Feb. 25, 1936. T. L. CORWIN 2,031,934

PRINTING TELEGRAPH SYSTEM

Filed July 12, 1934 2 Sheets-Sheet 1

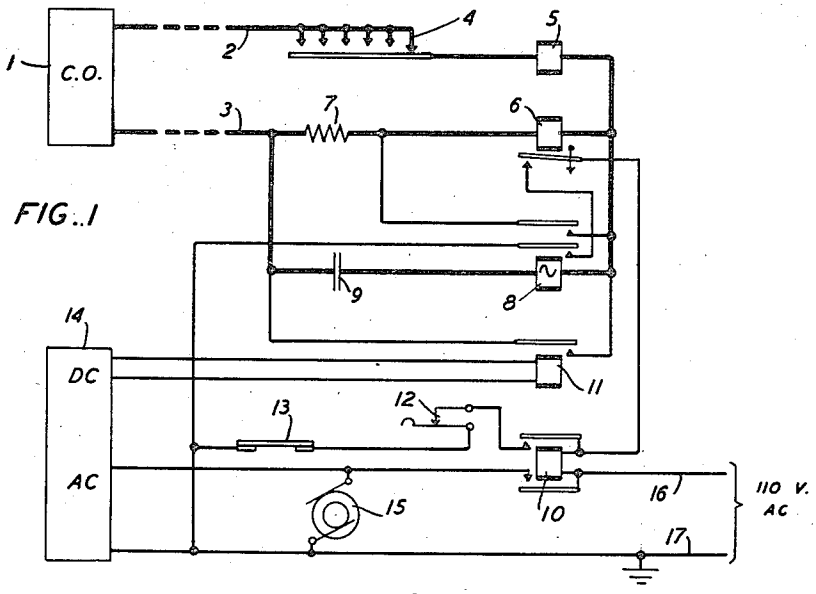

FIG. 1

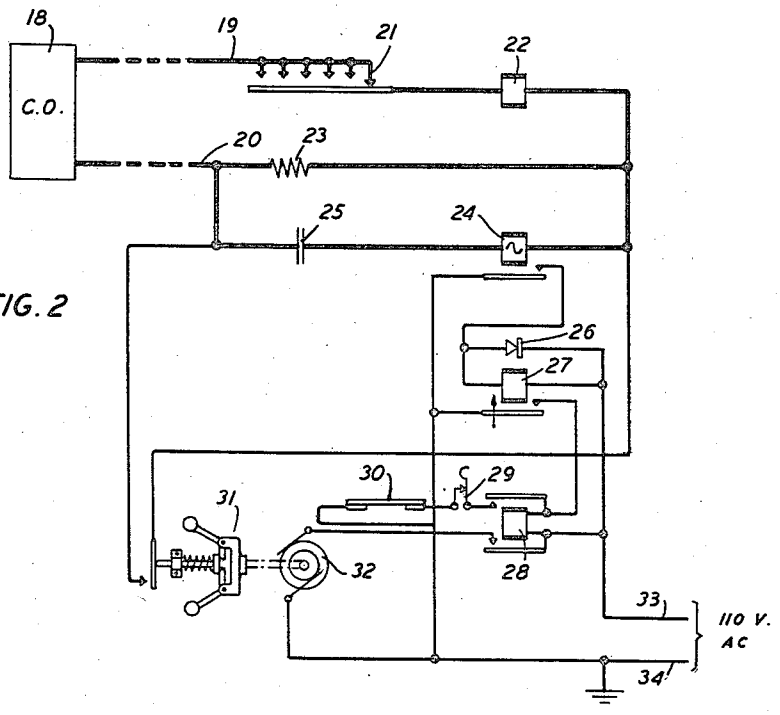

FIG. 2

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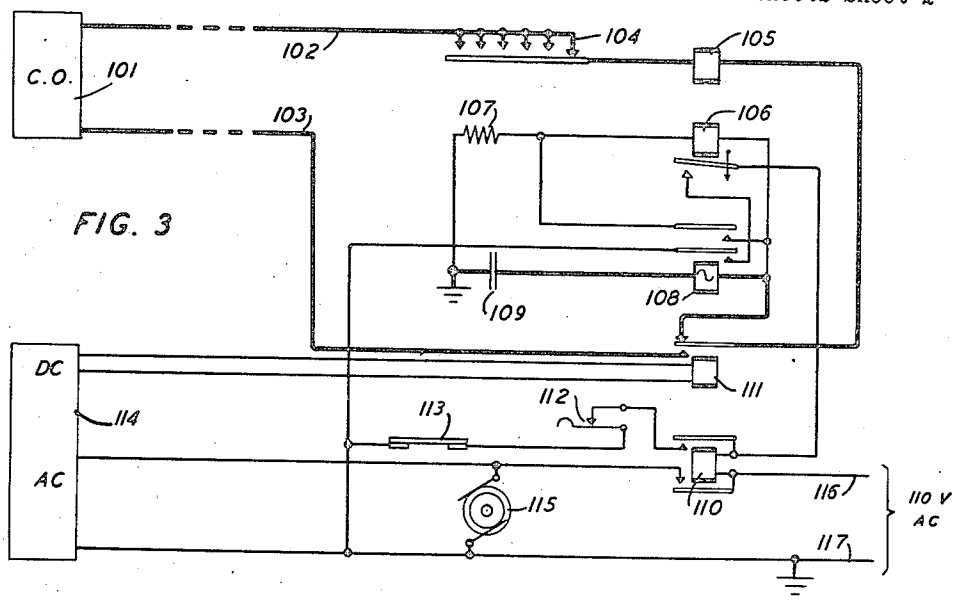

FIG. 3

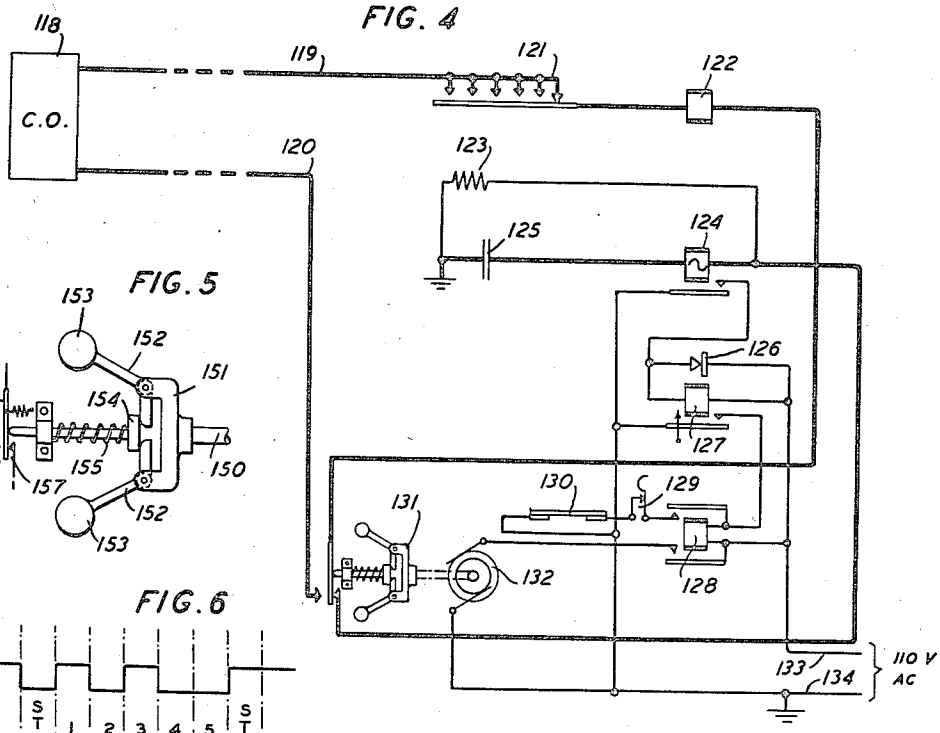

FIG. 4

FIG. 5

FIG. 6

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PRINTING TELEGRAPH SYSTEM

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Application July 12, 1934, Serial No. 734,709

12 Claims. (Cl. 178—4.1)

This invention relates to improvements in printing telegraph systems and, more particularly, to printing telegraph systems of the light traffic type in which the local power supplies for the motors at subscribers' printing telegraph stations are arranged to be remotely controlled over either normally closed or normally open loops.

