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COLLATERAL CONTROL BY TAPE SLACK

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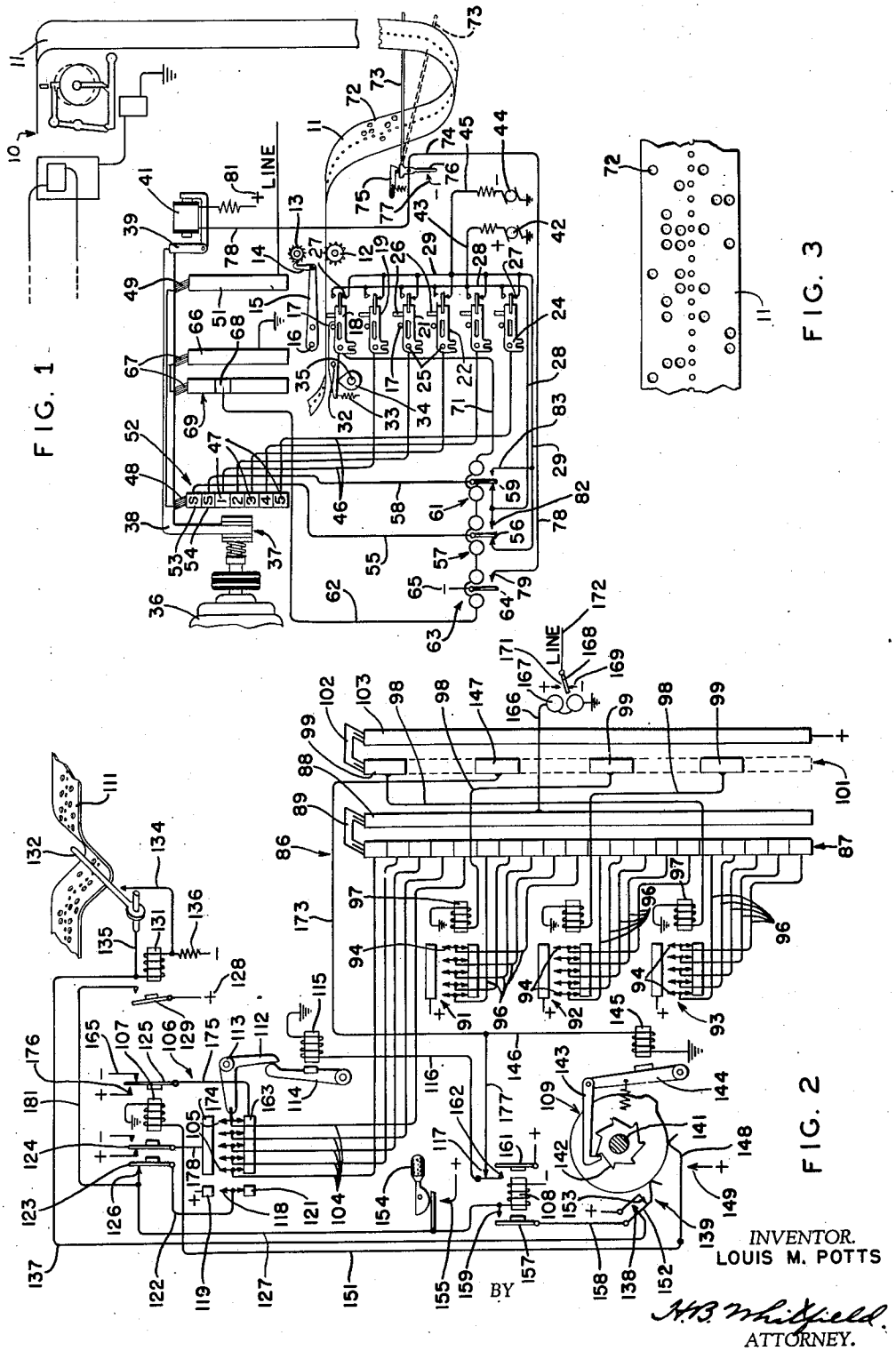

FIG. 1

FIG. 3

FIG. 2

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COLLATERAL CONTROL BY TAPE SLACK

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Original application September 19, 1929, Serial No. 393,761, now Patent No. 2,134,005, dated October 25, 1938. Divided and this application August 31, 1938, Serial No. 227,671

43 Claims. (Cl. 178—17)

The present invention relates to telegraph systems and more particularly to telegraph systems wherein the apparatus is under the control of a previously prepared control strip.

The present application is a division of U. S. Patent No. 2,134,005, Serial No. 393,761 filed September 19, 1929, for Selective control system and apparatus.

A primary object of the present invention is to provide means for automatically controlling the sequence in telegraph transmission of successive code combinations of impulses relating to a complete message when a predetermined condition obtains in the control form or strip.

Another object of the invention resides in the control of transmission from a control strip by dual conditions established by the control strip and by a signal indicia therein.

In its contemplated embodiment, the invention may be concisely described as comprising tape transmitting apparatus including one or more record readers each having a set of feeler levers, which is successively presented to and withdrawn from tape supporting means between the record reader and a point from which the tape emerges such as the preparing machine, with a space interval between the two points at which the tape may form a loop. At predetermined points on the tape and preferably with respect to the message matter thereon a mark or index is applied for denoting the termination of each message. A pivotal switch controlling arm is presented so that its extremity may extend over the region occupied by the tape loop and so that the forshortening of the loop will cause the tape to engage the arm and rotate it about its pivot causing a contact operation to be effected for establishing a preparatory circuit. The tape is permitted to proceed in accordance with the conventional operation of the record reader until the aforementioned predetermined mark or index arrives at the point of sensing by the feeler levers, whereupon a condition is established supplementing the preparatory circuit arresting advancement of the tape subject to a replenishment in its supply which will establish a loop in the tape and continue the operation.

