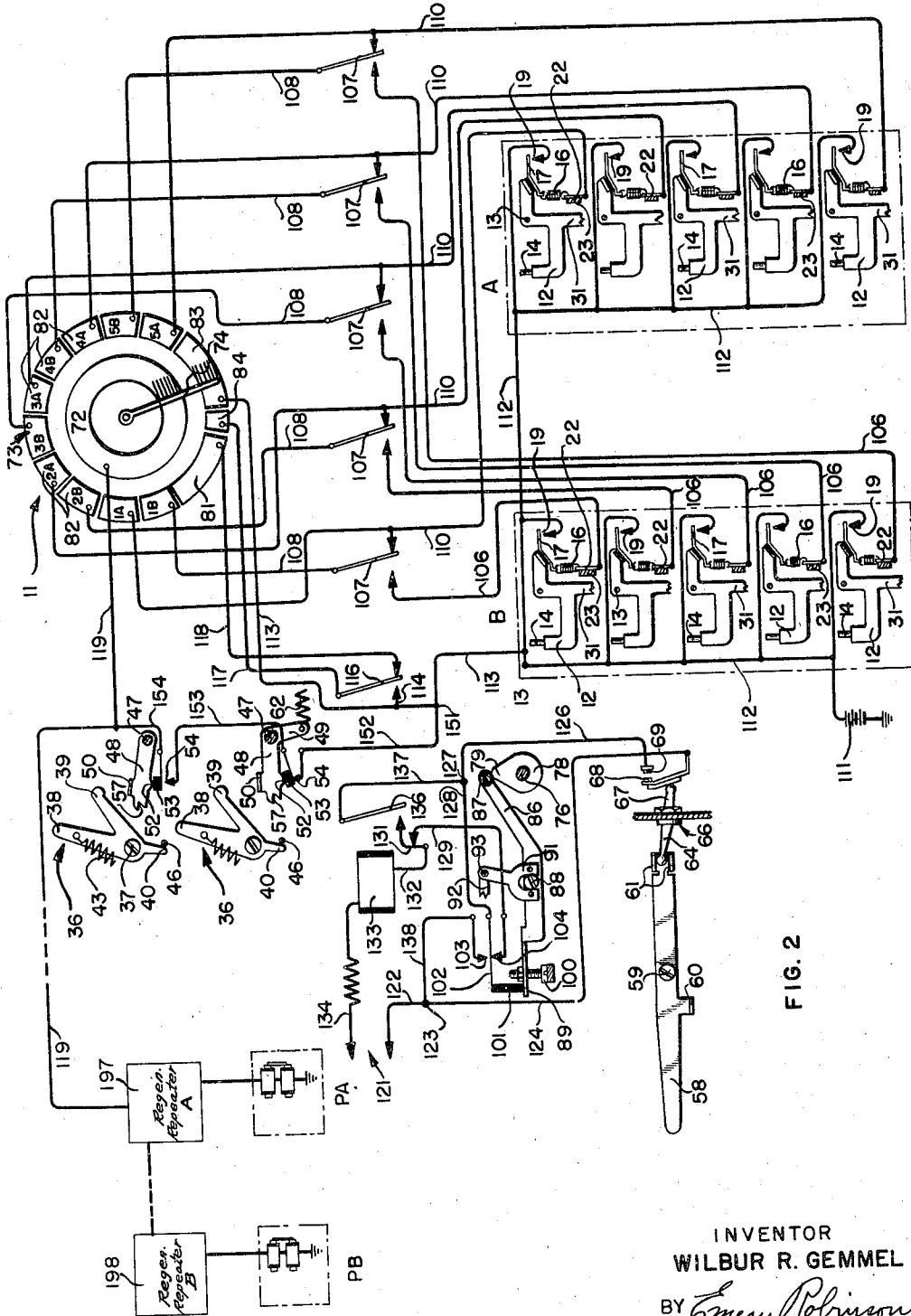


FIG. 2

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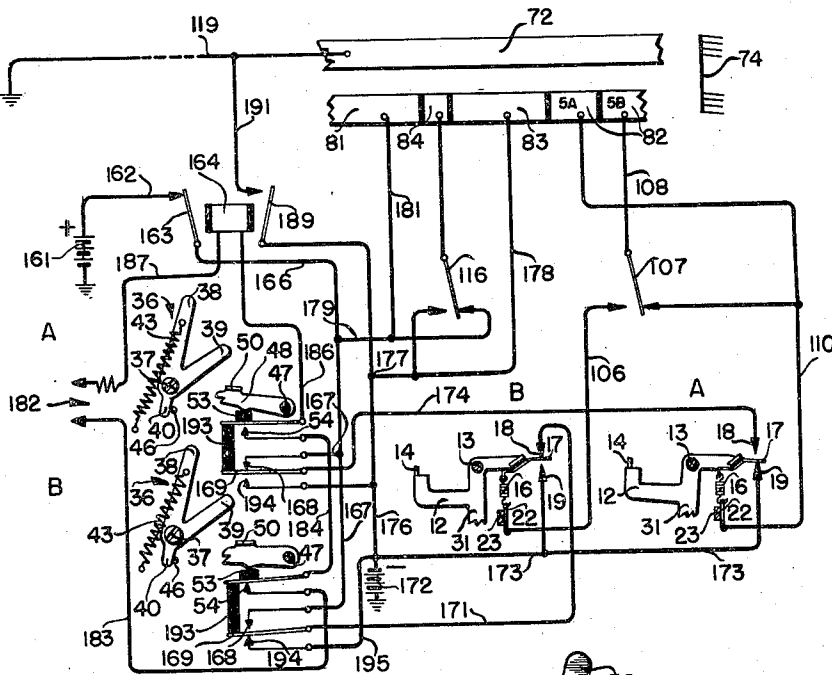


FIG. 3

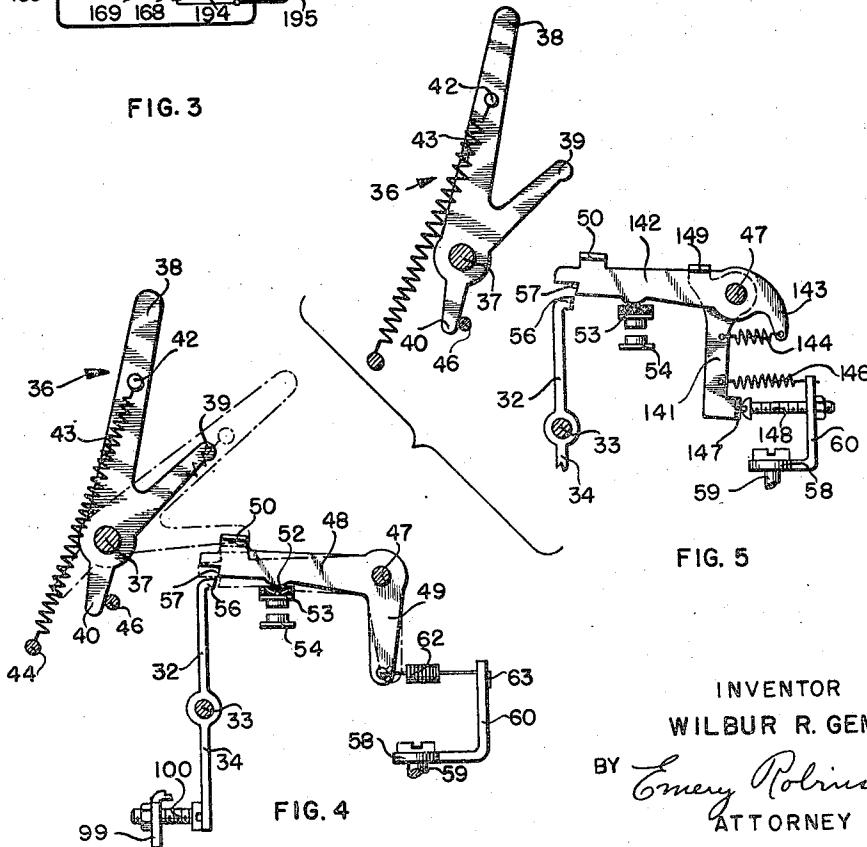


FIG. 5

FIG. 4

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UNITED STATES PATENT OFFICE

2,418,928

TELEGRAPH SYSTEM AND APPARATUS FOR
SELECTIVE SINGLE OR DOUBLE CHANNEL
OPERATION

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Application November 4, 1944, Serial No. 561,874

10 Claims. (Cl. 178—53.1)

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This invention relates to start-stop multiplex telegraph apparatus and more particularly to transmitting apparatus for multi-channel operation.

The normal use of start-stop telegraphic communication apparatus has previously usually been limited to the transmission of a single message in one direction over a single channel at any one time. The result of such operation tends to decrease the maximum possible message transmission over a single line, and thereby results in an incomplete use of a signaling channel.

Telegraphic systems have been operated over what is known as a two-channel system. In this operation the messages are doubled by use of apparatus so that two messages may be sent by start-stop apparatus in the time previously utilized for the transmission of a single message. However, in such a system it has been necessary to reduce by approximately one half the length of time allocated to each of the individual impulses constituting the five unit Baudot code signals. The result of the decrease in the impulse interval has been that under poor signaling conditions, such as static in radio transmission, the shorter duration impulses will be "lost," and therefore an error will result in printing at the receiving station. Therefore, it becomes necessary to either stop transmission completely during times of poor signaling conditions, to use a separate standard single channel transmitter to send out only a single message over one channel, or to provide apparatus whereby two-channel transmission may be utilized during times of good signaling conditions and single channel operation during times of poor signaling conditions.