In a communication system where the demands on distant teletypewriter motors are not continuous, such as in a light traffic printing telegraph system, it is desirable to operate the motors only when the working of the system requires such operation. This will reduce current consumption and maintenance expense. Several types of arrangements have been developed for performing this function.

For systems in which the transmission lines are normally closed, it has been found that in the case of those arrangements which are designed to start motors in response to the closure of the transmission lines following a short open period, false operation may occur. For example, if a switchboard operator should stop the motor at a subscriber's station and in withdrawing the plug from the line jack cause a momentary interruption of line current, the motor at the subscriber's station would start and continue to run without the knowledge of the switchboard operator. A subscriber's motor might also be unintentionally started by the swinging together of open wire lines, by an induced surge of current due to lightning, or by any other cause which would result in a momentary cessation of line current.

The false operation of remotely controlled teletypewriter motors is objectionable in that a motor at a subscriber's station may be caused to start and continue to run without the knowledge of the switchboard operator. This wastes current from the power supply at that particular station and causes needless wear of the teletypewriter apparatus at that station.

It is an object of the present invention to provide improved unattended teletypewriter exchange service over both normally closed and normally open loops.

Another object of this invention is to enable an operator at a sending printing telegraph station to start and stop the motor of a receiving teletypewriter, located at an unattended printing telegraph station, in an improved manner.

Still another object of this invention is to provide an improved arrangement at a subscriber's station for giving a signal to an operator at a central office to indicate that the subscriber's local source of power supply has been connected to his motor.

A further object of the invention is to provide an improved arrangement at a subscriber's station for giving a signal to an operator at a central office to indicate that the subscriber's motor has attained its full operating speed.

In accordance with this invention, when an operator at a sending printing telegraph station wishes to start the motor of a receiving teletypewriter located at an unattended printing telegraph station, the operator causes her sending teletypewriter to transmit significant current variations over a normally closed telegraph line to the receiving teletypewriter apparatus. These significant current variations should consist of a series of alternate openings and closures of the telegraph line connecting the two stations and should be so rapid that they, in effect, comprise pulsating direct current. When a certain well known permutation code of signals is used, these significant current variations could comprise a series of "S" signals.

When these significant current variations arrive at the unattended station, they actuate an alternating current relay located at the unattended station and connected into the telegraph line. The actuation of this alternating current relay causes it to operate its armature and to thereby close a path for current, from a source of power supply also located at the unattended station, to actuate another relay. The actuation of this second relay causes it to operate its armature and to thereby close a path for current from the power supply source to start the motor of the receiving teletypewriter located at the unattended station and to also lock up this second relay. At the same time, a resistance which is normally connected in the line is short-circuited. This causes an increase in the line current which, in effect, gives a signal to an operator at the central office to indicate that the subscriber's apparatus is in condition for communication.

After communication between the two stations has ceased, the operator at the sending station transmits a preassigned signal, such as upper case H. When this preassigned signal is received at the unattended station, it operates a contact which opens the locking-up circuit of the second relay at the unattended station. This causes the second relay to release its armature and thereby open the path leading from the power supply source to the motor of the receiving teletypewriter. As a result, the motor stops.

In order to prevent false operation due to un-

intentional openings of the telegraph line, such as those caused by line hits, a modification of this invention employs a delay arrangement located at the unattained station. This delay arrangement includes a direct current relay of the slow-to-operate type and a rectifying device, such as a Rectox unit, connected in parallel with the direct current relay. When the alternating current relay is now operated, it closes a path for current from a source of alternating current to pass to the direct current relay and the rectifying device. The rectifying device requires a certain amount of time in which to operate after which the direct current relay connected in parallel with it will also operate. In operating, the direct current relay closes a path for current from a source of power supply to operate a third relay corresponding to the second relay in the case mentioned above. This third relay locks up and connects the power supply to the motor thereby starting the motor. The motor is stopped in the same manner as that described above.