For a more comprehensive understanding of the present invention, reference may be had to the accompanying drawing and to the detailed specification following hereinafter wherein like reference characters designate corresponding parts throughout, and wherein

Fig. 1 is a diagrammatic circuit illustration of a start-stop transmitting apparatus having embodied therewith one form of the present invention,

Fig. 2 is a diagrammatic circuit illustration of another form of the present invention as applied to a multiplex type of message transmitting assembly, and

Fig. 3 is a fragmentary detail view of a section of control from which illustrates the arrangement of special control perforations thereon.

In Fig. 1 a perforated tape 11, prepared by an automatic reperforating mechanism such as that indicated by the reference character 10, is fed through the record reader unit of an automatic transmitter by means of the feed wheel 12, the teeth of which engage the central row of perforations in the tape 11. The location of reperforator 10 with respect to the transmitter record reader is such as to afford an intervening space whereat the prepared tape may be permitted to accumulate to form a loop if the rate of tape preparation exceeds that of signal transmission. As transmission overtakes tape preparation the tape loop is consumed approaching a taut condition and lifting the slack probing arm 73 as will be explained later. It is manifest that the relative positioning of the tape senser and reperforator of Fig. 1 is merely diagrammatic. Obviously, the units may be arranged so that the tape between them when taut assumes substantially a horizontal plane. Tape feed wheel 12 is rotated in a step-by-step manner when a ratchet wheel 13 integrally associated with it on a common shaft is engaged during the successive reciprocable action of a tape feed pawl 14, the latter being carried upon an arm 15, pivoted at 16 and moved by the bail rod 17.

In operative relation with the perforations of the tape and positioned across the tape 11 are a set of individual feeler levers 18, 19, 21, 22, 23, and 24. Said feeler levers are mounted on a common shaft 25 about which they are urged in a counterclockwise direction under impetus of individual springs (not shown). Each feeler lever is provided with an individual feeler pin 26 which, when its associated lever is moved in a counterclockwise direction about pivot 25, engages a position in the tape whereat there may or may not be a code perforation, depending, of course, upon the permutation characteristics of each signal code that is presented in the proximity of the feeler lever alignment for sensing. Each feeler lever 18, 19, etc., is also provided with a contact extension member or contactor 27 capable of engaging alternatively one or another of a pair of contact points the upper ones of

which are associated with a positive current circuit 28 and the lower ones with a negative current circuit 29.

Bail rod 17, in addition to being secured to the tape feed lever arm 15, is also secured to a power arm 31 and extends transversely across the top of the feeler levers 18, 19, etc., as conventionally illustrated in Fig. 1. Power arm 31 is itself pivoted at 32 and is influenced in a counter-clockwise (tape sensing) direction by a spring 33. A cam having a single apex is carried upon a shaft 35 which may be driven from any suitable source of power. One such source is represented by the motor 36, which through a friction clutch 37 rotates the distributor brush arm 38, when the stop pawl 39 is withdrawn as a result of the energization of release magnet 41. It is to be accepted that shaft 35 is also driven through clutch 37 in any suitable manner and at the same speed in order that the arrestment of brush carrier 38 will at the same time suspend the rotation of shaft 35.

Circuits 28 and 29 mentioned above may be termed current supply circuits, each having associated with it a generator 42 or 44 for producing a current having an individual signalling characteristic, e. g. positive current generator 42 is shown connected over lead 43 with line 28 and a negative current generator 44 shown connected over a line 45 with circuit 29. When any of the contact extensions 27 are in engagement with their upper or lower contacts current is projected from current supply circuits 28 or 29 through such contact extensions 27 and their associated feeler levers 18, 19, etc., their individual distributor conditioning circuit 46 to the corresponding segments 47 of the distributor ring 52. When in the course of a distribution cycle, brush carrier 38 sweeps across said segments 47, its brushes 48 and 49 which are connected electrically together, cause to be projected the signal impulse conditions over the aforedescribed circuit paths through the distributor ring 51 onto the signal transmission line.

Distributor ring 52 of which the aforedescribed segments 47 are a part, includes also the stop and start segments 53 and 54 in the manner of conventional start-stop distributors. Segment 53 which is the stop segment, is connected over a line 55 with the contactor 56 of a polar relay 57, while start segment 54 is in a similar manner connected over a line 58 to the contactor 59 of a polar relay 61.

In series with polar relays 57 and 61 is another polar relay 63 having an armature 64 which is connected to negative current supply source at 65. A periodically established circuit which extends through the relays 57, 61, and 63 originates at ground which is connected through a distributor ring 66, thence through a pair of connected distributor brushes 67, a segment 68 of distributor ring 69 (when said brushes 67 are in the proper cyclic position), line 62 through the relays 63, 57, and 61, in series, line 71 to the feeler lever 18 aforedescribed. Thereafter the circuit continues either over positive line 28 or negative line 29 depending upon whether feeler 18 encounters a perforation 72 or a non-perforated condition in the sixth hole position of the tape, Fig. 3, as will be described in detail later.

