

Feb. 20, 1934.

M. H. WOODWARD ET AL

1,948,364

TELEGRAPH SYSTEM

Filed Aug. 19, 1932

2 Sheets-Sheet 1

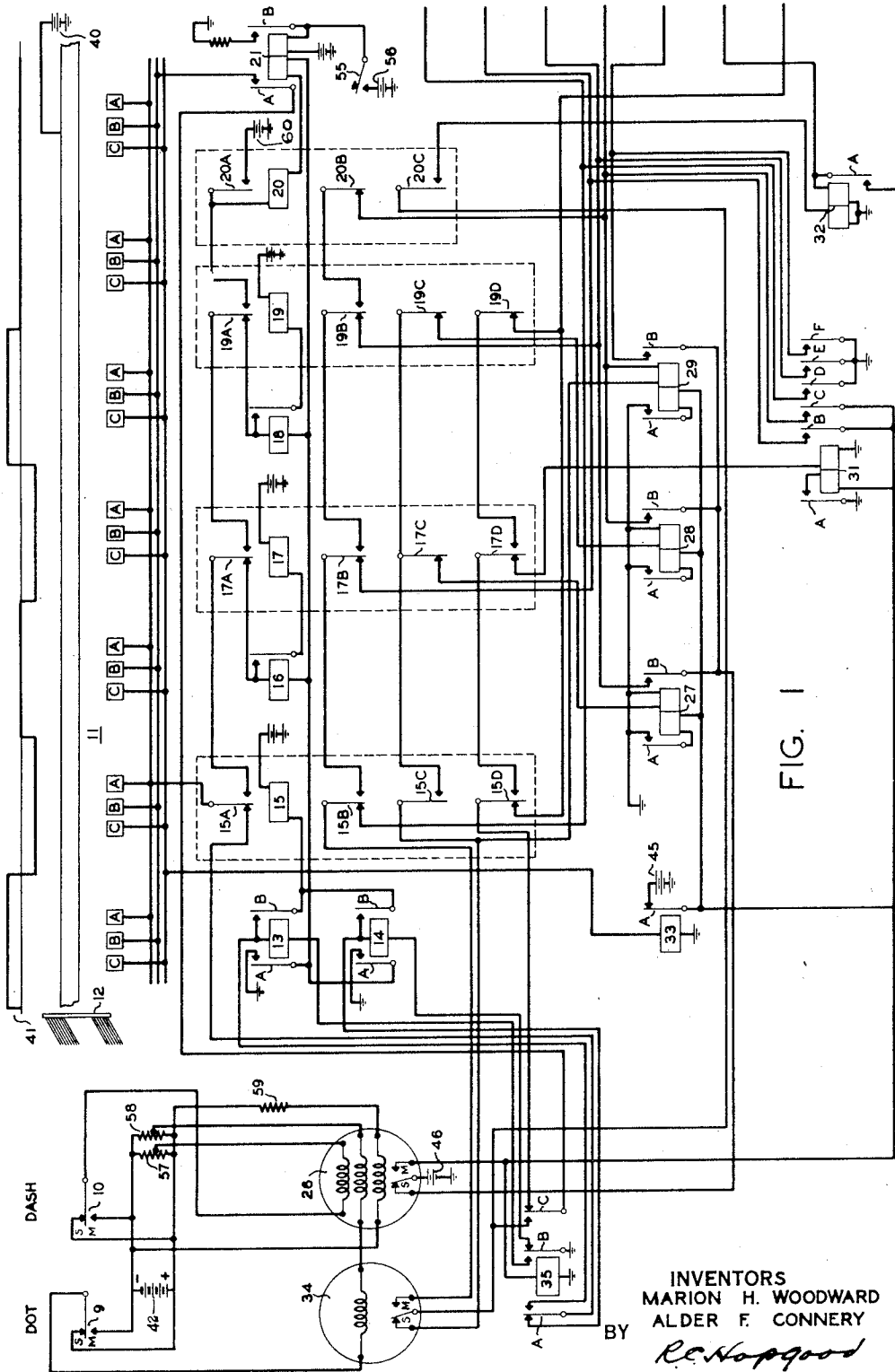


FIG. 1

INVENTORS
MARION H. WOODWARD
ALDER F. CONNERY
BY *R. H. Haggood*
ATTORNEY

Feb. 20, 1934.