Accordingly, the primary object of this invention is to provide apparatus which may be operated to transmit in two-channel operation or in single channel operation, depending upon the setting thereof.

Another object of the present invention is to provide a means whereby either or both of the transmitting units comprising the components of two-channel transmitting apparatus may be prevented from further transmission.

A further object of the invention is to provide either neutral or polar single or two-channel operation. A still further object of the present invention is to provide, during polar operation, means whereby when one of the transmitters is stopped, a "letters" combination rather than the conventional "blank" combination will be transmitted over the signalling channels.

This latter object is important when the ap-

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paratus is used in systems wherein the "blank" combination is utilized as a switching or station selecting combination.

A more detailed understanding of the invention may be had from the following description with reference to the accompanying drawings wherein similar numerals indicate similar parts, in which:

Fig. 1 is a perspective view, partly broken away, disclosing the apparatus embodying the invention including two tape transmitters and an associated distributor;

Fig. 2 is a schematic view disclosing the electrical circuit of the apparatus for neutral signaling and certain mechanical parts associated therewith;

Fig. 3 is a schematic view, showing part only of a polar electrical circuit and certain of the mechanical elements associated therewith;

Fig. 4 is an enlarged elevational view showing an operational representation of the apparatus associated with one of the tape transmitters for shifting from two channel to single channel operation, and also the device for individually stopping one of the tape transmitters; and

Fig. 5 discloses a modification of the apparatus for shifting from two channel to single channel operation.

The present apparatus comprises two tape transmitters connected to a distributor in such a manner that the impulses making up the code signals will be transmitted in alternate sequence by the distributor. A switching lever is provided which causes the ball of one of the tape transmitters to be locked in its unoperative position and which at the same time de-energizes a relay to open the connections of this transmitter to the distributor. That is, when the switching lever is thrown and the relay de-energized, electrical circuits are established so that instead of transmitting two messages over half length segments, a single message will be transmitted over normal or full length segments. Stop levers are also provided, individually associated with each of the tape transmitters, so that upon operation they will cause the ball of the associated tape transmitter to be locked in such a position that the tape transmitter will be rendered unoperative.

Referring to Fig. 1, the apparatus disclosed therein is also shown in Bulletin No. 1119, published in March, 1944, by the Teletype Corporation, Chicago, Illinois. The use of two tape transmitters in conjunction with a single distributor is disclosed, substantially as shown in the present

invention, in U. S. Patent No. 2,231,375 issued to E. F. Watson on February 11, 1941.

Specifically with reference to Fig. 1, the transmitting apparatus comprises two tape transmitters designated A and B and a distributor indicated generally by the numeral 11. Transmitter A comprises a series of five feeler levers 12 which are each pivoted about a pivot rod 13 and each of which have a tape sensing pin 14 at their forward end. Each of the feeler levers 12 is biased in a counterclockwise direction by means of individual springs 16 connected near the rearward end of the feeler levers 12. An extension 17 is provided at the extreme rearward end of each of the feeler levers 12 which serves as the movable contact of an electrical contact switch formed of individual upper contacts 18 and lower contacts 19. Set screws 20 are provided for both the upper and lower contacts 18 and 19 so that the contacts may be individually adjusted with respect to the movable contact arm 17, associated therewith. The individual springs 16 are connected at their lower ends to lugs 22, one of which is individual to each of these springs and which are all mounted on an insulated panel 23. A sixth lever 25 is provided, which is also pivotally mounted on the rod 13, and which does not have an electrical contact associated with its rearward end but does have a pivoted pawl 26 mounted at the forward end thereof. A ratchet 27 is mounted adjacent the pawl 26 on a shaft 28, said shaft having mounted securely thereon, in proximity with the feeler pins 14, a tape feed wheel 29 which is provided to intermittently step the tape utilized in the transmitting apparatus a distance between adjacent transverse rows of perforations during operation of the mechanism. The tape feed wheel 29 and the ratchet 27 are both securely fastened to the shaft 28, which is rotatively mounted in the framework of the apparatus so that upon motion to the ratchet 27, through the operation of the pawl 26, the tape feed wheel 29 will be rotated to step the tape.

Each of the feeler levers 12 has a downwardly extending projection 31, in front of which is pivotally mounted a bail 32 on a shaft 33. The tape feed lever 25 has a similar downwardly extending arm (not shown), also engageable by the bail 32. The bail 32 has a downwardly extending lug 34 which is provided to cause the bail to operate in a manner which will be described hereinafter. The mechanism which has been described above, with respect to tape transmitter A, is standard equipment and may be more fully understood by referring to Bulletin No. 141 issued in March 1942, by the Teletype Corporation, Chicago, Illinois.

Briefly, the operation of the mechanism, as is well known in the art, consists in a tape being passed over the tape feed wheel 29 and the feeler pins 14 of the feeler levers 12. The individual springs 16 of the feeler levers 12 normally urge the levers in a counterclockwise direction, so that, assuming that the bail 32 is not blocking the feeler levers 12 by engaging their downwardly extending portions 31, the pins 14 will be allowed to sense the tape and, if there is a perforation in the tape at that point, will pass therethrough. The result of a pin 14 passing through the associated perforation in the tape is to cause the contact arm 17 associated with that particular pin 14 and feeler arm 12 to come into engagement with the lower electrical contact 19, thereby establishing a circuit for a marking impulse to be transmitted over the line conductor, in conjunc-

tion with the distributor 11 as will be described hereinafter. In the event that there is no perforation in the tape opposite a particular pin 14, the pin 14 will not be able to move upwardly and the associated feeler lever 12 will not be allowed to pivot in a counterclockwise direction, which results in the contact arm 17 associated with that particular feeler lever 12 not being moved downwardly, but instead being held in engagement with the upper electrical contact 18. The absence of a perforation in the tape and the engagement of the contact arm 17 with the upper contact 18 results, in conjunction with the distributor 11, in a spacing condition being established on the line conductor. After a complete signal has been transmitted, later to be described, which includes the movement or nonmovement of all five feeler levers 12, the bail 32 will be operated, through its lug 34, pivoting in a counterclockwise direction as viewed in Fig. 1, causing its upper rear surface to engage the projection 31 extending downwardly from each of the five feeler levers 12 and the tape feed lever 25. Such movement on the part of the bail 32 causes the feeler levers 12 and the tape lever 25 to be rotated in a clockwise direction, causing the feeler pins 14 to be removed from any perforation in the tape that they may have sensed. At the same time the tape feed lever 25 is also pivoted in a clockwise direction and pawl 26 moved downwardly, which results in the ratchet 27 being rotated a corresponding amount. As the ratchet 27 rotates a predetermined amount, the rod 28 is rotated which causes tape feed wheel 29 to move a corresponding amount. This last movement causes the tape (not shown) to be moved a distance which is equal to that of the distance between adjacent transverse lines of perforations in the tape. Immediately after this occurs, pressure will be released from the lug 34 of the bail 32, the bail then being free to move in a clockwise direction under the urging of the projections 31 through the action of the feeler levers 12 and the springs 16. Thus, the pins 14 are now free to sense the next row of perforations in the tape. The above operation recurs automatically as long as the operating means for the bail lug 34 work or until such time as the bail 32 may be prevented from moving, as will be described hereinafter.

Associated with the tape transmitter A is a three armed lever, indicated generally by the numeral 35, pivotally mounted at 37, and having an upwardly extending arm 38, a forwardly extending arm 39, and a short downwardly extending arm 40. A pin 42 extends outwardly from the upwardly extending arm 38 and has a spring 43 connected thereto. The opposite end of the spring 43 is fastened to a pin 44 extending from an arm 45 which is securely fastened to the apparatus frame and extends rearwardly and downwardly. The spring 43 and the arm 45 act as an over-throw device with respect to the three armed lever 35. A stop pin 46 is provided in association with the short downwardly extending arm 40 whereby the counterclockwise movement of the three armed lever 35 is limited to a predetermined distance.

Pivotally mounted on a shaft 47 is a rearwardly extending lever 48. The lever 48 has a sidewardly extending lug 50 which extends far enough sidewardly so as to be in the path of the forwardly extending arm 39 of the three armed lever 35, and is operated about its pivot rod 47 in the event that the lever 35 is moved in a clockwise direc-

tion. The lever 43 has a downwardly extending portion 52 which normally is in engagement with the upper contact spring 53 of an electrical contact pair formed with a lower contact spring 54. Thus, in the event that the three armed lever 36 is operated in a clockwise direction, the forwardly extending arm 39 will engage the side-wardly extending lug 50 of the lever 43, thereby causing the lever 43 to be pivoted in a counter-clockwise direction, causing the portion 52 thereof, in engagement with the upper contact spring 53, to move the spring contact downwardly into engagement with the lower contact spring 54. All of the above apparatus, which has been described for the tape transmitter A is identical in tape transmitter B. Therefore, for purposes of simplification, the parts in transmitter B have been labeled with numerals similar to those in tape transmitter A. Hereinafter throughout the specification, reference will be had to specific parts by giving the numeral and then identifying to which of the tape transmitters mention is being made.

It is to be noted that the bail 32 is provided with a forwardly extending upper lip 56, and that the lever 43 is provided with a notch or shoulder 57 therein, which corresponds with and engages the forwardly extending lip 56 of the bail 32 under certain operating conditions.

In the tape transmitter B the lever 43 is not a single arm lever, but instead is one arm of a bell crank lever, the opposite arm 49 of which extends downwardly. The bell crank lever is pivotally mounted on the shaft 47. Other than for the noted difference the levers 43 of the transmitters A and B are identical and perform a similar operation, as will be described hereinafter.