The invention will now be described in detail with reference to the drawing in which:

Fig. 1 shows a preferred embodiment for closed loop operation;

Fig. 2 shows an alternative arrangement for closed operation;

Fig. 3 shows a preferred embodiment for open loop operation;

Fig. 4 shows an alternative arrangement for open loop operation;

Fig. 5 shows the details of a centrifugal contact device used in the arrangements shown in Figs. 2 and 4; and

Fig. 6 shows the form of an "S" signal used for starting the motor of an unattended teletypewriter.

As previously explained, the subscriber's station is arranged so that the motor is started and the apparatus made ready to receive printer pulses by the sending from the central office of rapidly alternating marking and spacing signals, such as a series of "S" signals. As is shown in Fig. 6, each signal comprises practically alternate spacing and marking impulses.

Referring now particularly to Fig. 1, which shows a preferred embodiment of the invention for closed loop operation, the effect of sending "S" signals is to open and close the line momentarily a number of times thereby causing the operation of alternating current relay 8. The circuit of the operation of this relay 8 is traced from positive battery (not shown) at a printing telegraph station, such as central office 1, over line conductor 2, through sending contacts 4, selector magnet 5, relay 6, resistance 7, and then to negative battery in the central office 1 over line conductor 3. In parallel with relay 6 and resistance 7 are alternating current relay 8 and condenser 9.

When a series of rapidly alternating marking and spacing impulses, such as "S" signals, are transmitted over the telegraph line and are received by the subscriber's station, relay 8 operates, but relay 6, which is of the slow releasing type, does not release. The operation of relay 8, however, through its upper make contacts, short-circuits relay 6, thereby causing the release of relay 6. Relay 6 is of the slow-to-release type, so that momentarily open circuits on the line will not cause the apparatus to lock-in. Thus, relay 6 acts as a control means for insuring against false or unintentional operation of the motor control arrangement.

With relay 6 deenergized, a circuit is closed to operate power relay 10. This circuit is traced from the grounded power supply conductor 17 from a source of alternating current power through the inner front contacts of alternating current relay 8, the back contacts of relay 6, and then through the winding of relay 10 to power supply conductor 16. This operates relay 10 and locks-in a path traced from power supply conductor 16, winding and upper front contacts of relay 10, emergency stop key 12, stop bar contacts 13, to grounded power supply conductor 17. The operation of relay 10 also closes a circuit from the power supply to motor 15, causing motor 15 to rotate. This also closes a circuit to rectifier 14, which may be any well known rectifying apparatus, such as a full-wave copper oxide rectifier.

After an interval, during which motor 15 is allowed to come up to full speed, rectified current from rectifier 14 operates relay 11. The operation of relay 11 short-circuits the network consisting of relay 6 and resistance 7 in parallel with relay 8 and condenser 9, thereby placing selector magnet 5 in condition for receiving printer pulses. The short-circuiting of resistance 7 reduces the resistance at the subscriber's station. This increases the current flowing in the line (conductors 2 and 3). This increase in line current, in effect, gives a signal to an operator at the central office 1 to indicate that the local source of power supply has been connected to the subscriber's motor.

The subscriber's substation apparatus remains in a position to receive printer pulses with the motor 15 running until a prearranged character, such as upper case H, is sent as a stop signal. When this character is received, the locking circuit to relay 10 is broken at stop bar contacts 13 (by selecting mechanism and junction bars of the subscriber's teletypewriter) and relay 10 is allowed to release. The release of relay 10 opens the circuit to motor 15, allowing the motor 15 to come to rest and also removes the power line voltage from rectifier 14. This causes the direct current to disappear from the output terminals of rectifier 14 and permits the release of relay 11. Relay 11 released, removes the short circuit from the network comprising relay 6 and resistance 7 in parallel with relay 8 and condenser 9, and restores the line to its normal non-operated condition.

An alternate method of procuring the same result for closed loop operation is shown in Fig. 2. In this case, when the line is opened and closed repeatedly due to the sending of "S" signals, relay 24 operates in a circuit traced from positive battery (not shown) from central office 18 over line conductor 19, through sending contacts 21, selector magnet 22, alternating current relay 24 and condenser 25 in parallel with resistance 23 and then over line conductor 20 to negative battery at central office 18.