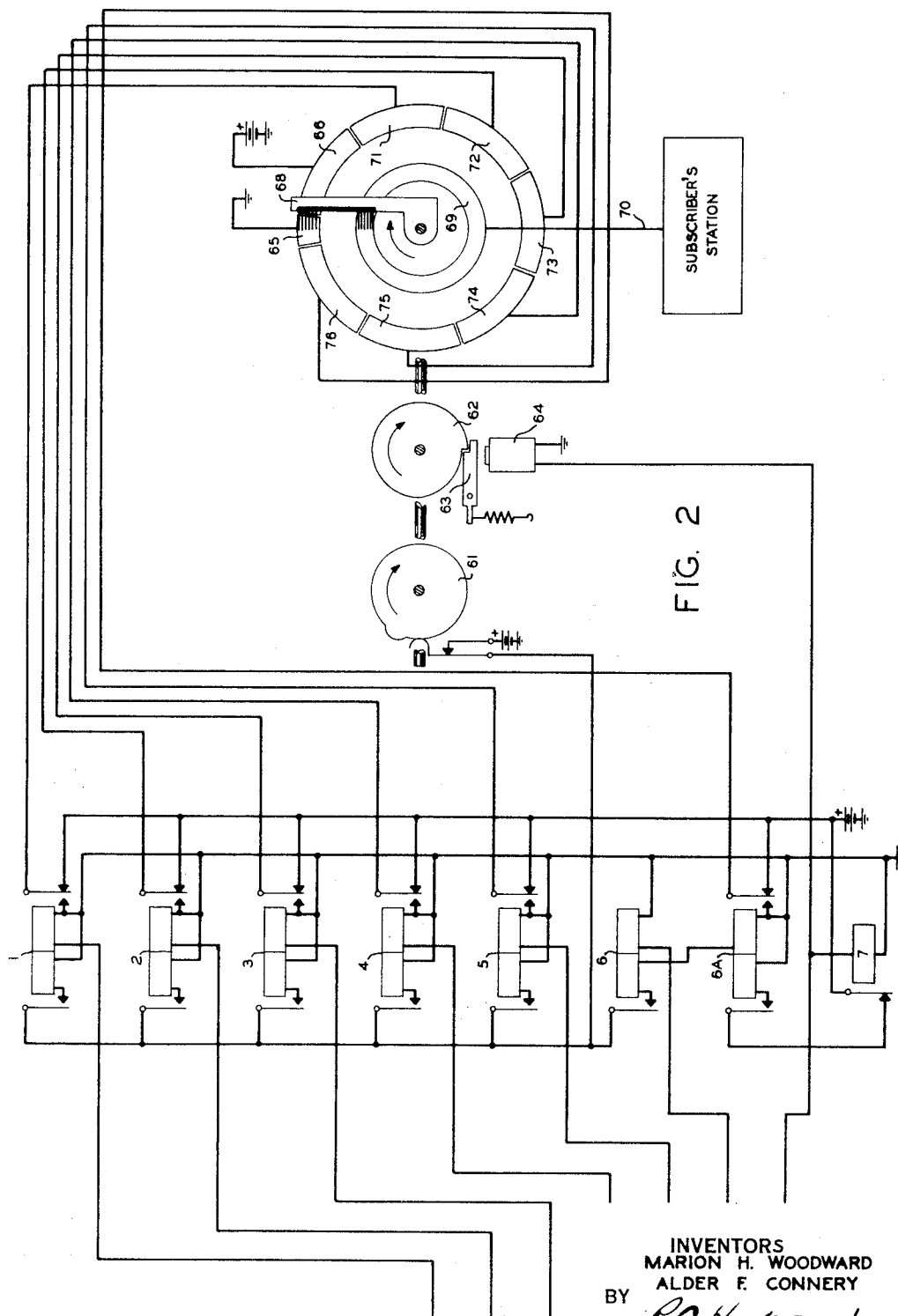
M. H. WOODWARD ET AL

1,948,364

TELEGRAPH SYSTEM

Filed Aug. 19, 1932

2 Sheets-Sheet 2



INVENTORS
MARION H. WOODWARD
ALDER F. CONNERY
BY *RC. Hopgood*
ATTORNEY

UNITED STATES PATENT OFFICE

1,948,364

TELEGRAPH SYSTEM

Marion H. Woodward, Springfield, and Alder F. Connery, Brooklyn, N. Y., assignors to International Communications Laboratories, Inc., Newark, N. J., a corporation of New York

