Aug. 8, 1933. E. W. HEWITT ET AL 1,921,990

MOTOR CONTROL CIRCUIT FOR TELEGRAPH PRINTERS

Filed Aug. 1, 1931 2 Sheets-Sheet 1

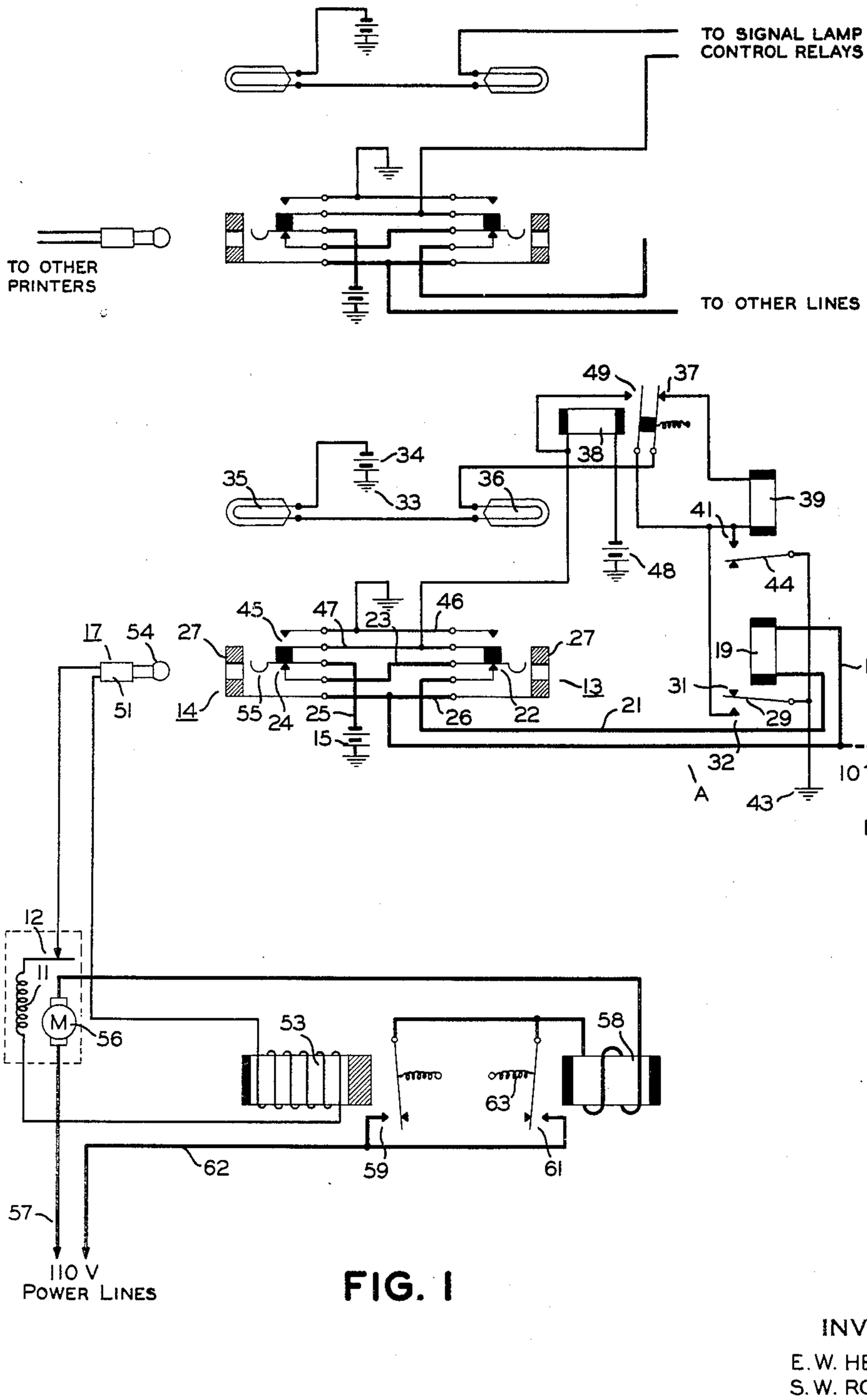

FIG. 1

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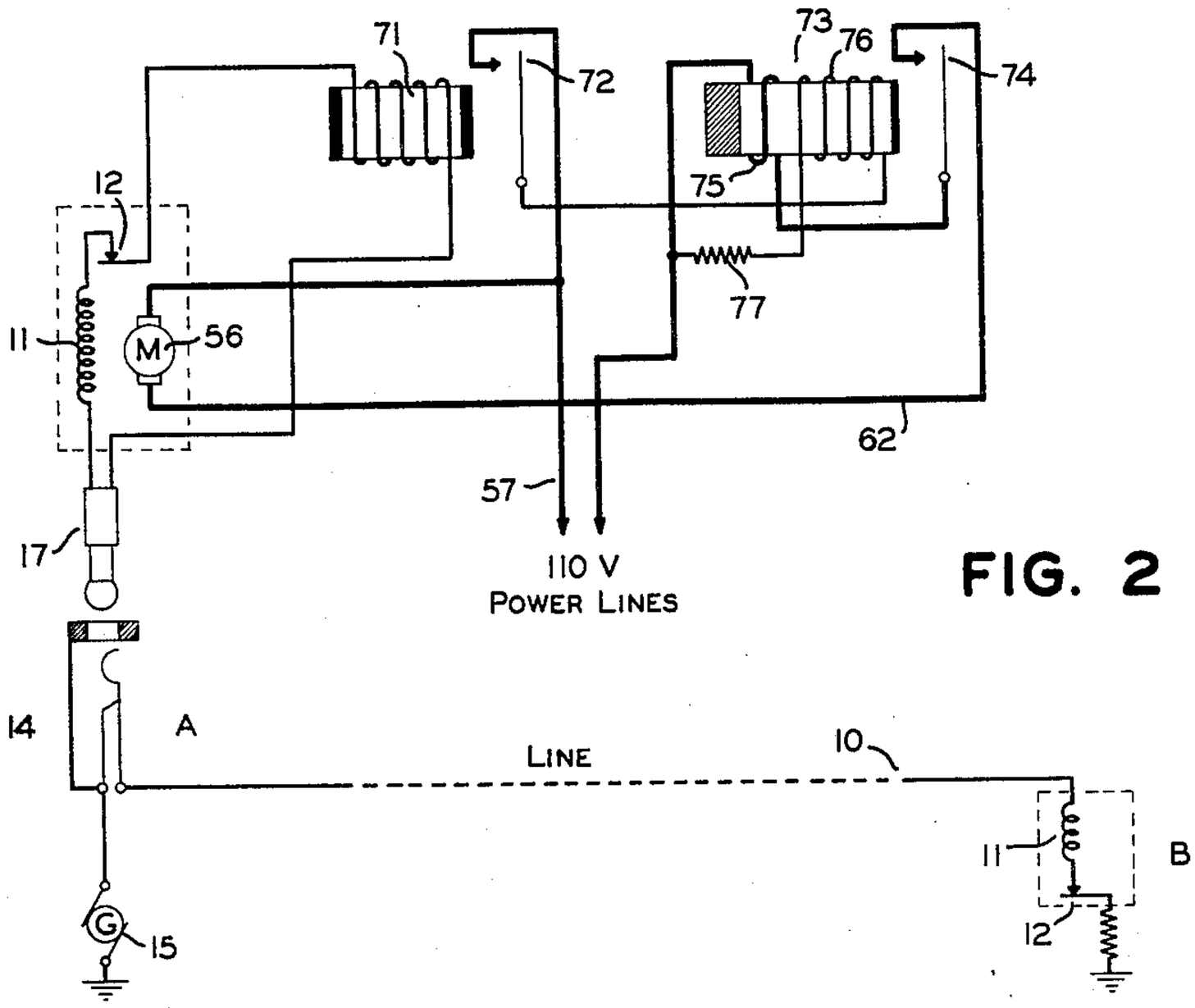