It is to be noted that the tape sensing apparatus in the instant embodiment comprises six feeler levers 18, 19, etc., already described, though the perforated tape 11 is prepared in accordance with but a five-unit fundamental code as described in United States Patent No. 2,134,005 and as illustrated in Fig. 14 thereof. The sixth hole perforation 72, Fig. 3, is arranged to track in the longitudinal file in which the tape sensing lever 18 is operatively disposed. Particular attention is directed now to the tape slack arm 73 which is pivoted at 74 and which may be held in a horizontal position when manual detent pawl 75 engages a projection thereon. Except when so restrained, arm 73 by reason of its weight, seeks to assume a drooped or tilted position unless the tape 11 is too taut to permit the necessary freedom, in which case the arm 73 will dwell upon the tape to whatever extent it may be permitted to do so. A contact arm 76 also is integrally associated with the arm 73. It engages a contact point 77, for introducing negative at this point, during the time that the arm 73 is permitted to tilt or to assume its extreme clockwise position. A conductor 78 which is electrically associated with the contactor 76, extends from a right-hand contact point 79 of relay 63 to the contactor 76 of arm 73 and thereafter on through the winding of relay 41 to positive source at 81.

Under ordinary operating conditions with sufficient slack in the tape 11 between the reperforator 10 and the tape sensing unit to form a loop, as illustrated in Fig. 1, arm 73 may assume a drooping position, as illustrated in dotted outline. This condition will prevail so long as the amount of prepared tape is equal to or is in excess of the linear quantity of tape which passes through the tape sensing unit. When a condition obtains under which the supplied tape is less than the tape consumed during transmission, then the storage quantity, represented by the size of the loop, will correspondingly diminish. Eventually the loop in the tape will become sufficiently shortened so as to engage and lift the arm 73 to a level so as to withdraw contactor 76 from its contact point 77 opening the circuit and removing negative supply thereat. The circuit 78 is not dependent solely upon this source of supply for negative current, for it will be recalled that at 65 is another source under the control of polar relay 63. In the illustration of Figs. 1 and 2, the amount of angular movement described by the tape slack sensing arms 73 and 132 is illustrated at comparatively short range. This is so because there is contemplated in the specific illustration brief message matter of but few code combination signals. Where messages of larger proportion might be used the degree of movement of lever arms 73 and 132 will be correspondingly greater.

Negative current is supplied from source 65 during all times except at the start of a quotation message when feeler lever 18 is permitted to rock counterclockwise on account of encountering a perforation 72 in the tape 11. Accordingly, the distributor brush carrier 38 is permitted to revolve continuously because of the continuous energization of magnet 41 except when negative is withdrawn at source 65 after having already been removed from source 77. This condition will occur only after arm 73 has been lifted due to a taut condition of the tape 11 followed by an end-of-message operation of relay 63 (due to the perforation 72) withdrawing its armature 64 from contact point 79.

It will be understood from the foregoing description that tape slack arm 73 may be rotated

counterclockwise from its tilted position (in dotted outline) under the control of the tape. The extent of its movement thereafter will correspond to variable conditions but under no circumstance beyond the point at which the end-of-message perforation 72 is encountered by the sixth hole feeler lever 18. Since negative is supplied to line 78 from source 65 at all times except during the occurrence of the end-of-message signal having the perforation 72, it will be understood that the control of distributor magnet 41 is at all times maintained by the supervisory relay 63 except upon the occurrence of said end-of-message signal. Under this recited exception the control is transferred from relay 63 to the mechanical relay or control arm 73. This is so because with the interruption of circuit 78 the tape advancing mechanism is arrested, since, as has been stated, it too is driven through clutch 37.

Being on the same control circuit as supervisory relay 63, relays 57 and 61 also respond to the mechanical conditioning of the sixth hole feeler 18. Accordingly, their armatures 56 and 59, when no hole is encountered by lever 18, will be attracted to their right-hand contact points 82 and 83 the latter being a part of negative current supply circuit 29 while the former is connected with the positive supply line 28. Armature 56 of relay 57 is connected over line 55 with the stop impulse segment 53 of distributor ring 52 imparting positive current thereto in all cases except when said relay 57 is operated in the special manner by feeler lever 18. Correspondingly, armature 59 is connected over line 58 with the start segment 54. Accordingly, negative will be supplied to the start segment 54 under all conditions when no hole is encountered by the feeler lever 18 and positive will be supplied under the said special condition.

Under the special condition, that is, when a hole is encountered by feeler lever 18 and when thereafter brushes 67 complete the circuit 62 to ground as aforedescribed, an opposite condition will prevail causing the relays 63, 57, and 61 to move their armatures 64, 56 and 59 toward the left-hand side. In the case of relay 63, as has already been described, this will merely result in the opening of the circuit 78 but in the case of relays 57 and 61 whose armatures 56 and 59 in both instances complete circuit conditions, there will result a reversal in polarity with circuit 29 connected to the stop segment circuit 55 and circuit 28 connected to the start segment circuit 58. Accordingly, start segment 53 and stop segment 54 being in their normal condition plus and minus current they will under the special circumstance be supplied minus and plus respectively.

The purpose in reversing the potentials of the start and stop segments is to afford a method for assuring correct orientation or phasing of the receiving apparatus distributor as more particularly explained and described in the parent application.

