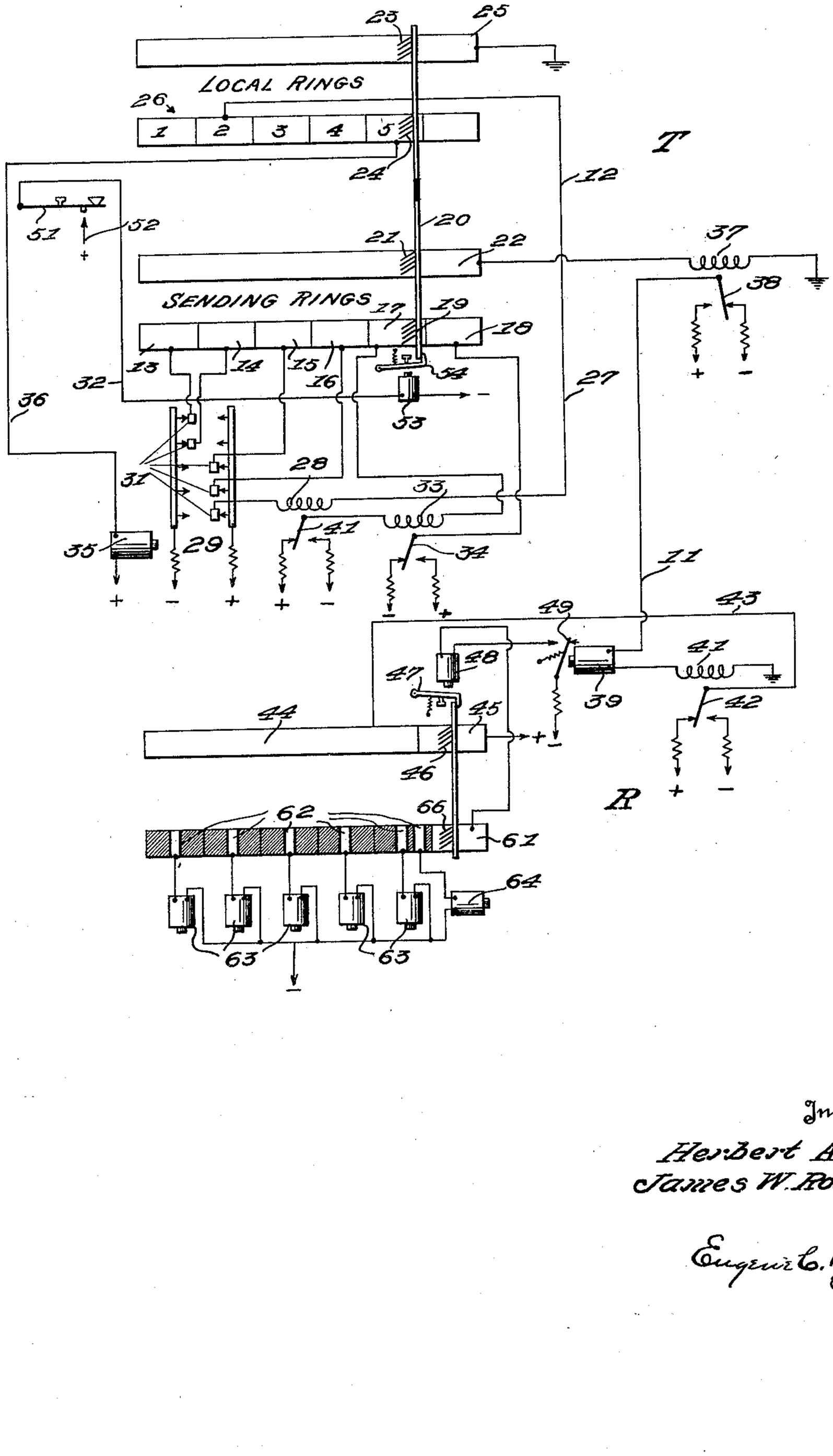
Feb. 9, 1932. H. ANGEL ET AL 1,843,909

START STOP PRINTING TELEGRAPH SYSTEM

Filed Sept. 26, 1930



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Patented Feb. 9, 1932 1,843,909

UNITED STATES PATENT OFFICE

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START STOP PRINTING TELEGRAPH SYSTEM

Application filed September 26, 1930. Serial No. 484,668.