Also associated with tape transmitter B but not with tape transmitter A is a lever 58, extending leftwardly and rightwardly, as viewed in Fig. 1, pivotally mounted at 59 and having an upwardly extending arm 60 toward the left and a pair of upwardly extending flanges 61 at the right extremity thereof. A spring 62 is provided which is secured at one end to the bottom of the downwardly extending arm 49 of the bell crank lever pivoted at 47 and has its opposite end pass through an opening at the top of the upwardly extending arm 60 of the pivoted lever 58. After the spring passes through the opening in the arm 60 it is bent downwardly, as shown at 63. The connection is such between the spring 62 and the arm 60 that if the lever 58 is pivoted in a counterclockwise direction the spring 62 will be extended, whereas if the lever 58 is moved in a clockwise direction a straight section of the spring material will merely pass through the opening in the arm 60. The upwardly extending flanges 61 of the lever 58 control the operating arm 64, of a toggle switch indicated generally by the numeral 66. The toggle switch 66 has an operated arm 67 extending from the opposite side thereof which is positioned in engagement with one contact arm 68 of a contact pair formed with an opposite contact arm 69. The contact arm 68 is formed in such a manner that if the toggle switch 66 is operated from normal position, the operated arm 67 will cam the contact arm 68 into engagement with the contact arm 69.

The apparatus described immediately above is utilized in the switch-over operation so as to achieve either single or two-channel transmission.

The distributor generally designated by the numeral 11 comprises a face plate 71 having a solid ring 72 and a segmented ring 73, concentric

therewith, with a brush arm 74 traveling over and bridging electrically the rings 72 and 73. The brush arm 74 is securely fastened to a shaft 76 on which is also securely fastened a gear 77. The gear 77 is driven by means of a pinion connection with a motor, neither of which are shown, in order to rotate the shaft and consequently the brush, over the rings 72 and 73. Positioned at the bottom of the shaft 76 is a cam 78 having a high portion 79 thereon.

By referring to Fig. 2 it may be seen that the segmented ring 73 is formed with a start segment 81, ten code segments 82, a stop segment 83, and a small segment 84 which is one half the size of the code segments 82, the utility of which will be described hereinafter. The code segments 82 are approximately one half the size of the normal code segments as used in a single channel start-stop transmission system. Each of the segments 81, 82, 83, and 84 are insulated from their adjacent segments. The ten code segments 82 are connected in an alternate sequential order to the five contact lugs 22 of transmitter A and to the five contact lugs 22 of transmitter B. That is, one code segment 82 is connected to lug 22 of transmitter B and the adjacent code segment 82 is connected to a similar lug 22 on transmitter A. In order for the two complete code signals to be transmitted, one from transmitter A and one from transmitter B, the brush arm 74 must rotate over all of the code segments 82. Thus, it may be seen that when the brush arm 74 makes a complete revolution two individual signals will be transmitted over the line conductor on two-channel operation, whereas with the usual standard system the brush arm would rotate one revolution and send one code signal only. Two channel transmission is described in the above-mentioned patent to Watson.

Cooperating with the cam 78, Fig. 1, is an operating lever 86 which has a follower roller 87 extending therefrom which engages the periphery of the cam 78 and thereby controls the operation of the lever 86 accordingly, the lever 86 being pivoted at 88. The operating lever 86 has an extended portion 89 which is adjacent to the downwardly extending lug 34 of the bail 32 of transmitter A and separated therefrom by an adjustable set screw 90 secured in the portion 89, the latter of which controls the operation of the bail about its pivot rod 33 in accordance with the movement of the operating lever 86 about its pivot 88.

An arm 91 having a bifurcated forward end is securely connected to the operating lever 86 in such a manner that the bifurcations straddle the pivot point 88. A connecting link 92 is pivotally mounted at 93 to the arm 91, said link extending from transmitter A to transmitter B. At the opposite end of link 92 (transmitter B), pivotally connected at 94, is an arm 95 similar in design to the arm 91 and also having a bifurcated forward end. An operating lever 97, pivoted at 98, is securely fastened to the bifurcated portion of the lever 95 in such a manner that the bifurcation straddles the pivot point 98. An extended portion 99 of the lever 97 is associated with the lug 34 of the bail 32 of transmitter B but separated therefrom by an adjustable set screw 100. Thus the operating lever 97, through its extended portion 99 and set screw 100, controls the operation of the bail 32 of transmitter B.

From the structure just described it may be seen that each of the bails 32 of transmitters A and B are under the control of their associated

operating levers 86 and 97, respectively, both of which are under the control of the periphery of the cam 78. Thus, at such time as the cam 78 rotates to present its high portion 79 or its opposite low portion to the cam follower roller 87, thus controlling the operation of the operating lever 86, the bails of transmitters A and B will be operated accordingly.

It is to be further noted that the extended portion 89 of the operating lever 86, which is associated with the lug 34 of the bail 32 of transmitter A, has fastened thereto an insulated section 101 which at its opposite end controls a movable electrical contact spring 102. The electrical contact spring 102 acts as the common spring contact with relation to contacts 103 and 104, one of which is positioned to each side of the spring contact 102. Thus, when the operating lever 86 with its extended portion 89 is moved under the control of the cam 78, the movable contact spring 102 will be positioned either in engagement with the associated electrical contact 103 or 104, depending on whether the high or low portion of the cam 78 is presented to the follower roller 87.

By referring now to Fig. 2, it may be seen that the contact lugs 22 of transmitter B are connected electrically by conductors 106, through armatures 107 (when their associated relay is energized), and through conductors 108 to the first, third, fifth, seventh, and ninth code segments 32 of the segmented ring 73. Likewise, the contact lugs 22 of transmitter A are connected electrically over conductors 110 to the second, fourth, sixth, eighth, and tenth code segments 32 of the segmented ring 73. The contact arms 17 are electrically connected to the lugs 22 through the springs 16. Thus, it may be seen that the two tape transmitters are connected in alternate sequential order to the segmented ring 73, as previously mentioned.

It may also be seen (Fig. 2) that the electrical contacts 19 of both transmitters A and B are connected to a grounded battery 111 through a common conductor 112. A conductor 113 extends from the common conductor 112 to the stop segment 33 of the segmented ring 73. A short branch conductor 114 extends from the conductor 113 and supplies potential from grounded battery 111 through the common conductor 112, the conductor 113, the short conductor 114, an armature 116 (when attracted by relay 133), and a conductor 117 to the small segment 34 of the segmented distributor ring 73. A conductor 118 extends from the start segment 31 of the segmented distributor ring 73, and under the condition shown in Fig. 2, establishes an electrical circuit through the unattracted armature 116, over the conductor 117, to the small segment 34.

In considering normal operation of the apparatus, as disclosed under neutral signal conditions of Figs. 1 and 2, it may be seen that ordinarily when the device is in its stop position a marking condition will exist on the line which results from the clockwise rotation of the two levers 36 and the closing of the associated contacts 53 and 54, in a manner and over a circuit to be described hereinafter.

In the operation of the apparatus, let us assume that it is desired to transmit, upon starting, over the two channels. Prior to any operation, the three-armed lever 36 associated with each of the tape transmitters is manually moved to its maximum clockwise position, which will cause the bails 32 to be blocked and the tape

transmitters to be unoperative, as will be more clearly described hereinafter. Such provision is made so that upon starting the distributor into operation it can attain the proper speed prior to the transmission of any signals. Also prior to motor operation the switch-over lever 58 should be positioned in its extreme clockwise position, Figs. 1 and 2, for a purpose to be later enumerated. Thereafter, a switch is closed in the motor circuit, neither of which are shown, which causes the shaft 76, through the gear 77, to be rotated. After the shaft 76 has rotated sufficiently to allow the brush arm 74 to be brought to operating speed, the three-armed levers 36 are positioned manually in a counterclockwise direction, and the tape transmitters are rendered operative, to be hereinafter described.

Referring to Fig. 2, it may be seen that simultaneously with the operation of the switch-over lever 58, the upwardly extending flanges 61 at the rightward extremity thereof will cause the operating lever 64 of the toggle switch 66 to be moved in a counterclockwise direction, thereby resulting in the operated lever 67 camming the electrical switch arm 68 into engagement with the stationary electrical switch arm 69, closing the electrical contact at this point. Assuming that the high portion of the cam 79 is in engagement with the follower roller 87, which occurs when the brush arm 74 is on the stop segment 33, the operating lever 86 will be pivoted about pivot point 88 in a counterclockwise direction, causing the extended portion 89 to be moved in a counterclockwise direction, and the movable contact swinger 102 connected to the extended portion 89 by means of the insulated securing member 101 to likewise be moved in a counterclockwise direction. This results in the movable swinger 102 being positioned in engagement with an electrical contact 104. Thus, an electrical circuit is established which may be traced from the local D. C. source 121 (Fig. 2) over conductor 122 to junction point 123, over conductor 124, through movable electrical contact arm 68, through the electrical contact arm 69, through a conductor 126 to junction point 127, through a conductor 128, through the movable swinger arm 102, through the electrical contact 104, through a conductor 129, through a conductor 131, through a conductor 132, through the coil of the relay 133, through a conductor 134 having a resistance therein, and back to the D. C. source 121.

The result of the electrical circuit just established is that the relay 133 will be energized, resulting in its associated armatures 116 and 107, previously mentioned, being attracted thereto, as is also an armature 136.