Multiplex transmitter

Referring now to Fig. 2 the reference character 86 designates a standard four channel multiplex sending distributor such as is generally known in the telegraph art but modified in accordance with the present invention. Distributor 86 comprises a segmented ring 87 and a solid ring 88 companionate thereto, and the two bridged by a pair of brushes 89. The segments of ring 87 are twenty in number comprised of four groups of five segments each. Associated with the last three groups of segments on ring 87 are three standard telegraph transmitter units indicated 91, 92, and 93. These units are illustrated diagrammatically in accordance with conventional practice. Each unit contemplates a tape sensing mechanism having a set of feeler levers of which the contactors are designated by the reference characters 94. Each set of contactors 94 is connected over individual cables comprising five lines 96 to its associated segments of ring 87.

Each transmitting unit is provided with a supervisory magnet 97 connected over an individual conductor 98 to an associated segment 99 on a segmented ring 101. The several segments 99 of ring 101 are bridged by a pair of brushes 102 with a solid ring 103, the latter being connected to the positive side of battery. The movement of brush 102 over the segments of ring 103 of any one of the transmitter units 91 to 93 energizes the supervisory magnet 97 thereof over a circuit which includes the associated segment 99 on ring 101. Locating of each of said segments 99 just below the position of its associated set of signal impulse segments in ring 87 provides a condition whereby the tape sensing contacts may be prepared to be operated in accordance with a new code setting immediately after the transmission of the preceding code combination.

Referring now more particularly to the first five segments of ring 87 it will be noted that these are connected over the cable conductors 104 to the transmitter contacts 105 of the special transmitting unit 106. This unit has been modified from the conventional construction exemplified by the other three units by having included with it the pole changing relay 107, the starting relay 108, and the cam mechanism 109 which will be described more fully hereinafter. The feelers of transmitter 106 are operated so as to engage their upper or positive bus 174 or their lower or negative bus 163 in accordance with the perforations in a control tape 111.

Bell crank 112 pivoted at 113 returns the feeler levers 105 against the influence of their individual operating springs (not shown) and with its other arm is in turn actuated by an armature 114 of a magnet 115. Magnet 115 is connected over conductor 116 to the make-before-break switch 117. In addition to the five standard feeler levers 105, transmitter 106 is provided with another feeler lever 118 which operates between an individual set of contact buses 119 and 121 under the control of a sixth perforation, such as that described in the above embodiment with Fig. 3. Feeler contact 118 is connected over line 122 with an armature 123, which, in turn, is under the supervision of the aforementioned pole changing relay 107.

The pole changing or synchonising relay 107 controls armature 123, as just described, as well as the armatures 124 and 125; the latter two operate to change the polarity of the contact plates 163 and 174 of the transmitter 106. When relay 107 is energized, the upper contact plate 174 becomes negative and the lower contact plate 163 positive, whereas, when relay 107 is de-energized, the upper contact plate is positive and the lower contact plate negative. Armature 123, when de-energized, engages its back contact 126 extending positive current from plate 119 over the line 127. Circuit 127 extends through the winding of the starting relay 108, the opposite terminal of which is connected to a negative current supply source.

A tape follower arm 132, pivoted at 133, controls a shunt circuit around the relay 131 comprising the conductors 134 and 135. The energizing circuit for relay 131 extends from negative side of battery through a resistance 136, winding of relay 131, conductor 137 to the contact 138 of the make-before-break switch 139. This switch is actuated by the aforementioned cam 109 which is secured to the shaft 141 together with a ratchet wheel 142. A feed pawl 143, for engaging and actuating the ratchet wheel 142, is pivotally carried by an armature lever 144 of the stepping magnet 145. As in the case of supervising magnets 97, stepping magnet 145 is connected over a conductor 146 to a segment 147 of ring 101.

During each cycle of the main cam 109, and before it encounters the make-before-break switch 139, it engages first the follower contactor 148. In so doing, it thrusts contactor 148 against the contact point 149, completing a circuit for energizing the change-over relay 107 as follows: from positive current source through the contact point 149, contactor 148, line 151, winding of relay 107 to ground. As a result the change-over relay armatures 124 and 125 as well as is the armature 123, are pulled up causing, as in the case of the preferred embodiment, a reversal in the current characteristics of the start and stop impulses of a phasing signal code.

Key 154 is employed manually as a start key and controls the application of positive polarity to contactor 156 of conductor 127 from an auxiliary supply source 155. To start operation, the driving motor (not shown) is energized and the manual start key 154 is operated to close its contactor 156 with contact point 155. This completes an obvious energizing circuit for start relay 108 completing a locking circuit for itself over armature 157, and including positive current source contact 153, contactor 152, line 158, armature 157, contact point 159, winding of relay 108 to negative battery. Also, armature 161 is drawn up closing with contact 162 and causing first to be completed an obvious circuit for energizing the record reader operating magnet 115, followed immediately by the opening of the circuit at line 177, including contact point 117.

As a result of the energization of the record reader magnet 115, its armature 114 is attracted, causing bell crank 112 to be rocked in a counter-clockwise direction about its pivot 113 and withdrawing the feeler pins represented by the elements 105. Accordingly, all of the feelers 105 are held so as to establish electrical contact with their lower contact block or bus 163 and, with their feeler projections, withdrawn from engagement with the tape.

The distributor brushes 89 and 102 revolve continuously and at regulated speeds. As the brushes 89 move over the first five segments of ring 87, five impulses, originating from the negative side of battery at 165 conveyed through armature 125, line 175 and bus 163 are transmitted over the brushes 87 to the distributor ring 88 and thereafter through line 166, causing to be energized the polar transmitting relay 167 accordingly. An armature 168, under the control of polar relay 167, in turn reciprocates between a pair of current supply contacts 169 and 171, introducing negative and positive current impulses correspondingly over the line 172.