If alternating current relay 24 remains operated long enough it will cause the operation of slow-to-operate relay 27. The circuit for the operation of relay 27 is traced from grounded alternating current power supply conductor 34, through the contacts of relay 24, winding of relay 27 in parallel with rectifier 26, to power supply conductor 33. Rectifier 26 may be any well known rectifying device, such as a copper oxide rectifier. During the negative half cycle the resistance of rectifier 26 is in the high direction and the current is forced through relay 27, but during the positive half cycle it is in the conducting direction and the current goes through rectifier 26 rather than through re-

lay 27. Relay 27 therefore receives half-wave rectified pulses and due to this fact and to the fact that it is of slow-operating construction, it is slow to close its contacts, so that momentary open circuits on the line which might cause the momentary operation of relay 24, do not cause relay 27 to operate and lock-in the subscriber's station apparatus. This insures against faulty or unintentional operation of the motor control arrangement.

With repeated opens and closures of the circuit due to the sending of "S" signals, relay 24 is held operated long enough to cause the operation of relay 27. Relay 27 when operated, causes relay 28 to operate in a circuit traced from grounded power supply conductor 34, contacts of relay 27, through the winding of relay 28, and then to power conductor 33. Relay 28 locks-in a circuit traced from power supply conductor 33, winding and upper contacts of relay 28, emergency stop key 29, stop bar contacts 30, to grounded supply conductor 34. The operation of relay 28 closes a circuit from the power supply through the lower contacts of relay 28 to motor 32. When motor 32 has reached its full operating speed, centrifugal device 31 (shown in detail in Fig. 5) closes its contacts and short-circuits the network comprising relay 24 and condenser 25 in parallel with resistance 23 The short-circuiting of resistance 23 reduces the resistance of the subscriber's set and increases the line current as a signal to the operator at central office 18 that the subscriber's motor has attained its full operating speed.

As in the case of Fig. 1, the subscriber's station apparatus remains in condition for receiving printer pulses with the motor 32 running until a prearranged character, such as upper case H, is sent as a stop signal. When this character is received, selecting mechanism of the subscriber's teletypewriter operates a function bail which opens the stop bar contacts 30 thereby breaking the locking circuit for relay 28 and thus causing relay 28 to release. The release of relay 28 opens the circuit to motor 32, allowing the motor to come to rest and the contacts of centrifugal device 31 to open. The opening of the contacts on centrifugal device 31 removes the short circuit from the network comprising relay 24 and condenser 25 in parallel with resistance 23 and restores the line to its normal non-operated condition.

Fig. 3 which is a preferred embodiment of the invention for open loop operation is arranged to lock-in and start the motor in a manner similar to that described for Fig. 1. In this case, the "S" signals from central office 101 operate alternating current relay 108 in a circuit traced from battery at central office 101 over tip line wire 102 through sending contacts 104, selector magnet 105, back contact of relay 111, through alternating current relay 108 and condenser 109 in parallel with relay 106 and resistance 107, and then to ground. Relay 106 is of the slow-releasing type and does not release on the "S" signals. The operation of relay 108 short-circuits relay 106 through the upper front contacts of relay 108 and relay 106 releases after a time interval. Relay 106 is made slow in releasing so that momentary open circuits on the line will not cause the apparatus to lock-in and start the motor.

With relay 108 in an operated position and relay 106 in a released condition, a circuit is closed to operate power relay 110. This circuit is traced from grounded power supply conductor 117, inner front contact of relay 108, contacts of relay 106, through the winding of relay 110, and then to power supply conductor 116. When relay 110 operates, it locks-in by a path traced from power supply conductor 116, winding and upper front contacts of relay 110, emergency stop key 112, stop bar contacts 113, and then to grounded power supply conductor 117. The operation of relay 110 closes a circuit from the power supply to motor 115 thereby causing motor 115 to rotate. Relay 110 also closes a path to rectifier 114 which may be any well known rectifying apparatus, such as a full-wave copper oxide rectifier. After a time interval during which motor 115 is allowed to come up to full speed, rectified current from rectifier 114 operates relay 111.