Upon the armature 136 being attracted, due to the energization of the relay 133, a locking circuit is established for the relay which may be traced from the D. C. source 121, through the conductor 122, through the conductor 124, through the now closed contact pair comprising the contact arms 68 and 69, through the conductor 126 to junction point 127, through a conductor 127, through the armature 136, through the conductor 131, through the conductor 132, through the coil of the relay 133, and through the conductor 134 to the opposite potential of the D. C. source 121.

It is to be remembered that in the above description we assumed that the cam 78 was so positioned that its high point 79 was in engagement with the cam follower roller 87. In the event that the brush arm 74 were in any position

other than in engagement with the stop segment 83, the cam 78 would be so positioned that its high portion 79 would not be presented to the cam follower roller 87. Under such a condition the operating lever 86 would be in a clockwise position, as viewed in Fig. 2, and its extended portion 89 would likewise be so positioned resulting in the movable swinger arm 102 removed from engagement with contact 104, and instead positioned in engagement with the contact point 103. Thus, there would be no electrical circuit completed for the energization of the relay 133 inasmuch as in the unenergized condition of relay 133 the armature 136 would be in normal open position, as shown in Fig. 2, and no circuit could be traced from the D. C. source 121. The only time that the relay 133 will become energized is when the brush arm 74 is in engagement with the stop segment 83 as the circuit therefor is traceable through the contact 104. This provision has been made to cover a possibility which will be referred to hereinafter.

As previously mentioned, upon the energization of the relay 133, the armatures 116 and 137 are also attracted thereto. As a result of the attraction of the armature 116 a circuit may be traced from grounded battery 111, through conductor 112, through conductor 113, through conductor 114, through the armature 116, over conductor 117, through the small segment 84, over the brush arm 74, through the solid ring 72, and over the line conductor 119. The results of battery being extended to the small segment 84 acts as an increase in the length of the stop segment and thus of the stop impulse on the line conductor 119. Inasmuch as when the unit is in operation the tape spacing operation occurs while the brush arm 74 is on the stop segment, it is necessary that the stop segment and its corresponding impulse be of a certain duration. It is to be understood that the above condition prevails during double channel operation only, as will be hereinafter explained fully.

As a result of the attraction of the armatures 107, due to the energization of the relay 133, electrical circuits are established from the contact lugs 22 of transmitter B, through the conductors 106, through the armatures 107, and through the conductors 108 to the B code segments 82 of the segmented distributor ring 73. It may also be seen that the contact lugs 22 of transmitter A are connected directly over the conductors 110 to the A code segments 82 of the segmented distributor ring 73.

It is to be further noted (Fig. 1) that when the brush arm 74 bridges the stop segment 83 and the solid ring 72, the cam 78 on the bottom of the brush arm shaft 76 will be so positioned that its high point 79 will be in engagement with the follower roller 87, thereby causing the operating lever 86 to assume its extreme counterclockwise position, as viewed in Fig. 1, which results in the extended portions 89 and 99 of the operating levers 86 and 97, respectively, being in engagement (through set screws 90 and 100) with the downwardly extending lugs 34 of the bails 32 of both the transmitters A and B. This results in the two bails 32 being rotated in a counterclockwise direction about the pivot rods 33 to a position in engagement with the downwardly extending portion 31 of the tape feeler levers 12, thereby causing the tape feeler levers 12 to be moved to and held in their maximum clockwise position with the tape pins 14 retracted downwardly and held out of engagement with the tape thereover.

Therefore, as previously mentioned, the tape may be advanced during the stop impulse.

Referring again to Fig. 2, it may be seen that when the apparatus is put into operation by means of closing the switch in the motor circuit, thus imparting motion through the gear 77 to the brush arm shaft 76 and thus to the brush arm 74, the brush arm upon leaving the stop segment 83 will first rotate over the special segment 84. Inasmuch, as previously mentioned, as the special segment 84 is connected to the grounded battery 111, as the brush arm passes thereover potential will be transmitted over the line conductor 119. Therefore, as also previously mentioned, the special segment 84 at this time acts as a continuation of the stop segment. As the brush arm 74 passes from the special segment 84 to the start segment 81, a no-current condition will exist on the line conductor 119. This is true because the conductor 118, which is connected to the start segment 81, does not at this time establish any electrical circuit, so there will be no battery connected to the start segment 81 and therefore no potential will pass to the line conductor 119. This condition exists in neutral operation; that is, where the telegraphic communication is dependent upon marking and spacing impulses composed of current and no-current, respectively.

The result of the brush arm 74 passing over the start segment 81 is, as previously mentioned, to cause a no-current condition on the line conductor 119. Such a condition results in the line relays at the distant stations PA and PB being de-energized, thereby conditioning the printers at those stations for operation. Thereafter, as the brush arm 74 rotates over the code segments 82, marking or spacing currents will be transmitted to the line conductor 119, depending on the code signals which are perforated in the tape in transmitters A and B. That is, in the event that there is a perforation in the tape, the associated pin 14 will move upwardly passing through the perforation, the feeler lever 12 will be moved in a counterclockwise direction, Fig. 1, or a clockwise direction as viewed in Fig. 2, resulting in the contact arm 17 associated with that particular feeler lever 12 being positioned in engagement with its associated lower electrical contact 19 and causing a marking impulse to be transmitted over the line conductor 119. In the event that there is no perforation present in the tape the sensing pin 14 cannot pass therethrough and the feeler lever 12 will be held in its clockwise position, Fig. 1, causing the associated contact arm 17 to be in engagement with the upper electrical contact 18, which results in a spacing impulse on the line conductor 119 when the brush passes over that particular segment on the distributor. It might be mentioned that the feeler levers 12 are now free to rotate under the action of their individual springs 16 in the event that a perforation is present in the tape, because as the brush arm 74 passes over the start segment 81, as previously described, the brush arm shaft 76 will likewise rotate causing the high spot 79 of cam 78 no longer to be presented to the cam follower roller 87, thereby resulting in pressure being relieved from the operating levers 86 and 97, which similarly no longer exert pressure through extensions 89 and 99 to the downwardly extending lugs 34 of the bails 32.

Assuming that the first impulse to be transmitted, which will be from transmitter B, is a marking impulse, that is, the first feeler lever 12

has pivoted under the action of its associated pin 14 entering a perforation in the tape, the upper contact lever 12, as seen in Fig. 2 associated with transmitter B, will have pivoted in a clockwise direction. Such rotation causes the contact arm 17 associated with the feeler lever 12 to become engaged with the lower electrical contact 19. When this occurs, an electrical circuit is established which may be traced from the grounded battery 111, through the common conductor 112, through the lower electrical contact 19, through the movable electrical contact arm 17 now in engagement therewith, through the spring 16, through the contact lug 22, over the conductor 106, through the armature 107 (the relay 133 now being energized), through the conductor 108, to segment 1B on the segmented distributor ring 73, over the brush arm 74, through the solid ring 72, and over the line conductor 119. In the event that there has been no perforation in the tape associated with the particular feeler lever 12 just described, the lever would have remained in its normal position, as shown in Fig. 2. Under this normal condition the movable contact arm 17 associated with the feeler lever 12 is, referring to Fig. 1, in engagement with the upper electrical contact. However, as the present embodiment is utilized in a neutral transmission system, the contacts 18 are not connected in any electrical circuit. Therefore, for convenience sake, they have not been shown at all in Fig. 2. The result of such is that when the contact arm 17 is in its upper position in engagement with electrical contact 18, no circuit is established and therefore, as brush arm 74 passes over the particular segment associated therewith, there will be a no-current or spacing condition on the line conductor 119. The above described conditions exist throughout the rotation of brush arm shaft 76 and therefore brush arm 74 passes over all ten of the code segments 82. That is, as the brush arm 74 rotates over the segments 82 successively either a current or a no-current condition will exist on the line conductor 119 at that particular time, depending on whether a perforation existed in the tape for a particular feeler lever 12 or not. In the time that the brush arm 74 takes to make a complete revolution two complete signals have been transmitted over the line conductor 119, one from each of the transmitters A and B.

When the brush arm 74 completes the revolution described above and reengages the stop segment 83, a marking impulse will be transmitted over the line conductor 119 from the grounded battery 111 as previously described, and, under the control of the high portion 79 of the cam 78, the bails 32 will be operated to cause the selected pins 14 to be moved from engagement with the tape. At this time, as previously mentioned, the tape stepping levers 25 will also be pivoted causing the associated pawls 26 to rotate the ratchets 27 one step, causing the tape feed wheels 29 to be likewise rotated and the tapes to be stepped a distance equal to the distance between adjacent lines of transverse perforations. Thereafter the brush arm 74 will once again pass over the start segment 81, a no-current condition will exist on the line conductor 119, as previously described, and the apparatus is conditioned for a second cycle of operation.

It is contemplated in the present invention that the distributor arm 74 shall continuously rotate over the face of the distributor 11 once it has been started. Thus, the brush arm 74 does not stop when it is desired to stop transmission

as in other start-stop systems, but instead once the driving motor circuit is closed it will rotate until such time as the motor circuit is broken.

Let us assume that the transmission system has been operating, as described above, under a two channel condition. Further, let us also assume that the signaling conditions have become poor due to static disturbances or other conditions, which are not under the control of the operator, and therefore because of the short length of interval of the code impulses transmitted over the line conductor the printers PA and PB at the distant stations have not been able to receive their particular code signals. That is, the signals have not been clear enough, or have been too distorted, or lost completely, so that the improper signals or no signals at all are received at the distant station.

