

Jan. 21, 1936.

T. L. CORWIN

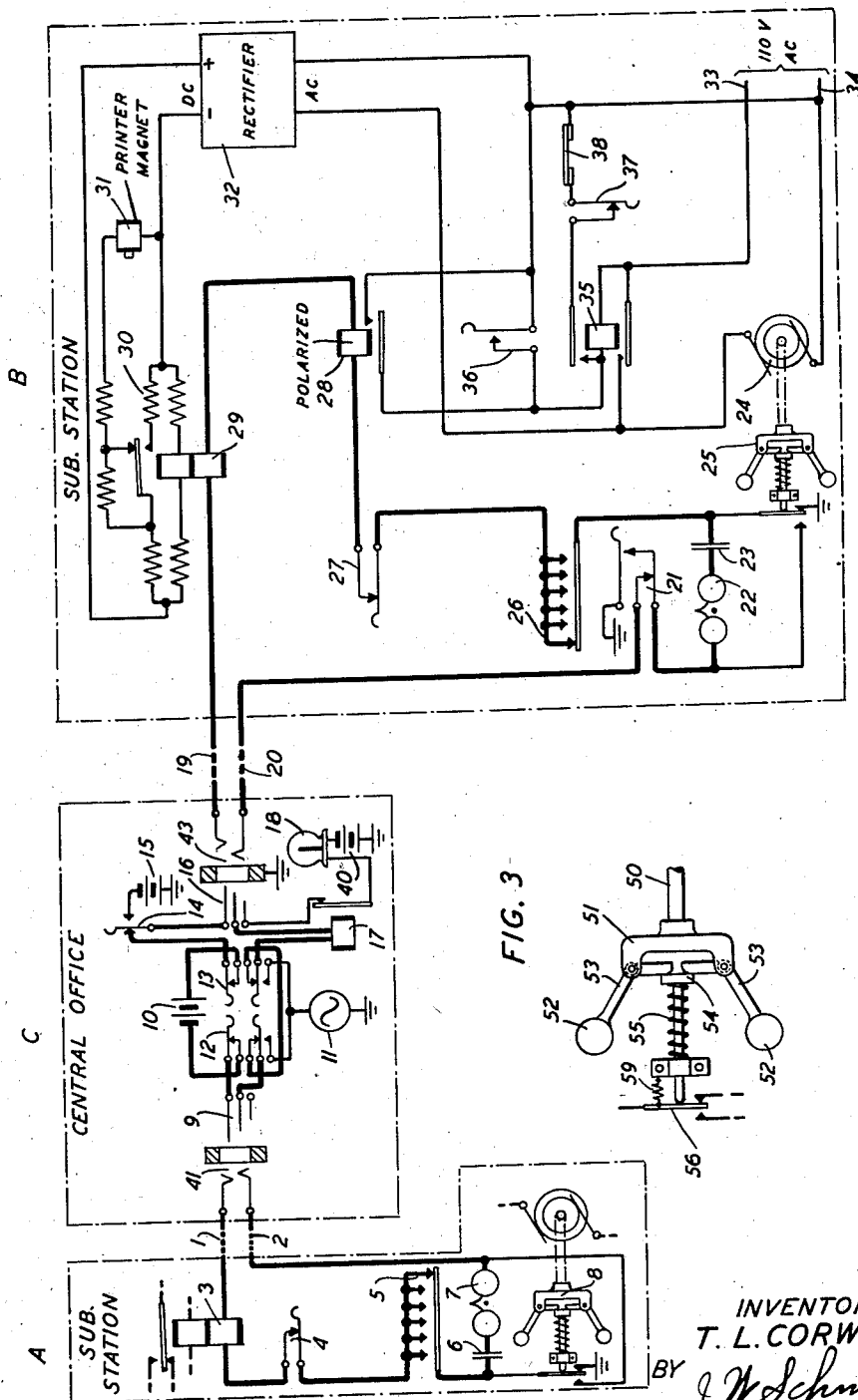
2,028,194

PRINTING TELEGRAPH SYSTEM

Filed July 14, 1934

2 Sheets-Sheet 1

FIG. 1



INVENTOR
T. L. CORWIN
BY *J. W. Schmied*
ATTORNEY

Jan. 21, 1936.