The operation of relay 111 removes the network comprising relay 106 and resistance 107 in parallel with relay 108 and condenser 109 from the tip conductor 102 and closes the circuit between the tip conductor 102 and the ring conductor 103 thereby placing selector magnet 105 in condition for receiving printer pulses. When resistance 107 is cut out of the circuit, this increases the line current thereby giving a signal to the central office 101 that the subscriber's local source of power supply has been connected to his motor.

The subscriber's apparatus remains in condition for receiving printer pulses with the motor 115 running until a preassigned combination of significant current variations, such as those assigned to upper case H, is sent as a stop signal. When these current variations are received they operate selecting mechanism which causes the operation of the stop bar contacts 113. When contacts 113 open they open the locking-up circuit for relay 110 and cause it to release. The release of relay 110 opens the circuit to motor 115 thereby causing the motor 115 to come to rest. It also causes the removal of the power line voltage from rectifier 114. This causes the direct current to disappear from the output terminals of rectifier 114 and permits the release of relay 111. When relay 111 releases, it restores the line to its normal non-operated condition with the network composed of relay 106 and resistance 107 in parallel with relay 108 and condenser 109 connected from the tip conductor 102 to ground.

Fig. 4 shows an alternate arrangement for obtaining the same result for open loop operation. In this case, when the line is opened and closed repeatedly due to the sending of "S" signals, alternating current relay 124 operates. The circuit for the operation of relay 124 is traced from battery from central office 118 over tip conductor 119 through sending contacts 121, selector magnet 122, back contacts of centrifugal device 131, through relay 124 and condenser 125 in parallel with resistance 123, and then to ground. If relay 124 remains operated on these "S" pulses for a sufficiently long interval, it will cause the operation of slow-to-operate relay 127. The circuit for the operation of relay 127 is traced from grounded alternating current power supply conductor 134 through the contacts of relay 124, winding of relay 127 in parallel with rectifier 126 to power supply conductor 133. Rectifier 126 may be any well known rectifying device, such as a copper oxide rectifier. The action of this combination of relay 127 and rectifier 126 is the same as that described above for relay 27 and rectifier 26 shown in Fig. 2.

When relay 127 operates, it closes a path from grounded power supply conductor 134, contacts of relay 127, through the winding of relay 128,

and then to power supply conductor 133. Relay 128 operates on this current and locks through a path from conductor 133, upper contacts of relay 128, emergency stop key 129, stop bar contacts 130, and then to conductor 134. The operation of relay 128 also closes a circuit from the power supply to motor 132 causing the motor 132 to rotate. When motor 132 has reached its full speed, centrifugal device 131 (shown in detail in Fig. 5) breaks its back contacts and closes its front contacts, thereby removing the network comprising relay 124, condenser 125 and resistance 123 from the tip side of the line and connecting the tip line wire 119 through selector magnet 122 to ring conductor 120, thus placing the subscriber's apparatus in condition for receiving printer pulses. The removal of resistance 123 from the circuit increases the line current which, in effect, gives a signal to the central office operator at central office 118 to indicate that the subscriber's motor has attained its full operating speed.

As in the other cases, the motor 132 is left running until a prearranged character, such as upper case H, is sent as a stop signal. When this character is received, the locking circuit for relay 128 is broken at stop bar contacts 130 and relay 128 is allowed to release. The release of relay 128 opens the circuit through motor 132 thereby causing the motor 132 to come to rest and the centrifugal contact device 131 to open the circuit between the two line conductors 119 and 120 and reconnect the network comprising relay 124, condenser 125, and resistance 123 to the tip conductor 119. This restores the line to its normal non-operated condition.

Fig. 5 shows the details of the centrifugal contact device used in Figs. 2 and 4. It is of the well known flyball governor type in which, upon the rotation of shaft 150 which is connected to the motor, the bracket 151 and arms 152 with flyballs 153 rotate with it. When the motor has reached its full operating speed, the centrifugal force (due to the rotation) forces the flyballs 153 outward and causes arms 152 to rotate on their pivots thereby pushing the operating shaft 154 in a longitudinal direction to the left against the pressure of retractile spring 155. The motion of shaft 154 in a longitudinal direction to the left causes armature 156 to break the circuit with its back contact 157 and make the circuit with its front contact 158. Conversely when the motor slows down, flyballs 153 will drop inwardly and cause arms 152 to resume the position shown in Fig. 5. This will pull the operating shaft 154 back to the right which, in turn, causes armature 156 to break its front contact 158 and make its back contact 157.