Application August 19, 1932. Serial No. 629,448

9 Claims. (Cl. 178—70)

This invention relates to improvements in cable code printers of the type disclosed in U. S. Patent No. 1,910,823, issued to A. F. Connery. The invention provides simplified means for printing figure abbreviations and stock quotations when relayed over a cable. It has for one purpose the sending of stock quotations over ocean cables and their automatic retransmission to distant cities over land lines.

One of the objects of the invention is to provide means for changing unequal element codes to equal element codes having six units in each element. In one modification, it makes possible the reception of cable code and the expansion of these signals into a six unit code and the retransmission of the same through a start-stop distributor.

Another object of the present invention is to provide simplified means for extending a circuit from one station to a plurality of distributively located subscribers' stations.

A still further object is to provide a simple intermediate circuit for receiving signal impulses and relaying them to other apparatus.

Further objects and means for accomplishing them will be disclosed in the specification when considered in conjunction with the drawings.

A code similar to that disclosed in the above-identified patent is used.

In the drawings:

Fig. 1 is a schematic drawing of the circuits employed to accomplish the various objects mentioned.

Fig. 2 shows the start-stop distributor used in conjunction with storing relays which, in turn, are operated in a predetermined manner.

The actual operation of the printing circuits will now be explained in detail, reference being made to Fig. 1. It should be understood that the transmission at the distant end of the cable must be automatic so that the signals are sent out at a constant speed. The distributor at the receiving end of the cable is operated in synchronism with the received signals and operates the printing circuits.

Magnets 1 to 7, inclusive, (Fig. 2) represent the relaying magnets of the apparatus. The start magnet is represented by 64. The shift magnet is dispensed with at the relaying station, its place being taken by magnets 6 and 6A which, in turn, are used to transmit a negative signal element whenever a signal having more than five elements is received over the apparatus disclosed in Fig. 1.

All the relays in Fig. 1 are of the neutral or non-polarized type, except intermediate relays 26 and 34 which are polarized. All relays are shown in their normal positions. In tracing the circuits, reference will be made to the

relay tongues resting on the marking and spacing contacts. It will be understood that the relay tongue moves to its marking position when the relay is operated and that, when the relay is de-energized, the tongue will move to its spacing position. Dot and dash receiving relays are shown, respectively, as 9 and 10, and it is to be understood that the dot or dash relays will be operated when the dots or dashes of the cable signal are received. The actual coupling of these dot and dash relays to the cable may be done in any suitable manner, and, since it is well known in the art and forms no part of this invention, there is no need to describe it here in detail. A developed view of the distributor is shown at 11 and the brushes 12 are assumed to be in synchronism and in suitable phase relation with the operation of the dot and dash relays 9 and 10. Methods of maintaining the distributor brushes in synchronism with the received signals are well known, and any suitable means may be employed with this invention.

The segments of the distributor are arranged in groups of three, every third segment being connected together, any suitable number of groups being arranged in the distributor face plate. The brush 12, as it rotates, connects positive battery 40 to the segments. The segments of the respective groups are indicated in Fig. 1 of the drawings by the letters C, B and A. The arrangement is such that the brush passes over the three segments in the order C, B, A each time a dot, dash or zero signal is received. The transit time of the brush over the segments is about one-half the duration of each impulse, and the segmented ring is so oriented in relation to the incoming signals that the brush passes over the C, B and A group while the central portion of each impulse is being received.