Our invention relates to apparatus for and methods of signalling and, more particularly, to novel apparatus for and methods of controlling the synchronous operation of two rotating members in a telegraph system.

As is well known, printing telegraph systems having a rotating distributor at the transmitting end of the system and a rotating distributor at the receiving end of the system must, for correct telegraph communications, be maintained in synchronism with each other.

Such synchronism is obtained by arranging to operate the receiving distributor "stop-start" under the control of the transmitting distributor. In a "start-stop" synchronous system, the receiving station distributor rotates to a predetermined stop position, from which point it starts into rotation again in response to a received start impulse transmitted by the transmitting station distributor when it has reached a predetermined start position. The transmitting and receiving station distributors may thus be started simultaneously from a fixed position and rotated one revolution in synchronism.

Both distributors comprise rotating brushes and a plurality of segments, usually seven in number. Five of these segments transmit telegraph code combinations of five impulses each. In addition to these five segments, there is a stop segment and a start segment on the transmitting distributor and a printing and stop segment on the receiving station distributor.

The receiving distributor is rotated at a slightly faster rate of speed than the transmitting distributor, so that, although both the transmitting and receiving distributors start out simultaneously on equivalent positions, the receiving distributor will complete its revolution before the transmitting distributor.

When the receiving distributor is on the stop segment, it is ready to start in response to the receipt of the start impulse condition. An ordinary start impulse condition of a predetermined character would obviously not suffice, due to the fact that the last impulse condition of the code combination will, in a number of code combinations, be of the same polarity or condition as the start impulse condition, so that the receiving distributor could not distinguish therefrom.

Accordingly, provision must be made for enabling the receiving distributor to distinguish a start impulse condition from the last one of the preceding code combination of impulse conditions.

Heretofore, this has been accomplished by providing a stop impulse of a predetermined polarity, followed by a start impulse, also of a predetermined polarity, but differing from that of the stop impulse condition.

Following the receipt of a complete code combination of impulse conditions, the receiving distributor will respond to these two predetermined impulse conditions, to start into rotation simultaneously with the transmitting distributor.

In such an arrangement, seven impulse conditions are necessary for each selection—five impulse conditions for a character, a sixth impulse condition for a stop condition and a seventh or start impulse condition.

In high speed telegraphy, it is desirable that the number of impulse conditions for each selection be reduced to as few as possible, in order to make maximum use of the line time. The elimination, therefore, of one impulse condition in each code combination will, accordingly, be highly desirable, so that, if it were possible, it would be preferable that the cycle be comprised of code combinations of five impulse conditions each and a single start impulse condition.

Such a condition can be obtained if some means is provided for enabling the receiving distributor to properly distinguish the start impulse conditions from the last impulse conditions of the preceding code combination.

With the receiving distributor on the start segment, it can only distinguish the start impulse condition if, in some way, it differs invariably from the last or fifth impulse condition.

Accordingly, an object of our invention is to provide novel means for maintaining two

remotely disposed distributors in a signalling system in synchronism.

A further object of our invention is to provide novel means for operating a six pulse start-stop telegraph system.

A further object of our invention is to provide novel means for enabling the receiving distributor to distinguish a single start impulse condition from the fifth impulse condition of the preceding code combination.

Heretofore, six pulse start-stop telegraph systems have been provided operated with mechanical mechanisms of involved character. Complicated cams and interlocking members have been necessary to distinguish the sixth or synchronizing impulse.

Accordingly, a further object of our invention is to provide novel means for controlling a six pulse start-stop telegraph system by electrical means.

Still another object of our invention is to provide novel circuits for operating a six pulse start-stop telegraph system.

Other objects of our invention will be more fully understood upon reference to the following detailed description, taken in connection with the accompanying drawing, while the scope of our invention will be particularly pointed out in the appended claims.

In the drawing, the figure is a circuit diagram embodying our invention.

As shown, a transmitting station T and a receiving station R are connected by a signalling line 11.

At the transmitting station a distributor 12 is shown in developed form, comprising a transmitting section having a plurality of segments 13 to 17, over which code combinations of impulse are transmitted, in a manner to be described hereinafter and a start segment 18.