Under the condition just described, which information would be conveyed to the operator of the transmitting station in some manner, the operator would manually pivot the switch-over lever 58 in a counterclockwise direction, as viewed in Figs. 1 and 2. It is to be noted that when the switch-over lever 58 has been positioned in either of its positions it will be held there as a result of a detenting action on the part of the toggle switch 66 until such time as it may be manually operated to the other of its positions. The result of such an operation, as seen in Fig. 1, is that the upwardly extending lug 60 will cause the spring 62 to be extended, resulting in the bell crank lever composed of the arms 48 and 49 being pivoted in a counterclockwise direction. The result of such rotation of the bell crank lever is that the arm 48 moves downwardly, causing it to be placed, and especially its engaging shoulder 57, in blocking position with respect to the bail 32 of transmitter B. That is, assuming that the bail is in its extreme counterclockwise position with the feeler levers 12 pivoted to their maximum clockwise position, as viewed in Fig. 1, with the pins 14 out of engagement with the tape, the shoulder 57 of the arm 48 will engage the forwardly extending lip 56 of the top of the bail 32, thereby preventing the bail from moving forwardly when the bail 32 would ordinarily be allowed to move because of the cam 78 no longer presenting its high portion 79 to the roller 87 and thus controlling the operating levers 86 and 97. It may be seen from the drawings that the switch-over lever may not be operated to block the bail 32 under any other condition than when the bail 32 is in its maximum counterclockwise position. This is obvious by referring to Fig. 4, wherein the switch-over lever and bail are more clearly shown. In the event that the bail 32 were in its clockwise position, as viewed in Fig. 4, and the switch-over lever 58 were operated, the arm 48 would rest on top of the lip 56 of the bail and therefore the shoulder 57 would not act to block the bail 32 by engagement with the forwardly extending lip 56.

Fig. 4 also discloses, in dotted line, the relative position of the bell crank lever comprising the arms 48 and 49 with respect to the bail 32 after the switch-over lever 58 has been operated, thereby moving the bell crank lever in a counterclockwise direction. Thus it may be seen that when the switch-over lever 58 is moved in a counterclockwise direction about the pivot point 59, the bail 32 associated with transmitter B will be blocked out so that the pins 14 will be held in their downward position, thus preventing any engagement with the tape passing thereover.

This will be the unoperative position of transmitter B.

Likewise, upon movement of the switch-over lever 58 to its maximum counterclockwise position the upwardly extending flanges 61 at the right end of the switch-over lever will cause the operating lever 64 of the toggle switch 66 to be moved in a clockwise direction, thereby causing the operated lever 67 to be cammed clockwise, thus allowing the movable electrical contact 68, through its inherent resilience, to move away from the contact 69 thereby breaking the electrical circuit at this point. Again, if we assume that the brush arm 74 is on the stop segment with the high portion of the cam 79 in engagement with the follower roller 87 it may be seen that the movable contact arm 102 is in engagement with the electrical contact 104 in this position. The locking battery previously described as being established from the D. C. source 121 to the relay 133 over the conductors 122, 124, and through the switch comprising the electrical contact arms 68 and 69 will no longer be available for the relay 133 inasmuch as the latter contact pair has now been opened. Thus, during the stop interval, the relay 133 will be de-energized and the armatures 136, 116 and 107 will no longer be attracted thereto.

In the event that the operator operates the switch-over lever 58 during the time that the brush arm 74 is traversing any of the code segments 82 the contact arm 68 will open at the contact arm 69 and thereby break the electrical circuit at this point. However, at any time other than when the brush 74 is on the stop segment the high portion 79 of the cam 78 will not be presented to the cam follower roller 87 and thus the operating lever 86 will be in a clockwise position. When the lever 86 is so positioned, its extended portion 89 (and through the insulated member 101) the contact swinger 102 will likewise be positioned clockwise. The swinger 102 will not be in engagement with the contact 104 but instead will be in engagement with the contact 103, thus establishing an electrical circuit, at the time when the brush arm 74 is not on the stop segment, which may be traced from the D. C. source 121, through the conductor 122 to the junction point 123, through a conductor 138, through the contact 103, through the swinger arm 102, through the conductor 128 to junction point 127, through the conductor 137, through the armature 136, through the conductors 131 and 132, through the coil of the relay 133 and over the conductor 134 to the D. C. source 121. Thus, even though the switch-over lever 58 has been positioned for single transmission and the contacts 68 and 69 opened, a locking circuit will still be established for the relay 133 in the event that the brush arm 74 is traversing any of the code segments 82 or the start segment 81. Such a condition has been provided so that if a switch-over occurs during the time that the brush arm is traversing any of the code segments the signal being transmitted at that time will not be obliterated or lost, but instead change-over may occur at such time only as no signal is being transmitted over the line conductor 119.

The result of the falling off of the armatures 107 is to break the circuits between the conductors 106 and 108, and instead establish a circuit between the conductors 110 and the conductors 108. It may be seen from Fig. 2, that when this occurs the adjacent A and B segments are connected together electrically through the con-

ductor 108, the armature 107, and the conductor 110 to the contact lug 22 of transmitter A for the B segment, and from the A segment directly through the conductor 110 to the contact lug 22.

The result of this is that the A and B code segments 82 are no longer separate with each being connected to a different tape transmitter, but instead are now both associated as single segments with a single tape transmitter. This occurs for all of the ten segments and results, instead of ten relatively small segments, in five normal sized segments now being associated with a single tape transmitter.

As previously mentioned, the relay 133 may only be de-energized when the brush arm 74 is on the stop segment 83. This has been provided so that the armatures 107 may only be operated to connect the B segments to the A segments (thus simulating five large segments) during the stop condition of the apparatus. If this were not true and such a switch-over occurred during the rotation of the brush arm over the code segments 82, thereafter as the brush passed over the B segments it would no longer transmit impulses from transmitter B over the line conductor, thus occasioning the loss of a signal in transmission over the line conductor 119. Thus, by providing the switch-over during the stop interval only, such a condition will not occur and no signal will be lost.

As was previously mentioned the armature 116 also falls away upon the de-energization of the relay 133. The result of such condition is that the small segment 84 which previously had been connected over conductor 117, over armature 116, through short conductor 114, and over conductor 113 to the stop segment 83 will instead now be connected over conductor 117, through the armature 116, and over the conductor 118 to the start segment 81. Thus the small segment which previously augmented the stop segment 83 will now be utilized to augment the start segment 81 instead. As was set forth hereinbefore, this segment 84 is approximately one-half the size of any of the code segments 82. The necessity for this switch-over from the stop to the start segment is necessary because under the two-channel operation the maximum impulse occurs approximately at the half way mark of the individual code segments 82. Now then, upon switch-over, so that the A and B segments are now consolidated into a single segment, it is desirable that the maximum signaling point occur approximately at the half way position of the combined segment which would be approximately at the point where they are separated by insulation. Inasmuch as this shift in maximum impulse point has occurred with respect to the five code segments, it becomes necessary to make some sort of a shift with respect to the stop segment 83 and the start segment 81. Thus, by having the extra segment 84, which is approximately the size of one-half of one of the small code segments 82, when the two adjacent code segments 82 are joined together and the maximum impulse point is shifted one-half of one of the small code segments, a similar shift is made with respect to the start and stop segments and a similar relative maximum impulse point will occur with respect to them. Such is necessary in order that the orientation mechanism of the A printer need not be reoriented for single channel operation to maximum impulse point but instead may utilize a single setting for either single or two channel operation.

Transmission will now occur over one of the

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tape transmitters only for such a period of time as it is desirable. Thereafter, assuming that good signaling conditions again exist, the operator may manually operate the switch-over lever 58 in a clockwise direction, as viewed in Fig. 2, which results in a pivotal movement of the switch-over lever about the point 59. Referring to Fig. 1, it may be seen that when this occurs the upwardly extending lug 60 will move inwardly on the straight section of the spring 62, resulting in the spring 62 no longer being extended and therefore pressure being relieved from the arms 49 and 48 of the bell crank lever. However, at this time the bail 32 of transmitter B will not be immediately released for operation. At such time as the bail 32 is rotated to its extreme counterclockwise position under the operation of the extended portion 99 in engagement with the lug 34 extending downwardly from the bail, which occurs at such time as the brush arm 74 is on the stop segment 83 and the high portion 73 of the cam 78 is presented to the operating lever 36, the upper electrical contact arm 53 will exert sufficient pressure to cause the arm 48 of the bell crank lever composed of the arms 48 and 49 to move in a clockwise direction thereby freeing the forwardly extending lip 56 of the bail 32 from the shoulder 57 of the arm 48. This latter occurs, even though the bail 32 has been held in an arrested position, because there is a slight amount of movement of the bail 32 during the operation of the operating lever 97 and its extended portion 99 when the follower roller 87 is in engagement with the apex 79 of the cam 78. However, this movement is not sufficient to cause the bail 32 to be freed in any other position than when the bail is rotated to its maximum counterclockwise position. By referring to Fig. 4, it may be seen that the forward edge of the extending lip 56 of the bail 32 is cut at an angle, as is the face of the shoulder 57 of the arm 48. Because of the angular surface of the lip 56 and the shoulder 57 the bail 32 will not be released from locking position at any time other than when the apex 79 of the cam 78 is presented to the operating lever 86 which occurs only when the brush arm 74 traverses the stop segment 83. At this latter time the bail 32 is moved to its maximum counterclockwise position which is the only time that there is sufficient clearance for the angular face of the shoulder 57 to pass the angular face of the lip 56. The lever 48 cannot be moved from locking position at any other time because the force exerted by the lever resetting contact spring 53 is not sufficient to overcome the force exerted on the bail, in a clockwise direction, by the tape sensing mechanism which would be necessary to unlock the bail.