Immediately following the transmission over the conductor cable 104, brush pair 102, wipe over segment 147 and ring 103, completing an energizing circuit for the sequence switch magnet 145 as follows: from positive side of battery, through ring 103, brushes 102, segment 147, lines 173 and 146, winding of magnet 145 to ground. Stepping magnet 145, upon energization, attracts its armature 144 moving the operating pawl 143 to the right and rotating the ratchet wheel 142 and its integrally associated shaft 141 and cam 109 a like distance. In the instant embodiment, this movement corresponds to $1/7$ of a revolution. Because relay 108 has been operated manually as described above, the circuit at contact point 117 will still be open. As the brushes 89 continue moving over the succeeding steps of five segments on ring 87, telegraph code combinations from the transmitters 91 to 93 are distributed over their corresponding sets of five segments in said ring 87, and following each code transmission from one of said transmitters, its individual magnet 97 is energized and de-energized as the brush pair 102 moves on and off its associated segments 99, conditioning the individual transmitter for the succeeding code to be transmitted.

The above cycles of operation are transmitted as magnet 145 is energized once during each revolution of the brushes of the distributor 86, the instant of energization being when brushes 102 encounter the segment 147. At the time when the apex of cam 109 engages the follower 148, however, positive polarity from source 149 over circuit 151 causes to be energized the change-over relay 107. This operation coincides with the seventh cycle of revolution and, as has already been explained, the energization of relay 107 causes to be reversed the characteristics of the electrical impulses of the seventh signal as a result of the operation of armatures 124 and 125.

In the distributor 86, each five segments, relating to a separate transmitter 91 to 93 etc., is commonly referred to as a channel and for the first channel, the brushes 89 send to the signaling relay 167 five negative impulses in each revolution except in the recurrent seventh revolution, in which case five positive impulses are transmitted.

During the six regular revolutions of the distributor 86, the energizing circuit of signaling relay 167 extends from ground through the winding of relay 167, line 166, distributor ring 88, brushes 89, one of the cables 96 or 104, the electrical contacts of its five feelers; for example, in the case of the improved transmitter the feelers 105, and through those of said feelers which are down to the junction block 163, line 175, armature 125 and its back contact point 165 to negative battery. When pole changing relay 107 is energized, as the result of the advance of apex of cam 109, the latter portion of the just described circuits is altered because armature 125 is then in engagement with its front contact point 176 introducing instead positive battery, as will be observed at this source. By this sequence of thirty pulses negative and five pulses positive, indefinitely repeated, the receiving equipment is brought into synchronism and made ready for operation in a manner described in the parent application referred to above.

To start message transmission, correct phase having been attained as aforedescribed, the tape 111 is inserted in the transmitter with the first alignment of holes presented over the retracted feelers 105. The key 154 then is opened and, at this instant, the brushes 102 may be found

in any position, and the cam discs 109 may correspondingly also be found in any position. It will be recalled that when brushes 102 encounter the segment 147, there is caused the energization of stepping magnet 145, and the resulting progress of said cam disc 109.

Through the operation of the stepping magnet 145, cam 109, through its apex, causes the follower 148 to make engagement with its contact point 149. Thereafter, the same apex, encountering follower 152, causes first engagement to be made between contact point 138 and contactor 153, following which the contact follower 152 is pulled away far enough to disengage itself from contact point 153, in the manner of conventional make-before-break contact operation. Engagement between contacts 138 and 153 completes a circuit for energizing relay 131. If at this time the tape is not taut, relay 131 will be shunted by the tape arm 132, engaging the contact point of line 134, and this operation will have no effect.

The locking circuit for relay 108 is also opened at this instant by the apex of cam 109 and for this reason relay 108 will be de-energized. This controls the starting of transmission as follows: Upon the de-energization of relay 108, armature 161, thereof, permits the make-before-break switch 117—162 to close connecting the stepping magnet 115 to the wire 177. Meanwhile, the brushes 102, having passed from segment 147, cause magnets 115 and 145 to become de-energized. This permits the feelers 105 to move into the perforation of the tape 111 impressing positive or negative polarity upon their several conductors of cable 104, and at the same time armature 144 together with its articulated pawl is free to be moved by its return spring to an oncoming tooth of ratchet wheel 142.

When now the brushes 89 rotate over the first five segments of ring 87, variable code combinations of five impulses will be transmitted in accordance with the perforations encountered by the feeler 105. Immediately thereafter, the brushes 102 rotate over segment 147, energizing the stepping magnet 145, over conductors 173 and 146 and the tape controlling magnet 115 through the make-before-break switch 117. Energization of the stepping magnet 145 will step the cam disc 109 to its next angular position by which the locking circuit for the relay 108 is again prepared by the restoration of the make-before-break switch 152—153. Energization of the tape control magnet 115 will operate its lever arm 114 and through the bell crank 112 will move all of the feelers 105 out of engagement with the tape 111 and will, at the same time, cause stepping of the tape to present a new set of perforations in the manner which has already been described.

After the brushes 102 move off the segment 147, stepping magnet 145 and the record reader magnet 115 are again de-energized. Magnet 145, upon de-energization, allows its pawl 143 to engage a succeeding tooth of the ratchet wheel 142 and, magnet 115, upon deenergization, releases its armature 114 and also bell crank 112 so as to permit the tape feelers 105 to enter a succeeding row of perforations and to prepare for the stepping of the tape to the next position. The movement of the feelers 105 into the perforations of the tape has no effect at this time, inasmuch as the brush 89 is now moving over the segments associated with the standard telegraph transmitters, transmitting, therefore, standard (without the end-of-mesage hole 72) uniform telegraph code over the line 172. When, however, the brushes 89 return to the position shown, the next succeeding stock quotation code of impulses is transmitted.