Segments 13 to 18 are wiped over by the brush 19, carried on the brush arm 20, which is driven by a motor (not shown). Brush arm 20 also carries the brush 21, which wipes over the solid ring 22 and, with the brush 19, bridges the segments 13 to 18 and solid ring 22. The brush carrier 20 also carries brushes 23 and 24, which bridge the solid ring 25 and segmented ring 26 of the transmitting controlling section. Ring 25 is grounded, as shown. The second segment of segmented ring 26 is connected over conductor 27 to the relay winding 28, which, in turn, is connected to the fifth contactor of the transmitter or sending contactor 29 and which controls the polarity of the start impulse, in a manner to be described in detail hereinafter.

The transmitter 29, which may be either key operated or tape operated, is herein disclosed, for purposes of illustration, as comprising two bus bars. Positive polarity is applied to the one bus bar and negative polarity is applied to the other. The transmitter, also comprises a plurality of contacting devices 31, which are operated in accordance with the perforations of a tape or key bar operation to selectively engage either the positive or negative bus bars, as illustrated.

The first four of these contactors are connected to individual ones of the first four segments 13 to 16. The fifth segment 17 is connected to the winding of relay 33, the armature 34 of which is connected to start segment 18 and operates between contacts connected to the positive and negative side of battery.

As is well known in the art, the tape transmitter is provided with a series of feelers which project through the perforations of a code perforated tape, to cause the engagement of the contactors, such as 31, selectively with the positive and negative busbars.

An electromagnet 35 is periodically energized and deenergized to permit the feelers to move into the perforations of the tape and to remove the feelers from the tape, during which period the tape is, at the same time, stepped to present a new set of perforations in the tape to the feelers. This magnet 35 is connected over conductor 36 at the fifth segment on segmented ring 26.

The code combination of impulse conditions generated at the contactors 31 and positive and negative busbars are transmitted over the first four segments 13 to 16, brushes 19 and 21 and ring 22, to the relay 37 connected to the solid ring 22. Grounded relay 37 repeats these impulses by means of its armature 38 over conductor 11 to the synchronizing relay 39 at the remote station, which is connected in series with the winding of receiving relay 41. Relay 41 has an armature 42 operating between contacts connected to the positive and negative side of battery and connected over conductor 43 to the ring 44 of the receiving station distributor.

Ring 44 is provided with a stop segment 45, on which the brush 46 is normally latched in stop position when the armature 47 of stop magnet 48 is in its de-energized position, as shown. The circuit for stop magnet 48 is controlled by armature 49 of the relay 39 and by stop segments 61 and 45. The brush 66, carried on the same brush-arm with brush 46, wipes over the receiving segments 62 of the receiving distributor, as it is driven by a motor (not shown) in approximate synchronous speed with the transmitting station distributor brush. The first five segments 62 are connected to the printing magnets 63 and the sixth segment is connected to the printer operating magnet 64. It will be noted that segments 62, separated by insulated sections, are much smaller than the transmitting segments and are placed in the center of the segment and are wiped over by the brush during the middle of each impulse

period. This is so arranged in order that the receiver will respond to the peak of each signal impulse.

In operation, the apparatus is normally in the position shown, with the brush arm 20 over the fifth segment 17, which is also its normal stop position. At this point an energizing circuit is completed for the magnet 35 from ground, over ring 25, brush 23 and 24, conductor 36 and through electromagnet 35, to positive battery. Electromagnet 35 is energized and holds the feelers (not shown) out of the perforations of the tape (not shown), so that all of the contactors 31 remain in their normal non-operative position. At the remote receiving station R the electromagnet 39 is energized and its armature 49 is in the positon shown. The brush 46 is in its stop position, as shown and in engagement with the stop segments 45 and 61. Armature 47 is in its de-energized condition and holds the brush 46 in the position shown.

In order to start operations, the transmitting operator at station T will operate the transmitting key 51, to engage its lower contact 52 connected to positive battery. A circuit is thereupon completed over the conductor 52, to the start magnet 53, the other terminal of which is connected to negative battery. Magnet 53, upon energization, operates its armatures 54 to disengage the brush arm 20, which thereupon rotates under control of a motor (not shown), to wipe over the segments 13 to 18.