As the brush passes over each C segment, positive battery is connected through the windings of relay 33 to ground, operating the relay and opening the locking circuit from battery 45, which releases any relay in the circuit that might have been locked due to a prior selection. Relay 21, when energized, locks up and its tongue A is held closed. When the brush passes over a B segment and the impulse then being received is a dot, the signal of which it forms a part comprising less than five dots and dashes, positive battery 40 is connected over the contacts of relay 21 and contacts of relays 35 and 34 (which will have been energized in a manner to be described later) to the winding of the first selector magnet 1, and thence to ground. In other cases, the impulses of a B segment serve to control the various relays in a printer selector system.

As the brush passes over an A segment, the circuit is closed from positive battery through

tongue A and contact of relay 35 (which will have been energized in a manner to be described later) to operate relay 13. It is to be noted that relay 13 operates only on a dot or dash, while relay 14 operates when a zero signal is received, e. g., relay 26 marks on dashes and relays 26 and 34 both mark on dots. After the operation of relay 15, which occurs when brush 12 leaves the A segment, relays 16, 17, 18, 19 and 20 operate and lock up progressively (the number operating depending on the number of dots and dashes in a character), as the brush passes over the segments indicated by the letter A.

Key 55 is provided in order to permit the deenergization of relay 21 by short-circuiting its locking winding through a circuit from battery 56, tongue B of relay 21 and resistance 61 to ground. When relay 21 has thus been de-energized, it will operate again only when relay 20 is operated. Since relay 20 is the last one of the chain of relays 14 to 20, it will be operated only when a signal containing more than five dots and dashes is received. Consequently, depression of key 55 and consequent de-energization of relay 21 breaks the circuit from the B segments to tongue C of relay 35 and thus removes battery from the circuits to the printer magnets and to filling in relays 27, 28 and 29, and prevents their operation while synchronizing signals are being received, since the type of signal chosen to keep the distributors in synchronism during idle periods does not have sufficient dots or dashes to step up the counting relay bank to its limit. The magnets are restored to operative position when a signal containing more than five dots and/or dashes is received, for the counting bank then operates to the limit and battery 60, applied over the contacts of relay 20, operates relay 21 which then locks, the key having been released to break the short circuit around the locking winding.

Assume now that the signals corresponding to the letters AN are received and that they are in proper phase relation with the distributor segments, as shown by curve 41 at the top of Fig. 1. Before brush 12 reaches the first group of segments, the dot relay 9 will close its contacts and a circuit will be completed from positive battery through the lower half of potentiometer 58, the middle winding of intermediate relay 26, the winding of intermediate relay 34, tongue and marking contact of the dot relay to negative plate of battery 42. A circuit is also set up from positive battery through the spacing contact of dash relay 10, the upper winding of relay 26, the upper portion of potentiometer 57 to negative battery. Also, the biasing current through the lower winding relay 26 is maintained at all times over a circuit from the positive plate of battery 42 through resistance 59 and lower winding of relay 26 to the negative pole of the same battery. When positive battery is flowing from the right- to the left-hand terminals of any winding of relays 26 or 34, the tongue of that relay will tend to move to its marking contact. It will be seen that, under the conditions just set forth, relay 34 will have its tongue lying on the marking contact, while relay 26, due to the current flowing in the upper and lower windings in opposite directions, will also have its tongue lying on the marking contact.

When the tongue of relay 26 moves to its marking contact, relay 35 will operate, and when tongue B of relay 35 leaves its spacing contact, ground will be removed from the locking circuit of relays 14 and 15 (assuming relay 14 was operated by a

previous space element) and these relays will be de-energized. As tongue A of relay 14 leaves its contact, it will cut off locking ground from all the relays of the counting bank 15 to 20 which may have been operated by a previous selection, and the tongues will fall back to the spacing position. As brush 12 passes over segment C, relay 33 will operate, cutting off battery 45 and unlocking all the relays the locking windings of which are connected to its armature A. During the time that the brush is on the B segment a circuit will be completed from positive battery 40, through the tongue A of relay 21 and co-operating contact, tongue C of relay 35 and its marking contact, tongue of relay 34 and its marking contact, tongue B of relay 15 and its spacing contact, and relaying magnet 1 of Fig. 2 to ground, causing relaying magnet 1 to operate.