This cycle of operation is now repeated, a code of five impulses being transmitted over one channel of the distributor by the modified transmitter 106 along with three other codes by the standard telegraph transmitters. The cam disc 109 is stepped from position to position until finally its apex operates the cam follower 148. An energizing circuit is thereupon completed for the relay 107 which operates its armatures 124 and 125 to engage their front contacts which thereupon reverse the polarity impressed on conductors 176 and 178. The seventh code transmitted accordingly comprises transposed impulses which are negative and positive, instead of their standard arrangement of positive and negative. During the transmission of the seventh code of a cycle, the armature 123 of relay 107 opens the line 122 and prevents the contact 119 and its feeler 118 from operating the relay 108.

If, during transmission, the tape becomes taut, the transmitter having operated faster than the perforator or other tape supply source, the tape follower arm 132 will disengage its contact on line 134 and open the by-pass circuit for the relay 131. This may have no immediate effect, but when, thereafter, the apex of cam 109 operates the follower 152, then make-before-break switch 138—153 is closed, completing an energizing circuit for the relay 131 which thereupon energizes and causes its armature 129 to engage its front contact 179. As a result an energizing circuit is completed for the relay 108 traceable from positive at 128, through armature 129, its front contact 179, line 181, line 127, through the winding of relay 108 to negative battery. Relay 108 at once prepares its locking circuit aforedescribed, but this circuit is not completed instantly due to the fact that the follower 152 is disengaged from its contact 153. As a result of the pulling up of armature 161 at this time, however, relay 115 is energized though removed from supply line 173 because of the plus batteries supplied directly by armature 161. Magnet 115, upon energization, operates the armature 114 and lever arm 112 withdrawing the feelers 105.

The stepping magnet 145 is periodically energized as the brushes 102 move over segment 147 and, accordingly, this magnet continues to move the disc cam 109 in step-by-step manner. On the first movement thereof, the locking circuit for relay 108 is completed and the circuit of relay 131 is opened at the follower 148. The relay 108 remains in an energized condition and prevents further stepping of the tape until the cam 109 has stepped to the position at which the follower 152 is again operated. Meanwhile, should the tape follower arm 132 be lifted, then when the locking circuit of relay 108 is opened and the energizing circuit for relay 131 closed, the circuit through said relay 131 will continue the energization of relay 108. The receiver is then in condition to receive the first of the letter code combinations at the beginning of operation and, by the automatic phase correction described above, the transmitter will condition itself to transmit the first or letter code combination at the beginning of each cycle.

If now the tape becomes sufficiently loose to permit arm 131 to re-engage its contact in circuit 134, and the by-pass for relay 131 is thereby

again completed, then, when cam 109 comes into position where the follower 148 is again operated, the locking circuit for relay 108 is opened. Relay 131 is de-energized and the transmitter is again in condition for reoperation.

In the event that the tape is out of proper phase relation with the cam disc 109, and distributor 86, the tape will be prevented from operation. Thus, for example, assuming that the tape is out of such phase relation and that the feeler 118 moves to contact its block 119 at an instant when the cam 109 has not rotated into the position which indicates a sixth pulse or last code of a cycle. In that event no energizing circuit will be completed for the relay 107 by the follower 148, for the reason that cam 109 will not be in engagement therewith. As a result, the circuit will be completed from positive battery over the contacts block 119, tape feeler 118, to the armature 123, and its back contact conductor 127, winding of relay 108 to minus battery. Relay 108 closes the locking circuit for itself beginning at minus battery and extending through its winding, contact point 159, armature 157, line 158, contactor 152, and contact point 153 to plus battery. At armature 161, relay 108 completes an energizing circuit for the record reader operating magnet 115, as has already been described. The continued energization of magnet 115 positions the tape with the perforations of the first code of a subsequent message presented above the retracted feelers 105. The record reader is withheld from further operation until the cam 109 has moved to operate the follower contact 152, effecting a de-energization of relay 108. When this occurs, the original energizing circuit for the relay also being open at the tape feeler 132, relay 108 becomes de-energized. The tape is now in proper phase relation with the cam 109 and the distributor 86 in order to obtain proper transmission.

While the foregoing description has been explained and illustrated in the accompanying drawing in contemplation of specific embodiments, it will be understood nevertheless that numerous changes and modifications may be made within the spirit or scope thereof without departing from the present invention. Accordingly, the patentable scope is to be construed not in accordance with the specific details but rather within the spirit of the hereunto appended claims.

What is claimed is:

1. In a telegraph system, a telegraph circuit, means to transmit over said circuit a series of groups of code signals representative of a message, and automatic means to stop the transmitting means only after all groups of code signals representative of a message have been transmitted.

2. In a telegraph system, a telegraph circuit, means controlled by a tape for transmitting code signals over said circuit, and means for stopping said transmitting means under the joint control of a slack in said tape and of a predetermined index in the tape.

3. In a telegraph system, a storage device, means to store in said device signals representing a succession of messages, means to transmit the signals stored in said device, means to stop the operation of the transmitting means when the number of signals stored is below a predetermined minimum, and means to prevent the stopping means from becoming effective until the transmission of an entire message has been completed.