It will be assumed from this point on, that a continued series of code combination of impulse conditions are to be transmitted. It will be further assumed that the fifth impulse of the previous code which was transmitted was a positive impulse condition, as a result of which, the armature 38 of the relay 37 has been operated into engagement with the positive segment, as shown.

The fifth contactor 31 has, under the conditions assumed, energized the relay 28 to set its armature 41 in the position shown, which, in turn, has completed an energizing circuit for the winding of relay 33, as a result of which armature 34 thereof was set in the position shown

When now the brush 20 starts rotating and the brush 19 wipes over segment 18, current from the negative side of battery at armature 34 flows over the segment 18 through the brushes 19 and 21, ring 22, to the winding of relay 37. Relay 37, upon energization, operates armature 38 from engagement with the right hand or positive contact to its alternate negative contact.

As the armature 38 moves between the two contacts, the current in line 11 is reversed and the inherent momentary zero is used to operate relay 39 at the receiving station which is momentarily deenergized, permitting armature 49 to drop to its back contact. An energizing circuit is thereupon completed for the start magnet 48 from positive battery over the armature 49 and its back contact through the magnet 48, segment 61, brushes 66, 46 and segment 45 to negative battery. The energization of magnet 48 operates armature 47 from engagement with the brush arm 46. Brush arm 46 is thereupon released for the rotation by the motor and brushes 66 and 46 now revolve in synchronism for one revolution.

As the brush arm 24 moves off the fifth segment of segmented ring 26, tape control magnet 35 is deenergized, permitting the feelers to move through the perforations of the tape, in accordance with the tape perforations presented to the feelers at that time.

For the purpose of the present illustration, it will be assumed that the first two contactors of the transmitter engage the negative bus and the next three engage the positive bus, as shown. As the brush 19 wipes over segment 13, the first impulse condition of the code combination is transmitted. In this case it is a negative impulse condition which flows over the first contactor 31, through the segment 13, brushes 19 and 21, ring 22, to the winding of relay 37 and ground.

Armature 38 is at this time already in engagement with the negative contact, as explained hereinbefore and, accordingly, no change occurs. The first impulse condition of the code combination is a negative impulse and relays 39 and 41 are energized over the circuit from negative battery through armature 38, magnet 39 and relay 41 to ground. Armature 49 is, accordingly, maintained in its energized position. Armature 42 is also maintained in engagement with its right hand or negative contact. The brush 66 is rotated at such a speed that, during the period while the brush 19 wipes over the segment 13, the brush 66 wipes over the first segment 62. The first impulse of the code combination is, therefore, repeated over a circuit from negative battery at armature 42, over conductor 43, ring 44, brush 66, and the first segment 62 to the first code selecting magnet 63 to negative battery.

However, inasmuch as this circuit is from negative battery to negative battery, it is not an energizing circuit and the first selecting magnet is not energized. This impulse constitutes a spacing impulse condition.

As the brush 19 wipes over segment 14, a second spacing impulse condition is transmitted in the manner described above, the brush 66 is at this time wiping over the second segment of the segmented ring 62, so that the second selecting magnet 63 remains deenergized.

When the brush 19 engages the third segment 15, an impulse of positive polarity from the positive bus is impressed over the above traced circuit through the winding of

the relay 37. Armature 38 is thereupon thrown from engagement with its left hand contact to its right hand contact. In this case, the current in line 11 is again reversed and relay 39 is, accordingly, momentarily deenergized. This, however, has no effect on the magnet 48 at this time, since the brush 46 is not in engagement with the stop segments 45, and accordingly, the circuit for the magnet 48 is still open at this point.

Relay 41, however, responds to this marking or positive impulse and throws its armature 42 from engagement with its right hand contact to engagement with its left hand contact. During this period, while the brush 19 is wiping over the third segment 15, the brush 66 is wiping over the third segment of ring 62. In this instance, current of positive polarity flows over the conductor 43, over ring 44, brush 46, third segment 62, to the third selector magnet 63 and negative battery. The third selecting magnet is, accordingly, energized in accordance with the marking impulse condition.