FIG. 2

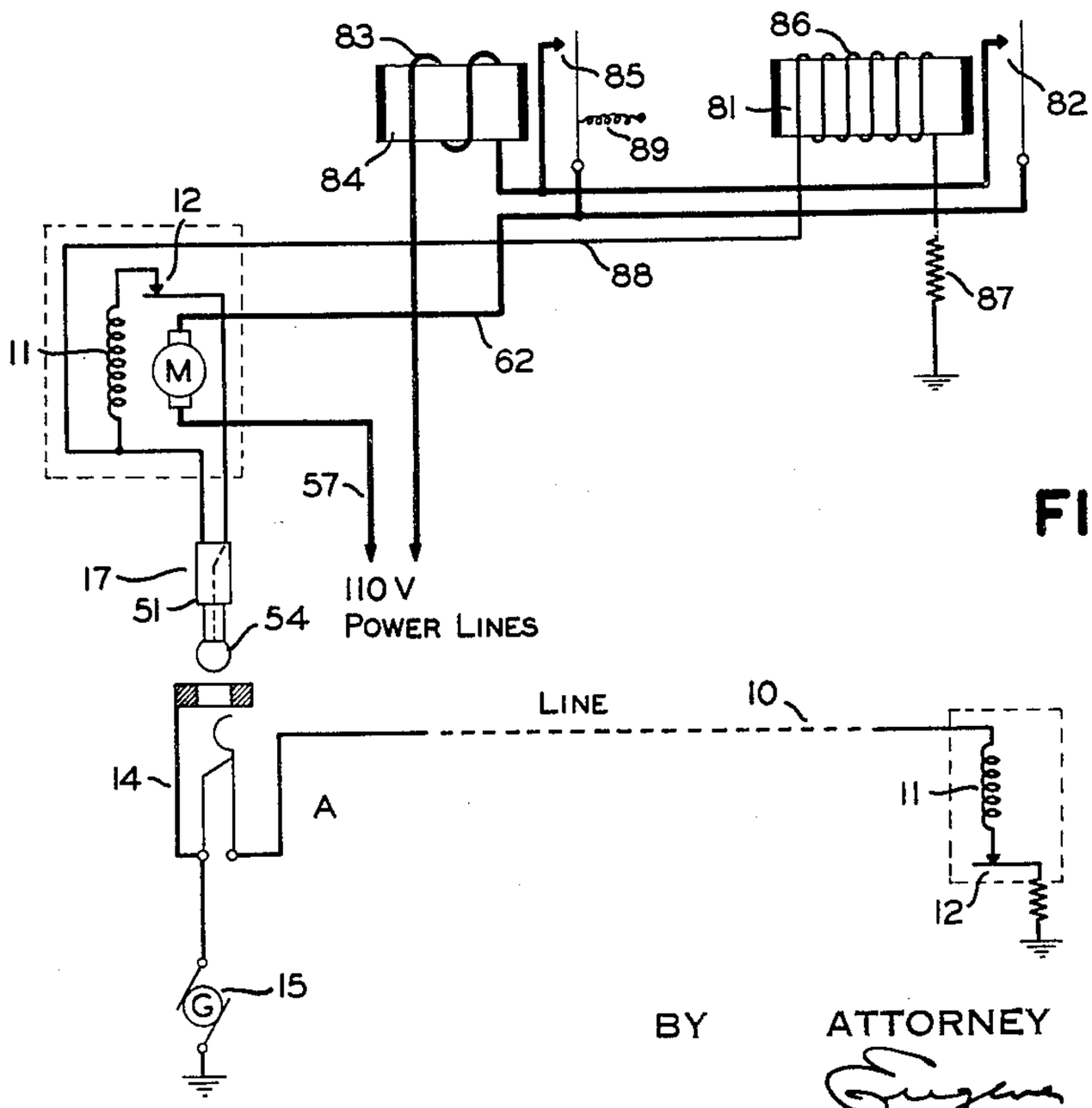

FIG. 3

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MOTOR CONTROL CIRCUIT FOR TELEGRAPH PRINTERS

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Application August 1, 1931. Serial No. 554,538