The above arrangements have been shown in order to illustrate the principles of this invention. It is to be understood that different arrangements employing the principles of this invention may be designed. Accordingly, the invention is not to be limited to the arrangements shown in the drawing but is to be restricted only by the claims appended hereto.

What is claimed is:

1. A communication system including a first communication station connected by a transmission line to a second communication station; said second communication station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities including a relay of the type which requires a plurality of current pulses to pass through its winding before it will operate, and control means at the first station for transmitting pulsating direct current over the line to the second station for operating said relay.

2. A printing telegraph system including a first printing telegraph station connected to a second printing telegraph station by a normally closed telegraph line which normally has direct current flowing over it, said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities including an alternating current relay located at the second station and adapted to be operated by the reception at the second station of a series of rapidly alternating marking and spacing impulses transmitted over the telegraph line by the first station.

3. A printing telegraph system including a first printing telegraph station connectible by a normally open loop to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, control means for closing said normally open loop, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities including an alternating current relay located at the second station and adapted to be operated by the reception at the second station of a series of rapidly alternating marking and spacing impulses transmitted over the telegraph line by the first station.

4. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of pulsating direct current transmitted over the telegraph line by the first printing telegraph station; and control means for insuring against false or unintentional operation of said instrumentalities.

5. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of a series of rapidly alternating marking and spacing impulses transmitted over the telegraph line by the first printing telegraph station; and control means for insuring against false and unintentional operation of said instrumentalities, and said control means including an electro-responsive device having a time delay.

6. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station;

said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor, but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of pulsating direct current transmitted over the telegraph line by the first printing telegraph station; and control means for insuring against false and unintentional operation of said instrumentalities, said control means including a relay of the slow-to-release type.

7. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of a series of rapidly alternating marking and spacing impulses transmitted over the telegraph line by the first printing telegraph station; and control means for insuring against false or unintentional operation of said instrumentalities, said control means including a rectifying device.

8. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of pulsating direct current transmitted over the telegraph line by the first printing telegraph station; and control means for insuring against false or unintentional operation of said instrumentalities, said control means including a copper oxide rectifier.

9. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of a series of rapidly alternating marking and spacing impulses transmitted over the telegraph line by the first printing telegraph station; and signaling means for accurately informing an operator at the first printing telegraph station whether the instrumentalities have operated to connect the source of power supply to the motor and whether the motor has come up to its full operating speed.

10. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station; said second printing telegraph station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities being operated by the reception at the second printing telegraph station of a series of rapidly alternating marking and spacing impulses transmitted over the telegraph line by the first printing telegraph station; and signaling means for giving an indication to the operator at the first printing telegraph station that the instrumentalities have operated to connect the source of power supply to the motor and that the motor has come up to its full operating speed, said signaling means including a resistance located at the second printing telegraph station and normally connected to the telegraph line, and a centrifugal contact device connected to the shaft of the motor for increasing the line current by short-circuiting the resistance when the motor has attained its full operating speed.

11. A printing telegraph system including a first printing telegraph station connected by a telegraph line to a second printing telegraph station, said second station having a teletypewriter, a motor for operating the teletypewriter, a source of power supply for operating the motor but normally disconnected therefrom, and instrumentalities for connecting the source of power supply to the motor, said instrumentalities including a relay which requires that a plurality of successive code impulse combinations pass through its winding before it will operate, and control means at the first station for transmitting a plurality of successive code impulse combinations over the telegraph line to the second station for operating the relay.

12. In a teletypewriter system having a first teletypewriter station and a second teletypewriter station with a telegraph line extending from the first station to the second station, said second station having a teletypewriter with an energizing circuit which is normally open and adapted to be closed in response to the operation of an alternating current relay also located at the second station, the method of starting the teletypewriter motor at the second station from the first station which comprises transmitting pulsating direct current from the first station over the telegraph line to the second station, operating the alternating current relay, and closing the energizing circuit of the motor.

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