Similarly, the fourth impulse condition is a marking impulse condition and operates the fourth selecting magnet accordingly.

During the time while the brush 19 was in engagement with the second segment 14 for transmitting the second impulse condition, as described in the above, brush 24 was in engagement with the second segment of ring 26. An energizing circuit was thereupon completed at the time from the positive busbar and the fifth contactor 31, through the winding of the relay 28, conductor 27, the second segment of ring 26, brushes 24 and 23, ring 25, to ground. Relay 28 thereupon operated its armature 41 to engage its left hand or positive contact.

When now the brush 19 engages the fifth segment 17, an energizing circuit is completed for the winding of relay 37 from positive battery over armature 41, winding of relay 33, segment 17, brushes 19 and 21, ring 22 and winding of relay 37, to ground.

Relay 37 thereupon operates its armature 38 to its positive contact, just as in the case of the third and fourth impulse conditions. Relay 33 operates its armature to engage its left hand contact, which is, however, connected to negative polarity. In this manner, the five impulses of the code combinations are transmitted.

It is assumed, as explained above, that the key 51 is still closed and stop magnet 53 is energized for the further transmission of other code combinations and, accordingly, brush arm 20 continues to rotate for another revolution over segment 18.

As stated hereinbefore, the motor at the receiving station is arranged to drive its associated brush slightly faster than the transmitting brushes are driven, so that brush 46 will have moved on to the stop segment 45 an instant before brush arm 20 moves the brush 19 to segment 18. When now the brush 19 wipes over segment 18, current from the negative battery at armature 34 flows through the winding 37. The armature of relay 37, being at this time in engagement with its positive segment, in accordance with the fifth impulse condition, will be thrown to its opposite or negative segment and the magnet 39 is momentarily deenergized. As explained in the above, magnet 48 is thereupon energized, releasing the brush 46 for another revolution and the above cycle of operations are repeated.

It will now be clear that the sixth impulse condition is invariably of a different polarity from the fifth impulse condition of the code condition. If the fifth code impulse condition is such as to throw armature 41 of relay 28 to engage its negative contact for the transmission of a negative or spacing impulse condition, relay 33 is energized invariably to throw its armature 34 to the positive contact and vice versa. That means that between the fifth impulse and the start impulse condition, a reversal of current through the relay 37 takes place. The armature 38 of relay 37 is, therefore, always thrown from whichever contact it happens to be in engagement with, to its alternate contact, momentarily deenergizing relay 39. This momentary zero condition of the line 11 thus controls the starting of the distributor at the receiving station.

As it will now be further evident, a very simple and ingenious electrical circuit is provided for a start-stop telegraph system, employing only six impulse conditions, and reducing the signalling time by one-seventh which is of considerable importance in high speed telegraphy.

Although we have disclosed our invention in connection with a specific adaptation thereof, it will be evident to those skilled in the art that it may be applied to other forms of signalling systems employing code combinations of impulse conditions where rotating members are to be maintained in synchronism.

What we claim is:—

1. In a printing telegraph transmitter; a rotary start-stop distributor; a sending contactor, for transmitting code combinations of impulse conditions, electrically connected to said distributor; and electro-magnetic means connected to said contactor and controlled by the last impulse condition of each code combination for controlling the transmission of a start impulse condition.

2. In a printing telegraph transmitter; a rotary start-stop distributor; a sending contactor electrically connected to said distributor for transmitting code combinations of impulse conditions; and means, including circuit connections from said contactor and cooper-

ating with said distributor, for controlling the transmission of a synchronizing impulse condition to precede each code combination of impulse conditions.

3. In a printing telegraph transmitter; a rotary start-stop distributor; a sending contactor cooperating therewith for transmitting code combinations of impulse conditions; and electro-magnetic means controlled in accordance with the last impulse condition of each code combination and cooperating with said distributor for transmitting a start impulse condition preceding each code combination.

4. In a printing telegraph transmitter; a rotary start-stop distributor; a sending contactor, certain contactors of which are connected to equivalent individual segments of said distributor; electro-magnetic means connected to one of said contactors of said contactor for controlling the transmission of one impulse condition for each code combination; and a second electro-magnetic means, controlled by said first electro-magnetic means, for controlling the transmission of a synchronizing impulse condition, in accordance with the character of the impulse condition transmitted by said first electro-magnetic means.