21 Claims. (Cl. 178—4.1)

This invention relates to telegraph systems employing printers which may be readily connected to telegraph lines, and has for an object to provide an automatic control system for starting and stopping the printer motor when the printer is connected to or disconnected from the telegraph line.

In printing telegraph systems, it is desirable, in order to save wear on the printing machines, to eliminate noise and conserve the current required for operating the machines, to maintain the driving motors idle when the printing telegraph circuit is not in operation, and at the same time it is desirable to have the printing unit immediately available when it is desired to employ the same in transmitting or receiving telegraph messages.

In a co-pending application of Rothermel and Hewitt, filed August 31, 1929, Serial No. 389,850, a system is described employing a call signal and a motor control system for simplex printers in which the call signal and, if desired, the motor of the telegraph printing machine are controlled at the distant station by a single open circuit condition of the line; and in which the call system responds irrespective of the length of time the open circuit condition is maintained. While this system has proven highly satisfactory there are, however, certain installations to which it is not well adapted, such as those in which so called "concentrators" are employed at one terminal of the line. It is desirable that the control system for the printing machine motors shall be operative to start and stop the motor as the printing machine is connected to and disconnected from the telegraph line.

The concentrator system is ordinarily employed in connection with service lines which handle a relatively small amount of business and do not require that they be in continuous operation. Several of such lines are brought to suitable switchboards available to the operators of a smaller number of telegraph printers. In one system now in use, eight telegraph lines are terminated at two concentrator switch boards each of which switch boards are located within easy reach of the operators of two telegraph printing machines. Each line has a terminal or jack in each of the switchboards, the system being so arranged that each of the four operators may connect her printing machine into the circuit of any one of the lines. With this system, a small number of operators can take care of the messages being sent and received over the eight lines. The concentrator switchboards are provided with a call signal corresponding to each jack in the switchboard and to each of the eight lines in the group so that when a call is sent over any one of the lines from the distant or branch office, any one of the operators who is not for the moment engaged connects her printing machine, by means of an ordinary telephone jack plug, into the line which has sent the call. Having connected her machine into the calling line, the desired communication between the two offices may be carried on.

In the systems heretofore employed and as described in the foregoing application, in order to place a telegraph printing machine in readiness for sending or receiving a message over a line the motor for driving the printer must be set into operation by means of a manually operated switch or a switch operated by the call signal from the distant station. In the latter case, a telegraph machine at the main office would have to remain connected to the calling line and such an arrangement, as already indicated is not desirable for use in connection with concentrator systems.

It is a further object of this invention, therefore, to provide a system for automatically starting and stopping the motor of the telegraph printer when the telegraph circuit of the printer is connected to or disconnected from a telegraph line desiring to communicate with the main office.

Still another object of this invention is to provide a motor control arrangement for telegraph printing machines which will automatically start the motor when the printing machine is connected into a calling telegraph line and which will maintain the motor circuit closed after the motor has been started until it has substantially reached its normal operating speed without regard as to whether the printer has been, in the meantime, disconnected from the telegraph line.

A still further object of our invention is to provide an arrangement which will continue the telegraph printer motor in operation after the motor has attained substantially normal speed, if the printer is then connected to a telegraph line and which will open the circuit of the motor after it has attained normal speed, if the printer is not at that time connected to a telegraph line.

These and other objects effected by our invention will be apparent from the following description and claims taken in connection with

the accompanying drawings, forming a part of this application, in which;

Fig. 1 is a circuit diagram illustrating the motor control system and also the signal call system used in connection with the concentrator units.