4. In a telegraph system, a record reader responsive to indicia in a control strip, means to advance said strip for subjecting its indicia to said record reader, means to transmit signals in accordance with said indicia, means controlled by the strip for conditioning a stopping means, and means controlled by a predetermined index in the strip to stop the advancement of said tape for subsequent operation.

5. In a telegraph system, a record reader responsive to successive groups of perforations in a control strip, means to advance said strip for subjecting successive groups of perforations to said record reader, means to transmit signals in accordance with each group of perforations, means controlled by a predetermined perforation in the strip to stop the advancement thereof, and means operated in response to a general condition of said strip for preparing said stopping means for subsequent operation.

6. In a telegraph system, a signaling line, a tape transmitter in communication with said line including means to transmit a series of groups of code signals representative of units of information each comprising a number of characters, and means automatically responsive to a predetermined condition collateral to said code signals following the transmission of a complete unit of information for arresting said transmitter.

7. In a telegraph system, a record reader responsive to codes in a control strip, means to advalnce the control strip through said record reader for subjecting said codes to said record reader in succession, means to transmit signals in accordance with each code, means controlled by a condition of the strip to prepare the arrest of said tape advancing means, and means controlled by a further condition of said strip for determining the stopping position of said advancing means.

8. A record reader mechanism including means for feeding a control form having signal perforations step-by-step for successively presenting said perfections, means controlled by the form and responsive to a predetermined perforation for suspending said form advancing means, and means controlled by a condition of said form collateral to said signal perforations for conditioning said suspending means.

9. In a record reader responsive to the codes in a control form, means to sense the codes in succession, a device to control the operation of the record reader, means controlled by the form at times unrelated to the time at which a preselected perforation is being sensed to precondition said control device for operation, and means also controlled by the form but operative subsequently and at times definite with respect to that at which preselected codes are being sensed to render said device effective.

10. In a tape controlled mechanism, a record reader responsive progressively to the perforations in a tape which appear in groups of predetermined number and conclude with a predetermined concluding index, apparatus for actuating said record reader, a preconditioning mechanism for permitting the operation of said apparatus under the control of the tape, and means associated with said apparatus responsive to the concluding index and to said preconditioning mechanism for stopping said record reader.

11. In a transmitter controlled by a tape carrying groups of code perforations, means to

transmit code signals according to the successive groups of code perforations, a control device adapted to stop and start the transmission of code signals, means controlled by the tape to precondition said control device for operation, and means controlled by preselected perforations in the tape to render said device effective to stop the transmission and responsive to other impetus to subsequently restart the transmission.

12. In a control form sensing apparatus, a set of sensing elements, actuating means for withdrawing said elements intermittently from said form and for thereafter permitting said elements to engage said form, and means effective at predetermined multipled periods for suspending the operation of said actuating means under the control of a physical attribute of said form.

13. In a tape sensing mechanism, a plurality of tape sensing elements, a tape advancing apparatus, and means under the control of a taut condition of a tape for disabling said tape sensing and advancing mechanism and apparatus at predetermined places in the tape.

14. In a tape controlled device, an intermittently operative tape advancing apparatus, a tape sensing element operated by said apparatus for seeking out a control index in said tape, means operative to arrest said apparatus after a predetermined number of operations, and controlled by said sensing element to reinstate the operative condition of said apparatus.

15. A tape controlled apparatus including a set of feelers for sensing code perforations in a tape, a feeler for sensing another physical condition of a tape, a tape advancing mechanism, a disabling device for said mechanism, and means under the control of said condition sensing feeler for preparing for subsequent operation said disabling device.

16. In a control form sensing apparatus, a record reader, means operative periodically and independent of a control form to prepare said record reader for interruption, and means responsive to a physical attribute of a control form to consummate said interruption.

17. In combination, a record reader mechanism, intermittently operative means for advancing a control form through a sensing area in said mechanism, a periodically prepared device for interrupting said record reader mechanism, and a sensing element responsive to a physical condition of the control form for completing the interruption of said mechanism.

18. In a tape controlled apparatus, an auto-arresting device including a signal sensing mechanism, a tape supply sensing mechanism, and an interrupter conditioned by said supply sensing mechanism and operated by said signal sensing mechanism.

19. In a telegraph system, means to transmit a series of signals, an arresting device, means independent of the signals to partially condition said arresting device, and means effective only when predetermined signals are being transmitted to execute the operation of said arresting device.

20. In a telegraph system, continuously operable transmitting means adapted to transmit a plurality of character signals in a single cycle, means for originating the character of signal to be transmitted, means to render said originating means ineffective, means to condition said originating means for effectiveness, and means to insure the initiation of said originating means during correct phase position only.

21. In a telegraph system, continuously operating transmitting means, a tape having successively arranged signals, means to advance the tape from signal to signal, and apparatus for preventing the initiation of said advancing means except during proper phase relationship between said tape and said transmitting means.

22. In a telegraph system, a transmitting distributor, a switching device moved step by step through one cycle during a plurality of cycles of the distributor, a tape transmitting device, means to move the tape in said device one step for each step of the switch, and means to arrest the tape moving means when the tape reaches a predetermined position until the switch is stepped to a corresponding predetermined position.

23. In a synchronous multiplex telegraph system, a multiplex transmitter, tape sensing apparatus, a sequence switch capable of a plurality of operative positions, means to actuate said sequence switch once for each cycle of operation of said transmitter, means to condition said tape sensing apparatus for operation, and means to initiate the operation of said tape sensing apparatus only when said sequence switch is in a predetermined one of its positions.