5. In a printing telegraph transmitter; a rotary start-stop distributor; a sender having contactors, certain of which are connected to the equivalent segments of said distributor; an electro-magnetic means connected to one of said contactors; means controlled by said electro-magnetic means for controlling the transmission of the last of each code combination of impulse conditions; and second electro-magnetic means, controlled by said first electro-magnetic means, for controlling the transmission of a synchronizing impulse condition.

6. In a printing telegraph transmitter; a rotary start-stop distributor; a sender comprising a plurality of contactors, certain of which are connected to segments of said distributor; and electro-magnetic means connected to a contactor of said sender for controlling the transmission of an additional impulse condition for synchronizing, in accordance with the character of the last impulse condition of each code combination.

7. In a printing telegraph receiver; a rotary start-stop distributor; a signalling line; electro-magnetic means connected in said line and responsive to received code combinations of impulse conditions received thereon for repeating said impulse conditions to said distributor; and a second electro-magnetic means connected in said line and responsive to a received synchronizing impulse condition for controlling the starting of said distributor.

8. In a printing telegraph system; a transmitter; a start-stop receiving distributor; a signalling line, connecting said transmitter and said receiving distributor; electro-magnetic means at said transmitter for controlling the transmission of a start impulse condition preceding each code combinaton and invariably differing in character from the last impulse condition of the preceding code combination; means controlled by said electro-magnetic means for utilizing the inherent zero moment of said signalling line and electro-magnetic means at said receiving station responsive to said momentary zero period of said signalling line for starting said receiving distributor into operation.

9. In a printing telegraph system; a start-stop transmitting distributor; a start-stop receiving distributor; a transmitter cooperating with said transmitting distributor; electro-magnetic means connected to said transmitter and cooperating with said transmitting distributor for controlling the transmission of a start impulse condition preceding each code combination, which is invariably different in character from the last impulse condition of each code combination; and an electro-magnet at said receiving station responsive to said synchronizing impulse condition for controlling the starting of said receiving start-stop distributor.

10. In a printing telegraph system; a start-stop transmitting distributor; a start-stop receiving distributor; a transmitter cooperating with said transmitting distributor; electro-magnetic means connected to said transmitter and cooperating with said transmitting distributor for controlling the transmission of a synchronizing impulse condition preceding each code combination, which is invariably different in character from the last impulse condition of each code combination; an electro-magnetic means at said receiving station responsive to said synchronizing impulse condition for controlling the starting of said receiving start-stop distributor; and means, including circuit connections, controlled by said last mentioned electro-magnetic means for controlling the starting of said receiving distributor.

11. A system for telegraphy, comprising transmitting means operating at a uniform rate for transmitting code combinations of electrical selecting conditions, each preceded by a receiver start condition, differing in character from the last selecting condition entering into the preceding code combination; a receiver stopped in operation at the end of each code combination; and electro-magnetic means responsive to the start condition preceding each code combination and including circuit connections for starting said receiver into operation.

12. In a printing telegraph transmitter; a signalling line; a start-stop distributor; a sending contactor cooperating with said distributor for transmitting code combinations of impulse conditions over said line; and

means controlled by said contactor for invariably introducing a momentary inherent zero in said signalling line preceding the transmission of a code combination of impulse conditions.

13. In a printing telegraph transmitter; a signalling line; a start-stop distributor; a sending contactor cooperating with said distributor for transmitting code combinations of impulse conditions over said line; means controlled by said contactor for invariably introducing a momentary inherent zero in said signalling line preceding the transmission of a code combination; a start-stop receiver at the receiving end of said line; and means responsive to the momentary zero of the line preceding each code combination for starting the receiver into operation.

14. In a printing telegraph transmitter; a signalling line; a start-stop distributor; a sending contactor cooperating with said distributor for transmitting code combinations of impulse conditions over said line; means controlled by said contactor for invariably introducing a momentary inherent zero in said signalling line preceding the transmission of a code combination; a start-stop receiver at the receiving end of said line; and means responsive to the momentary zero of the line only when it occurs preceding each code combination for starting the receiver into operation.

In testimony whereof we affix our signatures.

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