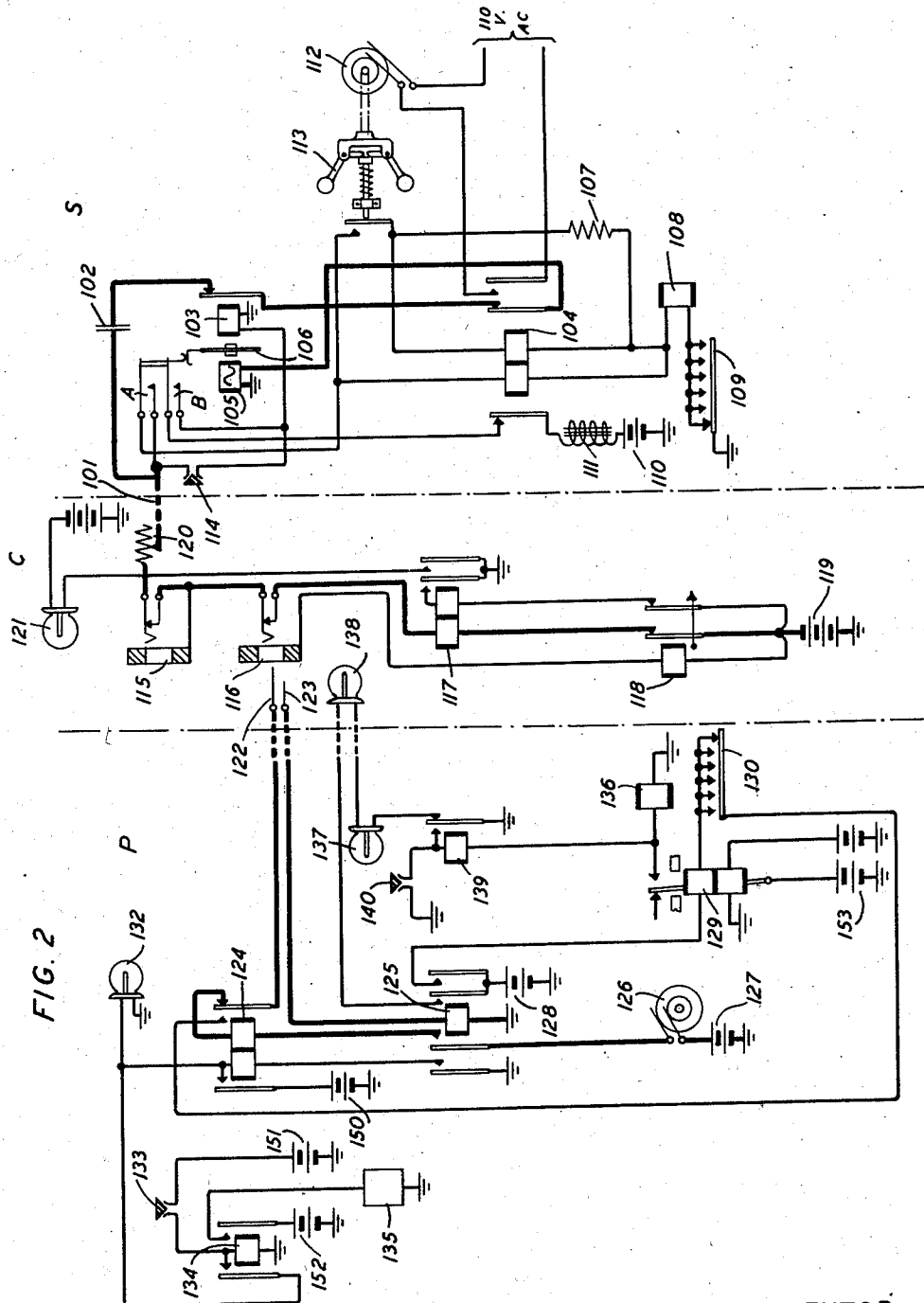
T. L. CORWIN

2,028,194

PRINTING TELEGRAPH SYSTEM

Filed July 14, 1934

2 Sheets-Sheet 2



INVENTOR
T. L. CORWIN
BY *J. W. Schmitt*
ATTORNEY

UNITED STATES PATENT OFFICE

2,028,194

PRINTING TELEGRAPH SYSTEM

Thomas L. Corwin, Newark, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application July 14, 1934, Serial No. 735,172

1 Claim. (Cl. 178—4.1)

This invention relates to improvements in teletypewriter exchange systems having subscribers' teletypewriter stations which may be attended or unattended.