The brush now passes over the A segment which operates relay 13 over a circuit from positive battery 40, through brush 12, segment A, tongue A and spacing contact of relay 15, tongue A and marking contact of relay 35, winding of relay 13, tongue B and marking contact of relay 35 to ground. Relay 13 operates at this time, preparing a locking circuit for itself through the winding of relay 15 which is utilized immediately afterward, when brush 12 leaves the A segment and removes the short circuit from the winding of relay 15.

During the time the brush is travelling from the A segment to the C segment the incoming signal will change from a dot to a dash. The current through the winding of relays 34 and the upper and middle windings of relay 26 will be reversed. The tongue of relay 34 will move to its spacing contact; but, due to the effect of its upper winding, the tongue of relay 26 will remain on the marking contact and relay 35 will continue energized. The brush next passes over segment C which causes battery to be supplied to the winding of relay 33, which momentarily operates. Since none of the relays which lock up through the contacts of relay 33 has been energized, the relay bank 27 to 29 and 31 is not affected. Next, the brush passes over a B segment. Since relay 15 is now operated, a circuit will be completed from battery 40, armature A and co-operating contact of relay 21, tongue C and marking contact of relay 35, tongue and spacing contact of relay 34, tongue C and marking contact of relay 15, tongue C and spacing contact of relay 17, and the right-hand winding of relay 27 to ground. Parallel circuits are also completed through tongue C of relay 19 to the right-hand winding of relay 28 and from the spacing contact of relay 34 directly to the right-hand winding of relay 29. Relays 27, 28 and 29 will, therefore, lock up through their respective tongues A and co-operating contacts to effect the filling in of certain impulses to the relaying magnets, as will be explained later.

The brush now passes over the A segment and relays 16 and 17 are operated and locked in the operated position. During the time the brush is passing from the A to the succeeding C segment the letter space or zero signal will be received and the armatures of relays 9 and 10 will be operated to the positions shown in the drawings. Due to this positioning of the relay tongues, the current flow through the windings of relays 26 and 34 is such that the tongues of both relays move to their spacing contacts. When relay 35 is de-energized, due to the de-energization of relay 26, relays 13 and 15 will unlock and return to their normal positions, and the breaking away of tongue

A of relay 13 from its contact will, in turn, unlock all other relays of the bank 16 to 20. When the tongue of relay 26 touches the spacing contact, a circuit is established from positive battery 46 to respective B tongues of relays 27, 28 and 29, the co-operating contacts of which are connected, respectively, to relaying magnets 3, 4 and 5 (Fig. 2). Current will, therefore, flow from battery 46 to the third, fourth and fifth relaying magnets, which will be operated. Relaying magnets which have now been operated are 1, 3, 4 and 5, which combination corresponds to the printer code combination for the letter A. It will be noted that relaying magnet 1 was operated directly from the received signals, while relaying magnets 3, 4 and 5 were generated from relays 27, 28 and 29. A sixth pulse will not be transmitted and, thus, magnets 6 and 6A will remain on spacing position, as the signal elements making up the letter A in cable code are well below five, being, in fact, but three elements long, i. e., plus, minus and space. Thus, the sixth pulse will be a positive element. The seventh pulse or distributor releasing pulse is transmitted as follows. After relays 3, 4 and 5 are actuated and locked up, the brush 12 passes over the C segment and relay 33 will be momentarily energized, relays 27, 28 and 29 being unlocked and restored to normal.

The brush now passes over the B segment and a circuit is completed from positive battery to tongue A and co-operating contact of relay 21, tongue C and spacing contact of relay 35, tongue D and spacing contact of relay 15, to magnets 7 and 64, and ground. Magnet 7 and starting magnet 64 operate, and, due to the selection set up in the relaying magnets, the letter A is transmitted over line 70 to the subscriber's station or stations.

The brush 12 now passes over the A segment and this will operate relays 14 and 15 of the counting bank. During the time a brush is passing over the space between the A and the next C segment the dash of the letter N will be received and dash relay 10 will operate. Further discussion as to the setting up of the letter N in the relaying magnets will be obvious to those versed in the art and is, therefore, believed to be unnecessary.