Thus, under this condition, the transmission will occur once again from both transmitters A and B over their respective segments 82 rather than from transmitter A alone over the double segments as just described.

By referring to Fig. 5, a switch-over lever may be seen which operates somewhat differently than the switch-over lever and associated parts just described. In the modified device the operating arm and bail blocking lever are two separate members, which are identified by the numerals 141 and 142, respectively. The blocking lever 142, which is pivoted about a shaft 47 similar to that in the preferred embodiment, has a sidewardly extending lug 59 and a shoulder 57 therein, and is also provided with a rearward and downwardly extending projection 143 which has one end of a

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spring 144 secured thereto. The operating lever 141 is also pivoted at point 47 and has the opposite end of the spring 144 secured thereto. Toward the downward extremity of the operating lever 141 is a second spring 146 secured thereto, the opposite end of which passes through the upwardly extending lug 60 of the switching lever 58, similarly as described with respect to Figs. 1 and 4. The operating lever 141 also has a sidewardly extending lug 147 at the lower portion thereof which is associated with a bolt 148 which is screwed through the upwardly extending lug 60 of the switching lever 58 and secured in place therein by means of a nut on the opposite side thereof.

In operation, assuming that there has been two channel transmission and it is necessary to switch over to single channel transmission, the operator would manually operate the switch-over lever 53 to its counterclockwise position which would result in the upwardly extending lug 60, Fig. 5, being moved toward the right. This would result in the spring 146 being extended, causing the operating lever 141 to be pivoted about pivot point 47 in a counterclockwise direction. When this occurs, an extending lug 149 which is a part of the operating lever 141 and which is so positioned as to overlie the top of the blocking lever 142 comes into engagement with the operating lever 142 and tends to force it in a counterclockwise direction. Assuming that the brush arm 74 is on the stop segment and the bail 32 in a position as shown in Fig. 5, the operating lever 142 will immediately move downwardly under the urging of the lug 149 and thus present its shoulder 57 in blocking relation with the inwardly extending lip 56 of the bail 32. In the event that the bail 32 were in its clockwise position, thereby underlying the bottom of the blocking lever 142, the blocking lever would not at this time move to blocking position but instead would rest on the top of the lip 56 until such time as the bail 32 moved rearwardly to its position as shown in Fig. 5. However, because the spring 146 was extended and tending to rotate the operating lever 142, and thus through the lug 149 impart motion to the blocking lever 142, the blocking lever will operate as soon as the bail moves to its normal position.

Assuming now that single channel operation has been utilized for such a time as is necessary, and that signaling conditions are now of such a degree that two channel operation may again be resumed, the operator may manually operate the switch-over lever 58 to its clockwise position. This results in the upwardly extending lug 60 moving toward the left, as viewed in Fig. 5, which allows the spring 146 to resume an unextended position. However, the bolt 148 will also move toward the left, Fig. 5, and engage the sidewardly extending lug 147 of the operating lever 141, thereby causing the operating lever 141 to be pivoted in a clockwise direction. This not only removes pressure of operating lever 141 upon blocking lever 142 through the overhanging lug 149 but also causes the spring 144 to be extended. The result of the extension of the spring 144 is that it exerts pressure tending to move the blocking lever 142 in a clockwise direction, through the rearwardly extending lug 143 thereof, which allows the blocking lever 142 to move free from engagement with the bail 32 under similar conditions as expressed in relation to the preferred embodiment. Therefore it may be seen that in the embodiment shown in Fig. 5 it is not neces-

sary to depend on the resilience of the electrical contact arm 53 to move the blocking lever 142 from blocking engagement with the bail 32, but instead it is positively removed by means of the spring 144.

It is self-evident that a switch-over lever such as lever 58 and its associated bail blocking elements need only operate in conjunction to block out the bail 32 of one of the tape transmitters, inasmuch as when it is operated, single channel operation is desired and so it is necessary that one of the tape transmitters still operate under this condition.

During two-channel transmission it may be necessary for some reason, such as the tape being exhausted in one of the tape transmitters only, to block out the operation of one or the other of the tape transmitters without switching to single channel operation. For this reason the three-armed lever 36 has been provided for each of the tape transmitters. Referring to Fig. 1, it may be seen that when an operator manually positions the three-armed lever 36 in a clockwise position, through pressure being exerted on the arm 38, the forwardly extending arm 39 will engage the lug 50 extending sidewardly from the arm 48. Under this condition the arm 48 will be forced in a counterclockwise direction, and operating as previously described with respect to the operation of the switch-over lever 58, will cause the shoulder 57 of the arm 48 to engage the forwardly extending lip 56 of the bail 32, thereby blocking operation of the bail. The associated spring 43 has been provided so that in the event that the bail 32 underlies the arm 48 at the time that the arm 38 is operated the spring 43 will act as an overthrow spring and supply constant pressure to the sidewardly extending lug 50, through the forwardly extending arm 39, so that when the bail 32 moves to its extreme rearward position when the brush arm 74 is on the stop segment 83, the arm 48 will then be operated to present its blocking shoulder 57 to the lip 56 of the bail 32. Likewise, when the arm 38 is operated to its position, as shown in Fig. 1, whereby it is not blocking the bail, the spring 43 acts to hold the three armed lever 36 in its extreme counterclockwise position. A pin 46 has been provided which will be engaged by the downwardly extending arm 40 of the lever 36 when the arm 38 is positioned in a counterclockwise direction, and which with the pressure applied thereto by the spring 43, tends to limit the counterclockwise movement of the lever 36.

As mentioned above, one of these lock out levers is provided for each of the tape transmitters A and B, both operating similarly with respect to the bail blocking lever 48. Thus an operator may, upon manual operation of either of the levers 36, cause its associated tape transmitter to be held in a locked out condition and therefore preclude the transmission of signals from that particular tape transmitter. In the embodiment shown in Fig. 1, when the operator moves the arm 38 to its extreme counterclockwise position, the upper electrical contact arm 53 will cause the lever 48 to be moved from blocking position, as previously described.

As was previously mentioned, an electrical contact pair 53, 54 underlies each of the bail blocking arms 48 in such a manner that when the blocking arm 48 is operated to preclude operation of the associated tape transmitter, through a lock-out of the bail 32, the upper electrical contact 53 is positioned in engagement with the lower elec-

trical contact 54 thereby completing an electrical circuit. By referring to Fig. 2, it may be seen that if only one of the blocking levers 48 is operated to cause the associated contacts 53, 54 to close, no complete circuit will be established. However, in the event that both of the blocking levers 48 are operated, thereby closing both of the contact pairs 53, 54, an electrical circuit will be established from the grounded battery 111, over common conductor 112, over conductor 113 to junction point 151, over conductor 152, through the contact pair 53, 54 associated with transmitter B, over the conductor 153, through the contact pair 53, 54 associated with transmitter A, and over conductor 154 to the line conductor 119. Such an electrical circuit has been provided, because in the event that both the transmitters A and B were to be held in their blocked or unoperative position, all of the tape feeler levers 12 will be held in their counterclockwise position, as viewed in Fig. 2, thereby causing their associated contact arms 17 to be in engagement with the upper electrical contact 18 (Fig. 1). As has previously been described, when this occurs a spacing condition exists on the line conductor 119, inasmuch as a no-current condition exists at this time. Therefore, inasmuch as the brush arm 74 continuously rotates, once its driving motor has been started up, it will continue to rotate until such time as the driving motor is shut off, and as the brush arm 74 passes over the start segment 81 and all of the code segments 82, a spacing condition would exist on the line. Inasmuch as such a spacing condition would actuate the printers PA and PB at the distant station to cause continuous blank spaces to be recorded on the printer, it is desirable to provide means whereby this will not occur. Therefore at such time as the transmitters A and B are both caused to be unoperative, a marking condition will exist on the line conductor 119, being supplied with potential from the grounded battery 111, over the circuit described immediately above. In the normal telegraphic system when a marking condition exists on the line, the printers at the distant station will not be actuated until such time as a spacing start impulse is transmitted. Thus, if marking is continuously applied to the line conductor 119, the printers PA and PB will not be initiated into operation during this condition. However, as soon as one of the tape transmitters is placed in operative service by means of a movement of the three-armed lever 36 associated therewith, the electrical contacts 53, 54 associated with that tape transmitter will then open and the shunting circuit for applying continual marking battery on the line 119 will no longer exist.

It is to be remembered that the prior description has been confined to telegraphic operation with neutral signals; that is, signals comprising current or no-current condition on the line conductor. However, inasmuch as certain telegraph systems operate on polar signals, that is, signals comprising positive and negative battery or polarity on the line conductor, a modification has been shown in Fig. 3 wherein such telegraphic communication is possible. It is to be noted that Fig. 3 does not show the complete tape transmitters A and B or the complete distributor, such as was shown in Fig. 2. It is believed, however, that inasmuch as the remaining elements necessary for Fig. 3 to make it similar to Fig. 2, that is, complete tape transmitters A and B and a complete distributor, is obvious to one skilled in the art and inasmuch as they are the same as the

unit shown, a repetition is unnecessary. Inasmuch as the component parts of the apparatus necessary for polar operation are substantially similar to those for neutral operation, numerals will be used in Fig. 3 similar to those of Fig. 2 wherever possible.