5 In furnishing teletypewriter exchange service over telegraph lines to attended or unattended subscribers' printing telegraph stations, it is necessary to switch a subscriber's ringer out of the subscriber's telegraph line whenever that sub-
10 scriber's teletypewriter is switched into the line for communication with an operator at a central printer office or at another subscriber's printer station. When communication has ceased between these stations, it is necessary to switch
15 the subscriber's teletypewriter out of the line and to switch the ringer back into the line. It is desirable that the switching arrangement used for switching a subscriber's ringer into and out of a telegraph line can be an automatic ar-
20 rangement in order that it may be used at either an attended or an unattended teletypewriter station.

When such a switching arrangement is used, it is advisable to employ a signaling arrange-
25 ment for notifying the operator at a calling teletypewriter station that the ringer has been switched out of the line and that the teletypewriter has been switched into the line and is ready for communication. It is important that
30 such a signaling arrangement should not give a signal to a calling operator until the motor of the teletypewriter at the called printer station has come up to the proper operating speed and its associated rectifier or motor-generator
35 set has built up its voltage to the point where the teletypewriter will remain closed and will not print false characters.

Accordingly, it is an object of this invention to furnish improved teletypewriter exchange
40 service over telegraph lines to subscribers' teletypewriter stations whether they be attended or unattended stations.

It is also an object of this invention to provide
45 an improved arrangement for switching a subscriber's ringer out of the subscriber's telegraph line whenever that subscriber's teletypewriter is switched into the line for communication with an operator at a central office or at another subscriber's station.

50 A further object of this invention is to supply an improved arrangement for controlling the operation of a teletypewriter motor located at a distant printer station.

Still another object of this invention is to pro-
55 vide an improved signaling arrangement for no-

tifying the operator at a calling printing telegraph station that the motor of the teletypewriter at a called printing telegraph station has started and has actually attained its full operating speed.

These objects are accomplished chiefly through the use of a centrifugal contact device which is connected to the shaft of the motor of the teletypewriter which is to be switched into the tele-
10 graph line. Since the centrifugal contact device does not operate until the motor has started and has come up to the proper operating speed, there is no danger of the printing of false characters due to the teletypewriter being operated prema-
15 turely.

In the case of an attended teletypewriter station, the attendant originates a call by momentarily pressing a key. The operation of this key closes a path which enables current from a local power supply at that station to energize a relay.
20 When this relay becomes energized, it operates its armature thereby closing a path from the local power supply to the teletypewriter motor and, at the same time, closing a locking-up circuit for this relay. Current from the local power
25 supply is now able to cause the operation of the teletypewriter motor and also the rectifier or motor-generator set associated with it.

When the teletypewriter motor has come up to its proper operating speed, it causes the cen-
30 trifugal contact device (which is connected to the shaft of the motor) to operate a switch which removes the subscriber's ringer from the line and switches the teletypewriter into the line.

After communication has ceased, the operator
35 at either station may send a disconnect signal which opens the locking-up circuit for the relay at the subscriber's station. When this locking-up circuit is opened, the relay becomes non-operated and releases its armature. This opens the
40 circuit from the local power supply through the teletypewriter motor with the result that the motor stops. The stopping of the motor causes the centrifugal contact device to return to its former condition thereby disconnecting the tele-
45 typewriter from the line and connecting the ringer back into the line.

If an operator at a central teletypewriter office wishes to call a subscriber, the operator applies
50 ringing current to the line thereby operating the subscriber's ringer. If the subscriber is present, he presses the key mentioned above which causes his motor to start in the manner described above. If the subscriber is absent, or if it is an un-
55 attended station, the operator will receive no

answer to her ring. She will then apply negative battery to the line by means of a key at her central office. This will cause a polarized relay at the subscriber's station to become energized.