The operation of the system on a signal having more than five elements will be obvious from the above, e. g., a negative element will be transmitted by segment 76, with appropriate changes in the polarities transmitted by segments 71 to 75, only relaying magnet 2 being held operated. Other letter combinations can be traced through the circuit in a similar manner.

Referring to Fig. 2, it will be noted that a start-stop transmitting distributor is shown at 67. The brush arm 68 and cams 62 and 61 are all mounted on the same shaft and driven by a constant speed motor through a friction clutch. The motor and the friction clutch are not shown because such an arrangement is used in practically every start-stop system, and its operation is well understood. The brushes of the start-stop distributor are normally in the position shown, their rotation being prevented by the armature 63 which will remain engaged with starting cam 62 until start magnet 64 is energized. During the time the brush is in this position it will be connected to a segment 65 which is connected to ground. Therefore, ground will be applied to the line 70 which goes to the start-stop printer, which is located some distance away. This line is designated in the drawings as 70.

The start-stop printer which is located some distance away is not shown here because its operations are well known, and it may be of any suitable type. The segment marked 66 is connected to positive battery, and, when the brush passes over this segment, positive potential will be applied to the line which will start the distant printer. The segments 71 to 76, respectively, will have applied to them either negative or positive potential, depending upon the character which has been received over the cable, and the brush, in passing over these segments, will transmit the proper signal combination to select the desired letter on the distant printer.

In the system being described, the polarities of transmitting segments 71 to 75 are determined by the operation or non-operation of selecting relays or relaying magnets 1 to 5, and the polarity of segment 76 is determined by the operation or non-operation of relaying magnet 6A, which takes the place of the shift magnet on the usual cable code printer. Relay 6 will operate and lock up only when the length of the signal combination received over the cable is of five or more units duration.

Assume, for example, that the letters AR are received over the cable. The relay combination for the letter "A" is negative potential on the armatures of relays 1, 3, 4 and 5, and the relay combination for the letter "R" is negative potential on the armatures of relays 1 and 3. The letter "A" will operate relays 1, 3, 4 and 5 through their right-hand windings, and these relays will lock up through their left-hand windings and contacts. The right-hand tongues of these relays control the polarity of the corresponding sending segments of the distributor, and the combination of polarities set up on these segments will, therefore, be as follows:

71—negative
72—positive
73—negative
74—negative
75—negative

and segment 76 will remain positive because cable letter "A", having only two units in it, did not operate the shift relay 6. When an impulse is received over the conductor to relay 7, relay 7 will operate but performs no useful function. Start magnet 64 will also operate and attract armature 63 which will permit the cam 62, the shaft to which it is attached, and the brush arm 68 and cam 61 to revolve. The brushes 68 will pass over the various segments and transmit to the line 70 the combination of polarities set up on the transmitting segments. Towards the end of the revolution, while the brushes are on segment 76, the contacts associated with cam 61 will open and disconnect locking battery from relays 1 to 6, and all of these relays which have been in an operated position will fall back to normal. When the brush reaches the end of the revolution, it will be stopped by the armature 63 engaging with cam 62, and in its resting position negative battery will be transmitted to the line, as previously explained. It will be noted that the length of the stop segment 65 is much shorter than any of the other segments. However, since the brushes will remain at rest upon this segment for a certain time, the signal transmitted to the line from this segment will, therefore, be the same as if this segment were longer and the brush stopped for a shorter period. The minimum length of time during which the brush 68 remains

on the stop segment 65 between letters will be determined by the rate at which the signals are received over the cable and the speed of the motor which drives the transmitting shaft to which the brush arm is attached.

Upon the completion of the signal elements for the letter "A", the letter "R" will be set up. Relays 1 and 3 will now be operated and they will lock up through their left-hand windings and contacts. When the operating impulse is received on the conductor going to relay 7, start magnet 64 will be energized and permit the transmitting shaft to revolve, and the combination set up on the transmitting segments will be transmitted to the line 70. In the case of the letter "R", all of the segments will be positive except segments 71 and 73, which will be negative. Near the end of the revolution cam 61 will open its contacts and unlock relays 1 and 3.