As only two of the code segments 82 have been disclosed, one associated with transmitter A and the other associated with transmitter B, the polar operation description will be confined to these segments. Likewise, inasmuch as only two tape feeler arms 12 have been disclosed, one connected to each of the above-mentioned segments and one associated with transmitter A and the other with transmitter B, the following description will be confined to these tape feeler levers 12. An assumption will be made for explanation purposes, that the feeler lever 12 shown for transmitter B is in its spacing position, that is, has not sensed a perforation in the tape, and that the tape feeler lever 12 associated with transmitter A has sensed a perforation in the tape and moved to its marking position.

Inasmuch as in the rotation of the brush arm 74 it passes over the code segment 82 associated with transmitter B prior to passing over the similar code segment 82 associated with transmitter A the following description will be made on such a basis.

In the description immediately following, it is to be assumed that the lever 48 associated with the B transmitter is in its unoperated or extreme clockwise position, as viewed in Fig. 3, rather than as shown. Under such a condition the contact pair 53, 54 and the contact pair 169, 194 would be opened rather than closed, whereas the contact pair 169, 168 would be closed (normal positions). The lever 48 (B transmitter) has been illustrated as shown in Fig. 3 in order to disclose more clearly a condition to be described hereinafter.

As was mentioned above in the present example, it is assumed that the feeler lever 12 shown for transmitter B is in its spacing condition, that is, the condition when there is no perforation in the tape opposite the pin 14 of that particular lever. Under such a condition the feeler lever 12 is held in its normal position; that is, extreme counterclockwise position, as shown in Fig. 3. When the feeler lever 12 is in this position, its contact arm 17 associated therewith is in engagement with the upper electrical contact 18, as shown. The result of such contact engagement is the establishment of an electrical circuit which may be traced from grounded positive battery 161, over a conductor 162, over an armature 163 of a relay 164, over a conductor 166, over a conductor 167, through an electrical contact 168 which is normally in engagement with a movable swinger arm 169, through the swinger arm 169, over a conductor 171 to the contact point 18, through the contact arm 17 in engagement therewith, through the spring 16, through the contact lug 22, over the conductor 106, through the armature 107 of relay 133 (in its left-hand position due to the energization of the relay 133 during two-channel transmission) and through the conductor 108 to the B code segment 82, through the brush arm 74, through the solid ring 72, and over the line conductor 119 to ground at the distant station. Thus, in the condition just described spacing or positive potential has been applied to the line conductor 119.

Immediately after the brush arm 74 traverses

the B code segment 82 just described, it passes over an A code segment 82 associated with transmitter A. Inasmuch as we have assumed that the feeler lever 12 of transmitter A, shown in the drawing, was in marking position, that is, its pin 14 had passed through a perforation in the tape and the lever 12 was pivoted in a clockwise direction, its associated contact arm 17 will be in engagement with the lower electrical contact 19. Thus, an electrical circuit may be traced from negative grounded battery 172, over a common conductor 173, through the electrical contact 19, through the contact arm 17, through the spring 16, through the contact lug 22, through the conductor 110 to the A segment 82, over the brush arm 74, over the solid ring 72, and over the line conductor 119 to ground at the distant station. Thus, it may be seen that a marking or negative battery condition will exist on the line conductor 119 during the traversal of the A segment 82 by the brush arm 74.

It is to be seen that transmitter A has a similar contact 163 normally closed at the movable swinger 169, so that in the event that any of the feeler levers 12 associated with transmitter A were in their spacing position, that is, with the pins 14 not entering a perforation in the tape, spacing battery 161 would be supplied to the code segment 82 associated with transmitter A over a conductor 174. Likewise, in the event that any of the feeler levers 12 of transmitter B was in its marking position, that is, with the pins entering a perforation in the tape, negative battery 172 would be supplied directly over conductor 173 to establish a negative battery or marking condition on the line conductor 119 through the B code segments 82 associated with transmitter B.

It is to be noted that in polar operation of the apparatus, Fig. 3, there is also provided the switch-over means through a relay 133 (not shown) and the armatures 107, so that in the event that it is desired to transmit over a single channel rather than the two channels, such change-over may occur. Likewise, an armature 16 is provided, associated with the switch-over of the short segment 84 from the stop segment 83 to the start segment 81 when operation over a single channel is desired, rather than two-channel transmission. The operation of this is similar to that described with respect to neutral operation.

It is to be noted that negative marking battery 172 is supplied over a conductor 176 to junction point 177, and over a conductor 178 to the stop segment 83 of the segmented distributor ring. Thus, when the brush arm 74 is bridging the stop segment 83, marking battery will be applied through the brush arm 74, through the solid ring 72, and over the line conductor 119. Likewise, when the brush arm 74 is on the start segment 81, positive spacing battery is applied from grounded battery 161, over conductor 162, through armature 163, over the conductor 166, over the conductor 179, and over the conductor 181 to the start segment 81 wherefrom it is applied to the brush arm 74 and the solid ring 72 to the line conductor 119. Such electrical circuits are necessary, inasmuch as in polar signal operation it is necessary that there be a marking or negative battery condition continuously on the line, and which is broken by a start or positive battery spacing impulse. Likewise, the code impulses may be either positive (spacing) or nega-

tive (marking), depending on the perforations in the tape.

In the event that both transmitters A and B were to be shut down for some reason, the brush arm 74 would still continue to rotate over the segments of the distributor face and if no changes were made negative marking battery would be transmitted over the line conductor 119 as the brush arm 74 rotated over the stop segment 82, whereas positive spacing battery would be transmitted over the line conductor 119 as the brush 74 rotated over the start segment 81 and all of the code segments 82. This would result in the initiation of operation of the receivers at the distant station which would cause them to space every time that the brush arm 74 completed a revolution. It is obvious that this is not a good condition as the receivers would not have any stop condition. In order to prevent such an occurrence, a pair of contacts 53, 54 has been provided for each of the tape transmitters similarly to that described with respect to Figs. 1 and 2. Therefore, at such time as the tape transmitters are shut off by means of the operation of the three-armed shut-off levers 36, the downward movement of the bail blocking levers 48 will result in the contacts 53, 54 being closed. When these latter contacts are closed an electrical circuit may be traced from local source of D. C. power 182, over the conductor 183, through the now closed contact pair 53, 54 associated with transmitter B, over a conductor 184, through the closed contact pair 53, 54 associated with transmitter A, over a conductor 186, through the coil of the relay 164, and over a conductor 187 back to the source of D. C. power 182. As a result of this circuit being established the relay 164 will be energized. Upon the energization of the relay 164, the armatures 163 and 189 are attracted thereto, which has the effect, as may be seen, of opening one circuit and closing a second circuit. The electrical circuit which is opened is the one previously described to the start segment 81 and the spacing contacts 19; namely, from the positive spacing battery 161 over the conductor 162 and through the armature 163. Therefore, the start segment 81 and the spacing contacts 19 will no longer be supplied with spacing battery.

Upon the armature 189 being attracted due to the energization of the relay 164, an electrical circuit is completed which supplies negative marking battery 172 to the line conductor 119 by means of the conductor 176, the armature 189, and a conductor 191. Thus, it may be seen that negative marking battery is supplied to the line conductor 119 in such a manner that it by-passes the distributor completely, and therefore is not dependent on the operation of the latter to keep the receivers at the distant station in an unoperative or stop condition.

In the event that only one of the tape transmitters is shut down by the manual operation of the shut-off lever 36, and the subsequent locking of the bail 32 to an unoperative position by means of the lock-out lever 48 associated therewith, the other contacts 53, 54 associated with the still operative tape transmitter will not be closed, and therefore no electrical circuit will be established for the energization of the relay 164. Such a marking on the line by-pass circuit is not necessary or warranted under this condition, inasmuch as the second tape transmitter must still transmit message signals over the line conductor 119, and therefore it is necessary that both mark-

ing and spacing battery be presented to the line in order for the receiving printer at the distant station associated with that particular tape transmitter to operate successfully.

In the event that only one of the tape transmitters is caused to be unoperative, by means of the manual operation of the shut-off lever 36, as the brush arm 74 rotates over the code segments 82 associated with that particular tape transmitter, and inasmuch as the associated feeler levers 12 will be held in their spacing position in engagement with the upper contact 18, spacing battery 161 would ordinarily be applied to the five code segments 82 of that tape transmitter, resulting in an allspacing or blank signal being transmitted over the line conductor 119. Inasmuch as only a single stop and start segment is provided to operate for both of the tape transmitters and for the two printers at the distant station, both of the printers would be operated but one would receive a blank signal. In certain telegraphic systems the blank or all spacing signal is utilized solely for switching or station selection purposes. Therefore, it would be disadvantageous to have such a condition exist; in order to offset such a possibility occurring, apparatus has been provided whereby spacing signals will not be transmitted over the line conductor when one of the tape transmitters is in its unoperated condition.