When this polarized relay becomes energized, it operates its armature thereby closing a path which enables current from the local power supply at that subscriber's station to energize the relay mentioned above in the same manner that the key did as described above. When this relay becomes energized, it causes the operation of the teletypewriter motor and its associated rectifier or motor-generator set as was described above. The motor is stopped by the transmission of a disconnect signal as was also described above.

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

Fig. 1 shows a preferred embodiment of the invention, in which a subscriber's station A is connected to a subscriber's station B through a central office C;

Fig. 2 shows an alternative arrangement in which subscriber's station S is connected to operator's position P through concentrating position C; and

Fig. 3 indicates a practical method of construction for the centrifugal contact device used in the arrangements shown in Figs. 1 and 2.

Referring particularly to Fig. 1, a subscriber's station A is shown in abbreviated fashion and connected by a telegraph line 1 and 2 to a jack 41 associated with plug 9 located at central office C. Likewise subscriber's station B is shown connected by a telegraph line 19 and 20 to a jack 43 associated with plug 16 at central office C. Central office C is shown as a double plug ended cord circuit arranged to connect subscriber's stations A and B in telegraphic communication. In subscriber stations A and B and central office C only those portions of the circuit necessary to the complete understanding of the invention are shown.

It will be assumed that the subscriber at station A has initiated a call and, after plug 9 has been inserted in jack 41, has transmitted to the central office operator the code of the desired line. The central office operator then inserts the plug 16 of the cord circuit into the jack 43 associated with the desired subscriber's line 19 and 20 and operates ringing key 13. With plug 16 inserted in the jack 43 associated with line 19 and 20, a circuit is closed to operate an alarm device, such as supervisory lamp 18. This circuit is traced from battery 40 through lamp 18, contacts of relay 17, sleeve conductor of plug 16, and then to ground on the sleeve terminal of the jack 43 associated with line 19 and 20. The operation of ringing key 13 connects ringing current to the ring conductor 20 and rings the subscriber's bell 22 in a circuit traced from grounded alternating current generator 11, lower front contact of key 13, the winding of relay 17, ring conductor of plug 16, ring spring of the jack 43, ring conductor 20, normal contacts of key 21, the winding of ringer 22, condenser 23, through the normally made contacts of centrifugal contact device 25, and then to ground.

If the subscriber is present he will answer the call in the usual manner by operating key 36. If, however, the station is unattended, provision is made for starting the substation apparatus by the momentary operation of key 14 at the central office. The operation of this key 14 removes positive battery 10 from the tip conductor 19 and substitutes negative battery 15. This operates polarized relay 28 which is connected in

such a way that the normal battery 10 is in a direction to non-operate it but when negative battery is applied to the line 19 it operates. The path for operating relay 28 is traced from grounded negative battery 15, operated contacts of key 14, tip terminal of plug 16, tip spring of jack 43, line conductor 19, the winding of receiving relay 29, the winding of polarized relay 28, break contacts 27, sending contacts 26, through the normally made contacts of centrifugal contact device 25, and then to ground.

When polarized relay 28 operates, it starts the motor 24 and connects the local source of power supply to rectifier 32 in order to make the subscriber's teletypewriter apparatus ready to receive printer pulses. Thus, when relay 28 operates, it causes the operation of power relay 35 in a circuit traced from power supply conductor 33, the winding of power relay 35, the contacts of relay 28 to power supply conductor 34. When relay 35 operates, it locks up through a circuit traced from power supply conductor 34, stop bar contacts 38, emergency stop key 37, upper front contact and winding of relay 35, and then to power supply conductor 33. The operation of power relay 35 connects the power supply conductors 33 and 34 to the motor 24 and also to rectifier 32 through the lower contacts of relay 35. Rectifier 32 may be any well-known rectifying apparatus, such as a full wave copper oxide rectifier. Its function is to rectify the alternating current from the local source of alternating current power supply for operating printer magnet 31 through resistance network 30 and the contacts of receiving relay 29.