24. In a multiplex telegraph system, a multiplex transmitter having uniform cyclic operation, a device for forming code signals including tape sensing apparatus, means to condition said tape sensing apparatus for operation, and means to initiate said tape sensing apparatus into operation only when said multiplex transmitter is in a particular one of its positions in a cycle.

25. In a multiplex telegraph system, a multiplex distributor having a plurality of rotations to each cycle of operation, a record reader, means for preparing said record reader for operation, and means to initiate said record reader into operation during a particular one of said plurality of rotations of said multiplex distributor.

26. In combination, a tape sensing apparatus for perforated tape having successions of code perforations in message groups, including apparatus for testing the tape for sufficiency of length, a power source for actuating the tape sensing apparatus under part supervision of said testing apparatus, and a device responsive to the termination of a message to augment said supervision and withhold said power source from said tape sensing apparatus.

27. In a record reader, an apparatus in continuous operation during signal code transmission, means for arresting the operation of said apparatus, a slack tape sensing device for conditioning said arresting means, and apparatus responsive to the termination of a message for operating said arresting means.

28. In an automatic transmitter, a supervisory apparatus under the control of taut or slack conditions in a tape, and means responsive to the characteristics of matter transmitted for suspending the effectiveness of said apparatus until prearranged periods in the transmission are attained.

29. A telegraph system comprising a signal storage unit, a transmitter controlled thereby, means for storing character signals in the storage unit and means jointly responsive to the number of stored signals in said unit and to a predetermined selective operation of the transmitter for stopping the transmitter.

30. A telegraph system comprising a signal storage unit, a transmitter controlled thereby, means for storing groups of character signals in

said storage unit and means to automatically start and stop the transmitter only between the groups of signals.

31. A telegraph system comprising means for storing permutation code signals representing intelligence characters and a special control signal, a transmitter controlled by said storing means to repeat the signals, and means responsive to said special control signal for stopping the transmitter.

32. A telegraph system comprising means for storing a continuous series of intelligence character code signals during a predetermined period of operation, a transmitter controlled by said storing means to repeat the signals and means operative before the ends of said series of signals but only between groups of signals for stopping the transmitter.

33. In a market quotation system, means for storing a continuous series of permutation code signals representing letter and figure characters forming two or more unspaced quotations, a transmitter controlled thereby to repeat said signals and means operative during said series only at the end of a quotation for stopping said transmitter.

34. In a market quotation system, a transmitter, signal storage means for controlling said transmitter to send quotations consisting of letter characters and figure characters and means including said storage means for stopping said transmitter as the transmitter shifts to a letter character from a figure character.

35. A telegraph system comprising a tape, a transmitter controlled thereby, means for recording unspaced groups of code signals representing intelligence characters on said tape and means for stopping the transmitter when the number of recorded signals on the tape between the transmitter and the recording means drops below a predetermined number, said means for stopping the transmitter being only operative at the end of a group of recorded signals being sent by said transmitter.

36. In an automatic transmitter, a control form advancing mechanism, a control form sensing mechanism, means controlled partially by said form sensing mechanism to interrupt the operation of said form advancing mechanism, and means to restart said form advancing mechanism into operation independently of control by said form sensing mechanism.

37. In an automatic telegraph transmitter, apparatus for sensing the perforations in a control form, apparatus for advancing a control form, means under the supervision of said control form sensing apparatus to stay the operation of said form advancing apparatus, and means to restart said form advancing apparatus independent of control by said form sensing apparatus.

38. In an automatic telegraph transmitter, a control form sensing mechanism, signal transmitting means, apparatus controlled partially by said sensing mechanism to interrupt the operation of said signal transmitting means, and apparatus independent of said form sensing mechanism to restart the operation of said signal transmitting means.

39. In an automatic telegraph transmitter, a control form sensing mechanism, signal transmitting means, apparatus controlled by said sensing mechanism to interrupt the operation of said signal transmitting means, and apparatus independent of said form sensing mechanism to restart the operation of said signal transmitting means.

40. In an automatic telegraph transmitter, a sensing mechanism controllable by a tape having successively thereon groups of perforations representing a corresponding series of character signals, means controlled by said sensing mechanism in response to perforations predeterminedly located in a tape to arrest the operation of said sensing mechanism, and means controlled independently of said sensing mechanism to thereafter restart the operation of said sensing mechanism.

41. In an apparatus for transmitting telegraph signals automatically, means for sensing code perforations in a tape, a source of power for operating said sensing apparatus, magnetically controlled means to couple said source of power and said sensing apparatus, and an energizing circuit for said magnetic coupling means including in series a contact pair responsive to said tape sensing apparatus and a contact pair under the supervision of means independent of said tape sensing apparatus.

42. In a signaling system, a tape transmitter apparatus including means responsive to code perforations in a tape for accordingly transmitting permutations of electrical impulses over a line, and means responsive to auxiliary perforations in a tape to arrest the operation of said transmitting means.

43. In a signal transmitting system, an automatic tape supervised apparatus including means for generating electrical impulses in accordance with code perforation groupings in a tape, and means to arrest the operation of said automatic tape supervised apparatus in response to auxiliary perforations in a tape having invariably predetermined positions of location with respect to said code perforations.

LOUIS M. POTTS.

CERTIFICATE OF CORRECTION.

Patent No. 2,292,404. August 11, 1942.

LOUIS M. POTTS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, second column, line 34, claim 7, for "advalnce" read --advance--; page 7, first column, line 29, claim 14, after "and" insert --means--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of October, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)