As previously mentioned, a swinger contact arm 169 is provided which is normally in engagement with the electrical contact 168. This swinger arm 169 is connected by an insulated section 193 with the contact arm 53 which is under the control of the lock-out lever 48. Therefore, in the event that the lock-out lever 48 is operated to lock the bail 32 of one of the tape transmitters, the swinger contact 169 under the control of the insulated section 193 will be moved from engagement with the electrical contact 168 and instead will be positioned in engagement with an electrical contact 194. The contact 194 is normally open and such engagement will only be made during the time that the brush arm 74 is on the stop segment, as described with regard to prior descriptions. Assuming that the lowermost blocking lever 48 in Fig. 3, associated with tape transmitter B, had been operated by means of the three-armed block-out lever 36 being manually rotated in a clockwise manner, the insulated section 193 will be moved downwardly under the control of the electrical contact arm 53 and the movable contact swinger 169 will be removed from engagement with electrical contact 168 and positioned instead in engagement with the electrical contact 194. As a result of the movement of the electrical contact, spacing battery which was formerly supplied from grounded battery 161, over conductor 162, through armature 163, over conductor 166, through the electrical contact 168, through the electrical contact swinger 169, over the conductor 171 and therefore to the spacing contacts 18, will no longer be possible inasmuch as the electrical circuit just traced is broken between the electrical contact 168 and the swinger 169. Instead, negative marking battery will now be supplied from the grounded marking battery 172, over the conductor 195 to the electrical contact 194, through the swinger arm 169, and over the conductor 171 to the spacing electrical contact 18. At such time as the tape feeler levers 12 are held in their unoperated or counterclockwise position, with the contact arm 17 in engagement with the spacing

contact 13, negative marking battery will be supplied from the contact 13, through the contact arm 17, through the spring 16, through the contact lug 22, over the conductor 106, through the armature 107, through the conductor 108, and to the B code segment 82. Therefore, under this special condition which would ordinarily transmit a "blank" or all spacing signal over the line conductor 119, five marking impulses or a "letters" combination will be transmitted instead. The "letters" combination transmitted over the line conductor will not cause any switching or station selection, inasmuch as the normal telegraphic system does not depend on this combination for such function to occur.

It is to be understood that the above condition exists only at such time as the block out lever 48 is operated under the control of the three-armed lever 36 to lock out the associated bail 32 and thereby hold the tape sensing levers 12 of that particular tape transmitter in an unoperated position. This condition will not exist under normal transmission as at such time a blank signal may actually be sent out over the line conductor 119 from the tape, or during such time as the brush arm 74 is on the stop segment 83 and all of the tape feeler levers 12 are held in their unoperative position so that the tape may be stepped. Such is obvious, because during these two conditions, the block-out lever 48 will not be operated, and therefore, the electrical swinger arm 169 will be in engagement with the electrical contact 168 and not in engagement with the electrical contact 194.

While the above description has been made with respect to transmitter B only, it is obvious, inasmuch as both of the tape transmitters are supplied with a similar contact under the control of the block-out lever 48, that if either of the tape transmitters are shut off a "letters" signal will be sent by that particular transmitter. This condition does not occur when both of the block-out levers 48 are operated, inasmuch as at that time marking battery is applied directly to the line conductor through the then attracted armature 189 of the relay 164 as described above.

Likewise, even though the two special contacts have been provided, associated with each of the lock-out levers 48, to supply marking battery through the code segments 82 of the distributor when the tape transmitters are held in an unoperated position, it is still necessary to provide the relay 164 when both transmitters are stopped. This is necessitated because even under the conditions described immediately above and under which marking impulses would be transmitted from the stop segment 83 and the ten code segments 82, spacing battery would still be transmitted from the start segment 81, as traced from the spacing battery 161, over the conductor 162 through the armature 163, over the conductors 166, 179, and 181 to the start segment 81. Therefore, even with the provisions described above, it is still necessary to have the relay 164 operated when both of the tape transmitters are shut down, to thereby cause the armature 163 to be attracted thereto, thus preventing the spacing battery from reaching the start segment, which, in turn, upon being transmitted over the line conductor 119 would cause the distant printers to be operated. As mentioned before, this is accomplished by supplying marking battery 163 directly to the line conductor 119, through the then attracted armature 189, thereby by-passing the segmented distributor completely.

Referring back to Fig. 2, the distant printers PA and PB, previously mentioned, comprise a line relay, a selector magnet, and a ground connection. It is to be noted in the instant disclosure that the line conductor 119 does not go directly to the receiving printers PA and PB, but instead pass through a pair of regenerative repeaters 197 and 198. These regenerative repeaters 197 and 198 are standard regenerative repeaters as disclosed in U. S. Patent No. 2,105,173, issued to W. J. Zenner et al. on January 11, 1938, with the exception that their orientation devices are so positioned that the regenerative repeater 197 will only be responsive to a particular group of code signals, for instance those transmitted from transmitter A, whereas the regenerative repeater 198 will be responsive only to a second group of signals, such as those transmitted from transmitter B. However, both of the regenerative repeaters 197 and 198 are responsive to the single start and stop impulses transmitted over the line conductor.

The signals received by the regenerative repeater will be repeated directly to the individual printer PA or PB associated therewith. Thus, the results of such a provision is that standard telegraphic printers such as are disclosed in U. S. Patent No. 1,904,164, issued to S. Morton et al. on April 18, 1933, and as described in Bulletin No. 138 issued in October 1941, by the Teletype Corporation, Chicago, Illinois, may be used without altering the standard range finder or orientation device setting. In this manner the two regenerative repeaters 197 and 198 are responsive to the incoming signals and thereby retransmit the proper signal group to the proper receiving printer PA or PB. Further, it is possible by using such regenerative repeaters to not only transmit the incoming signals to the proper printer PA or PB, but also to retransmit them to a second distant station. Similar equipment would be provided in the polar operation, as shown in Fig. 3.

However, it is not necessary that regenerative repeaters be inserted immediately before the printers PA and PB. It is possible to adjust the orientation device associated with the printers disclosed in the above-mentioned Morton et al. patent in such a manner that two series printers will each be responsive to the stop and start impulses, but each one will be only responsive to a single group of code impulses.

Although a specific embodiment of the invention has been shown and described, it will be understood that this embodiment is but illustrative and that various modifications may be made therein without departing from the scope and spirit of the invention.

What is claimed is:

1. In a start-stop telegraph system, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, and means operating to block the operation of one of said bails independently of said distributor associated means thereby rendering one of said tape transmitters unoperative and to alter the connections between said distributor and said tape transmitters whereby the first of said tape transmitters is disconnected from said code segments of said distributor

and the other of said tape transmitters is connected to all of said code segments of said distributor.

2. In a start-stop telegraph system, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, a switch-over lever for controlling the altering of the connections between said distributor and said tape transmitters whereby upon operation one of said tape transmitters is connected to all of said code segments of said distributor, and means associated with and under the control of said switch-over lever for blocking the operation of said bail associated with the other of said tape transmitters whereby said other tape transmitter is rendered unoperative.

3. In a start-stop telegraph system, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, and a shut-off lever associated with each of said tape transmitters whereby upon operation of one of said shut-off levers said associated bail is caused to be blocked and said tape transmitter to be rendered unoperative.

4. In a start-stop telegraph system, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, a shut-off lever associated with each of said tape transmitters, and an electrical contact associated with each of said shut-off levers whereby when both of said levers are operated to cause both of said tape transmitters to be rendered unoperative said contacts are closed to establish an electrical circuit to directly apply potential to a line conductor completely by-passing said distributor.

5. In telegraph transmitting apparatus, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a plurality of marking contacts and a plurality of spacing contacts associated with said signal forming means in each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, means to normally transmit spacing potential from said spacing contacts and marking potential from said marking contacts, means to block one of said bails whereby said associated tape transmitter is rendered unoperative with said spacing contacts conditioned, and means under the control of said bail blocking means to cause marking

potential to be applied to said spacing contacts.

6. In telegraph transmitting apparatus, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a plurality of marking contacts and a plurality of spacing contacts associated with said signal forming means in each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, means to normally transmit spacing potential from said spacing contacts and marking potential from said marking contacts, means to block one of said bails whereby said associated tape transmitter is rendered unoperative, and means under the control of said bail blocking means to cause potential of an opposite polarity to be transmitted from one of said sets of contacts.

7. In start-stop transmitting apparatus, a distributor comprising a solid ring and a segmented ring, said segmented ring including a start segment, a plurality of code segments, and a stop segment, a brush arm for bridging said solid and segmented rings, means to rotate said brush arm, a pair of tape transmitters each connected to half of said code segments in alternate sequential order, means to alter said connections whereby one of said tape transmitters is connected to all of said code segments and the other of said tape transmitters is disconnected from said code segments, said latter means being operative to reconnect said two tape transmitters to said code segments as initially described, and means to preclude such reconnection at any time other than when said brush arm is on said stop segment.

8. In a start-stop telegraph system, a pair of tape transmitters, a distributor having a plurality of code segments half of which are connected to each of said tape transmitters in alternate sequential order, signal forming means associated with each of said tape transmitters, a bail associated with each of said tape transmitters for controlling said signal forming means, means associated with said distributor for controlling the operation of said bails, a shut-off lever associated with each of said tape transmitters whereby upon operation of one of said shut-off levers said associated bail is caused to be blocked and said tape transmitter to be rendered unoperative, and means to prevent said unoperative transmitter from being rendered operative except under a predetermined condition of said distributor.

9. In a signal generator, a distributor provided for transmitting code impulses and a stop impulse, a pair of signal initiating means each connected to said distributor for initiating the code impulses, means to alter said connections whereby one of said signal initiating means is connected to said distributor and the other of said signal initiating means is disconnected from said distributor, said latter means being operative to reconnect said pair of signal initiating means to said distributor, and means to preclude such reconnection at any time other than during the transmittal of the stop impulse by said distributor.

10. In start-stop transmitting apparatus, a distributor including a plurality of code segments for transmitting code impulses and a stop seg-

ment for transmitting a stop impulse, a pair of signal initiating means each connected to half of said code segments, means to alter said connections whereby one of said signal initiating means is connected to all of said code segments and the other of said signal initiating means is disconnected from said code segments, said latter means being operative to reconnect said two signal initiating means to said code segments as initially described, and means to preclude such reconnection at any time other than during the

transmittal of the stop impulse by said distributor.

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REFERENCES CITED

The following references are of record in the file of this patent:

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