When motor 24 attains its full operating speed, centrifugal contact device 25 (whose action will be described in detail later) breaks its normally closed back contact and closes its front contact. This action short-circuits ringer 22 and condenser 23 and removes ground from tip conductor 19 connecting it instead through the receiving teletypewriter apparatus to ring conductor 20. This closes the communication circuit which leads from battery 10, normal upper contacts of key 13, normal contacts of key 14, the tip terminal of plug 16, jack 43, tip conductor 19, the windings of receiving relay 29 and polarized relay 28, break contacts 27, sending contacts 26, front contacts of centrifugal device 25, recall contacts 21, ring conductor 20, ring terminal of plug 16, the winding of relay 17, lower normally made contacts of key 13, lower normally made contacts of key 12, ring terminal of plug 9, jack 41, ring conductor 2, front contacts of centrifugal device 25, sending contacts 5, break contacts 4, the winding of receiving relay 3, tip conductor 1, tip terminal of plug 9, through the upper normally made contacts of key 12 and then to battery 10. Relay 17 operates in this circuit and opens the circuit to lamp 18 thereby extinguishing it as a signal to the operator at central office C that the teletypewriter apparatus at subscriber's station B is ready to receive printer pulses.

The apparatus at station B remains in condition for receiving printer pulses with the motor 24 running until a preassigned signal (or combination of significant current variations) is sent, such as upper case H. When this preassigned signal is received, it operates certain selecting mechanism and function bails of the subscriber's teletypewriter so as to open the stop bar contacts 38. When stop bar contacts 38 open, they open the locking-up circuit for relay 35 and cause it to release. The release of relay 35 opens the

power circuit from power supply conductors 33 and 34 to motor 24 and rectifier 32 thereby discontinuing their operation. After motor 24 has slowed down appreciably, centrifugal contact device 25 breaks its front contact and makes its back contact thus restoring the subscriber's teletypewriter apparatus to its normal condition by removing the short circuit from ringer 22 and condenser 23 and reconnecting them in circuit with the ring conductor 20 to ground, reconnecting the tip conductor 19 through polarized relay 28 to ground, and opening the direct current circuit between the tip conductor 19 and the ring conductor 20.

An alternative arrangement for accomplishing the same result is shown in Fig. 2 where a central office operator's position circuit P is shown connected to the subscriber's teletypewriter apparatus S through a concentration board C. The subscriber's station S is connected to the concentration board C by line conductor 101 and the circuit is arranged so that in the normal unoperated condition the line is closed to alternating current through a winding of alternating current relay 105 but is open to direct current by reason of condenser 102. Power from the local source of power supply is connected to motor 112 by motor control relay 104 which is energized over the line circuit after alternating current relay 105 has been operated. Motor 112 is equipped with a centrifugal contact device 113 (which will be described later and which is shown in detail in Fig. 3). After the motor 112 has attained its full operating speed, centrifugal contact device 113 closes its contacts and reduces the resistance of relay 104 to such a degree that its effect on the operation of receiving relay 103 is not appreciable but the reduction in resistance is sufficient to operate relay 124 in the operator's position circuit P. When relay 124 operates it closes a circuit to operate an alarm device, such as lamp 132, as a signal to the operator that the substation apparatus is ready to receive printer pulses.

In order to initiate a call, the subscriber at station S operates key 114 thereby closing a circuit to operate and lock relay 117 at the concentration board C. The operating path for relay 117 is traced from grounded battery 119, inner back contact of relay 118, left-hand winding of relay 117, tip spring of jack 116, tip spring of jack 115, variable resistance 120, subscriber's line conductor 101, key 114, through the winding of restoring relay 103, and then to ground. The locking circuit for relay 117 is traced from grounded battery 119, outer back contact for relay 118, right-hand winding and inner front contact of relay 117, and then to ground. When relay 117 operates, it closes a circuit from ground on its outer front contact through the filament of line lamp 121, and then to battery thereby lighting the lamp 121 as a line signal.