When a long cable code combination, having five or more units in it, is received, an impulse will be received over the conductor to relay 6, which will operate and lock up. Relay 6 has in series with its locking winding a winding of relay 6A, and immediately relay 6 operates it will also operate relay 6A. The last mentioned relay does not lock up through the contacts associated with cam 61. Instead, it locks up through the back contact of release relay 7. When an operating impulse is received over the conductor to relay 7, relay 7 will be momentarily operated and, of course, start magnet 64 will also operate and start the rotation of the brushes. The momentary operation of relay 7, however, will not unlock 6A because there is still a continuous flow of current through its right-hand winding.

Near the end of the revolution, the opening of the contacts associated with cam 61 will unlock relays 1 to 6, but relay 6A remains locked up through its left-hand winding, and, therefore, the operation of cam 61 during the time the brush is on segment 76 causes no interference with the signal set up on segment 76. The time at which relay 6A is finally unlocked will be when an operating impulse is received over the conductor to relay 7 for the next letter, but, if the next letter happens to be a long combination and relay 6 has been again operated, then relay 6A will remain operated for another revolution of the brushes 68.

What is claimed is:

1. In a telegraph system, the combination of means for receiving cable code signals, means for automatically storing said cable code signals, means for rendering said storing means inoperative, and means operative upon receipt of cable code signals having a predetermined characteristic to store received cable code signals, and a start-stop distributor controlled by and responsive to said storing means to retransmit the stored signals.

2. In a telegraph system, the combination of means for receiving signal combinations comprising unequal numbers of impulses of different polarity, means for converting said impulses to signals having an equal number of impulses, means for retransmitting said converted signals, and additional means responsive to received signals having impulses exceeding a predetermined number for reversing the polarity of the last signal impulse of the corresponding retransmitted signals.

3. In a telegraph system for receiving signal

combinations of unequal length, signal storing means operable by received signals, and a start-stop distributor controlled by and responsive to said storing means for retransmitting said stored signals as signal combinations of equal length.

4. In a telegraph system utilizing a code combination representing characters having different numbers of impulses, polar relays controlled by said impulses, a distributor co-operating with said polar relays to control signal storing means comprising a predetermined number of storage relays and a sending distributor for retransmitting the signal combinations stored in said storage relays, said retransmitted signals being comprised of signal permutations having a predetermined number of impulses.

5. In a telegraph system wherein signals having elements of plus, minus and zero potential are received, means for converting said elements to plus and minus elements only, a distributor and storage relay means co-operating with said first-mentioned means for storing said plus and minus elements, said storage means being operative to retransmit said received signals as equal length signals having plus and minus elements.

6. In a telegraph system for receiving signal combinations of unequal length, signal storing means conditioned for operation only by signal combinations exceeding a predetermined length, means responsive to the stored signal combinations for converting said signal combinations to signal combinations of equal length, means normally operative to retransmit said converted signals, means to render said last-mentioned means inoperative, and means responsive to received signals of a predetermined character to restore said storing and said retransmitting means to operative condition.

7. In a telegraph system, means for receiving signal combinations of different numbers of impulses, polar relays controlled by said receiving means, a distributor co-operating with said polar relays to control means for adding impulses to said received impulses to convert said signal combinations to signals having equal numbers of impulses, means for storing said converted signal impulses, and transmitting means for retransmitting said stored signal impulses.

8. In a telegraph system, means for receiving combinations of different numbers of impulses, polar relays controlled by said receiving means, a distributor co-operating with said polar relays to control means for converting said signals to signal combinations having a predetermined number of impulses, means for storing said converted signals, and means for retransmitting said stored signal impulses as signals having one element more than said converted signals.

9. In a telegraph system, the combination of means for receiving signal combinations comprising unequal numbers of impulses of different polarity, means for storing said signals, means for retransmitting said stored signals as signals having equal numbers of impulses, and means responsive to received signal combinations having impulses in excess of a predetermined number for reversing the polarity of the last polar impulse retransmitted.

MARION H. WOODWARD.
ALDER F. CONNERY.