The concentration board operator answers the call by inserting a plug, such as plug 122 associated with an idle operator's position, in jack 116 associated with lamp 121. Relays 118 and 125 are then energized in a circuit traced from grounded battery 119, the winding of relay 118, sleeve conductor of jack 116, sleeve terminal 123 of the answering plug, through the winding of relay 125, and then to ground. The operation of relay 118 breaks both operating and locking circuits to relay 117 thereby releasing relay 117 and extinguishing lamp 121.

The operation of relay 125 closes a circuit from grounded battery 128, right-hand inner front contact of relay 125, the filaments of lamps 138

and 137 in series through the back contact of relay 139, and then to ground. Lamps 137 and 138 light in this circuit as a busy signal. The operation of relay 125 also connects alternating current from alternating current generator 126 superimposed on direct current from grounded battery 127 through the left-hand inner front contact of relay 125, right-hand winding and right-hand back contact of relay 124, tip conductor 122, tip spring of jack 116, tip spring of jack 115, variable resistance 120, line conductor 101, condenser 102, back contact of restoring relay 103, right-hand inner back contact of relay 104, through the winding of alternating current relay 105, and then to ground.

Alternating current relay 105 operates over the circuit just traced and through its armature 106 operates the sets of springs labeled A and B. Springs A close the subscriber's line to direct current and cause the operation of motor control relay 104 in a circuit traced from grounded battery 127, the winding of alternating current generator 126, left-hand inner front contact of relay 125, the right-hand winding and right-hand back contact of relay 124, tip conductor 122, tip spring of jack 116, tip spring of jack 115, variable resistance 120, line conductor 101, set of springs A associated with armature 106, left-hand winding of relay 104, the winding of receiving relay 103, through sending contacts 109 and then to ground. The circuit just traced includes a winding of relay 124 but this relay, being marginal, does not operate at this time.

The operation of motor control relay 104 connects the local source of power supply to motor 112 through its right-hand outer front contact. The operation of relay 104 disconnects the operating path to alternating current relay 105 through its right-hand inner back contact and also disconnects the circuit from battery 110 to restoring relay 103 at the left-hand back contact of relay 104. In order to prevent the false operation of restoring relay 103 after relay 105 has operated and before relay 104 has had sufficient time to operate, spring assembly A and B is so constructed that contacts A close an appreciable time before contacts B close. In this way, sufficient time is obtained for relay 104 to operate and break its left-hand back contacts before springs B close the circuit to restoring magnet 103. The opening of the operating circuit of relay 105 does not cause armature 106 to restore. Consequently, contacts A and B remain closed until the operation of restoring relay 103.

When motor 112 reaches its full operating speed, centrifugal contact device 113 closes its contacts and reduces the resistance of relay 104 in the line circuit by placing the right-hand winding of relay 104 and resistance 107 in parallel with its left-hand winding. This reduction in the line resistance is sufficient to operate marginal relay 124 over the line circuit previously described. The operation of marginal relay 124 opens the circuit from alternating current generator 126 superimposed on direct current battery 127 at the right-hand back contact of relay 124 and connects the line circuit through the right-hand front contact of relay 124, sending contacts 130, the winding of receiving relay 129, through the right-hand outer front contacts of relay 125, and then to battery 128.

Relay 124 locks up in a circuit traced from battery 150, through the left-hand contacts and winding of relay 124 through the left-hand outer front contacts of relay 125, and then to ground.

The left-hand locking-up contact of relay 124 is adjusted to close the circuit to the left-hand winding of relay 124 before its right-hand contacts break the circuit to the right-hand winding in order to insure the complete operation of relay 124. Relay 124 in operating also closes a circuit from battery 150, through its left-hand front contact, through the filament of lamp 132, and then to ground thereby lighting the lamp 132 as an indication that the subscriber's station S is ready to receive printer pulses.

Due to the fact that centrifugal contact device 113 does not close its contacts until motor 112 has actually reached its full operating speed, there is no danger that a signal will be given to the operator at P before the motor is ready. This constitutes an improvement over other methods which only operate after a mere time delay regardless of whether the motor 112 is actually operating. The operator at position P noting the lighting of this lamp 132, operates key 133 which connects battery 151 to the winding of relay 134 thereby operating relay 134. Relay 134 locks up from ground, through its left-hand front contact, through the left-hand front contact of relay 124, then to battery 150. Relay 134 also closes a circuit from battery 152, through its right-hand front contact, through motor 135, and then to ground thereby operating motor 135.

The circuits and apparatus are now in a position to send and receive printer pulses. When the communication has ended the central station operator operates key 140 which operates relay 139 in a circuit traced from grounded battery 153, through the right front contact of relay 129, through the winding of relay 139, key 140, and then to ground. When relay 139 operates, it locks up through its own contacts and opens the circuit to the filaments of lamps 137 and 138. The central station concentration board operator noting the extinguishing of lamp 138, removes plug 122 from jack 116, thus breaking the circuits through motor control relay 104 and relays 118 and 125. Relay 118 is of the slow-to-release type in order that relay 104 may release first and permit the operation of restoring magnet 103 to open the line circuit to direct current before relay 118 closes its back contacts and reconnects relay 117 to the line. In this way, the false operation of relay 117 is prevented.

Relay 104, in releasing, closes a circuit from grounded battery 110, inductance 111, left-hand back contact of relay 104, contacts B associated with armature 106, through the winding of restoring relay 103, and then to ground. Relay 103 operates and restores armature 106 to its original position, thereby opening contacts A and B associated with it and also opening line 101 to direct current. In releasing, relay 104 also disconnects the local power supply from motor 112 allowing it to come to rest. When motor 112 does come to rest, it causes the centrifugal contact device 113 to open its contact and to thereby restore the alternating current circuit from line conductor 101 through condenser 102 to relay 105 through the right-hand inner back contacts of relay 104. In opening its contacts, centrifugal device 113 removes the right-hand winding and resistance 107 from the parallel circuit with the left-hand winding of relay 104.

At the central office, the release of relay 125

opens the circuit and releases relay 124, opens the circuit to lamps 137 and 138 to prevent them from re-lighting, opens the circuit to receiving relay 129 (allowing it to release), and opens the circuit to relay 134 permitting this relay to release and open the circuit to motor 135. The release of relay 129 opens the circuit to relay 139 allowing it to release. All circuits at both the central office and subscriber's station are thus restored to their normal condition as shown in Fig. 2.

The operation of the system when a call is initiated at the central station is similar to that just described and so need not be explained here.

Fig. 3 shows the details of the centrifugal contact device used in Figs. 1 and 2. It is of the well-known flyball governor type in which, upon the rotation of shaft 50 which is connected to the motor, the bracket 51 and arms 53 with flyballs 52 rotate with it. When the motor has reached its full operating speed the centrifugal force (due to the rotation) forces the flyballs 52 outward and causes arms 53 to rotate on their pivots thereby pushing operating shaft 54 in a longitudinal direction to the left against the pressure of retractile spring 55. The motion of shaft 54 in a longitudinal direction to the left causes armature 56 to break the circuit with its back contact and make the circuit with its front contact. Conversely, when the motor slows down, flyballs 52 will drop inwardly and cause arms 53 to resume the position shown in Fig. 3. This will pull the operating shaft 54 back to the right which, in turn, causes armature 56 (biased by spring 59) to break its front contact and make its back contact.

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 drawings, but is to be restricted only by the claim appended hereto.

What is claimed is:

A teletypewriter system having a central teletypewriter office with a concentration board, a subscriber's teletypewriter connectable to the concentration board by only a single wire telegraph line, said line being normally closed to alternating current and normally open to direct current, a normally unoperated teletypewriter motor located at the subscriber's station, motor starting means at the subscriber's station for starting the motor, control means at the concentration board for applying alternating current to the line to operate the motor starting means for starting the motor, a normally unoperated instrumentality for varying the direct current resistance of the line, said instrumentality being operated only by the teletypewriter motor and only when the motor has attained its full operating speed, and a normally unoperated indicating device at the central office operating in response to the variation in direct current resistance of the line for giving an operator at the central office an invariably correct indication that the teletypewriter motor at the subscriber's station has attained its full operating speed.

THOMAS L. CORWIN.