Fig. 2 is a circuit diagram illustrating a modification of the motor control system shown in Fig. 1, and

Fig. 3 is a circuit diagram showing still another modification of the motor control system shown in Fig. 1.

In carrying out this invention we may employ one relay which is energized by a circuit completed when the printer is connected into the telegraph line and which acts to close the motor circuit and start the motor, and which also acts when the printer is disconnected from the telegraph line to open the motor circuit and stop the motor. The relay energizing circuit may be established by connecting the relay in the printer signal circuit or by a suitable independent circuit or a shunt circuit which is completed through the printer circuit cord plug, through contacts included in the line jack, or by other means actuated when the printer is connected to a telegraph line.

In addition, we may employ another relay, preferably one of low impedance, connected in series with the motor circuit which is energized upon closing of the motor circuit and which acts to maintain the motor circuit closed during the starting period and until the motor has reached substantially its normal operating speed. Ordinarily, if the operator has inserted her plug into the wrong line jack establishing a false connection, she will, upon becoming aware of having done so, immediately remove her plug from this jack and insert it into the proper jack. If this false connection is interrupted during the starting period of the motor the second relay will maintain the motor circuit closed so that the removal of the plug after momentary connection with a line jack will not result in opening of the motor circuit while the motor is drawing a heavy current, and excessive arcing across the motor circuit closing contacts will be obviated. The motor circuit will be maintained by the first relay after the motor has attained its normal operating speed, and connection has been established to the proper line.

Instead of employing two relays in the motor control arrangement, one relay embodying the combined characteristics of the two relays may be employed. In addition various other combinations of relays may be employed, either connected directly into the printer circuit or controlled by a shunt circuit which is made and broken through the plug when it is inserted and removed from the line jack. The relays may be designed to have various characteristics according to the circuit arrangement in which they are employed, as is explained in the following description of typical embodiments.

As heretofore explained, this invention is particularly adaptable to telegraph systems which employ so-called concentrator units for the purpose of enabling a small number of telegraph printers to serve a larger number of lines. One arrangement in use employs units comprising two tables arranged back to back upon each of which two telegraph printers are located. A concentrator switchboard unit is located on each of the tables between the positions of the printing machines so that an operator at any one of the machines may plug her printer circuit into the jack corresponding to any one of the telegraph lines. In cases where more than eight telegraph lines are required additional number of switchboard units may be employed.

The circuit diagram illustrated in Fig. 1 embodies the details of an arrangement employed in connection with one telegraph line running to two concentrator switchboards together with representative elements of another line running to the same switchboards. The circuit arrangement for any number of telegraph lines will be apparent from the following description in connection with a single line.

Station A, in the illustration shown in Fig. 1, represents the main office and illustrates the operation of a call signal system employed in connection with the switchboard units as well as one form of motor control for the printer. Station B is a distant office, such as for instance, a broker's office. The printer at each office will be substantially the same, except that the printer at the broker's office may not be supplied with the automatic motor control. The printers are diagrammatically illustrated and 11 represents the printer magnet, while 12 represents the transmitting keyboard. If the operator at station B desires to call station A, she may do so by sending any code signal, preferably, a "space" signal. This will cause a momentary open circuit condition of the telegraph line 10. The telegraph line is connected to the concentrator units, which are represented by line jacks 13 and 14 and through the line jacks to the grounded battery 15, which supplies the required line potential. A plug 17 is inserted into one of the jacks by the operator of a printer at the main office who may not be busy at the time a call is received over line 10.

When the line is not in service, which we will term the normal inactive condition, the circuit is established at station A through a shunt wire 18 and a relay 19, thence by wire 21 through tip normal contact 22, jack bus bar 23, tip normal contact 24, thence through wire 25 and battery 15 to ground. It will be observed, that the main line 10 extends to jack bus bar 26, which is common to both jacks, the circuit being discontinued at the sleeve contacts 27 of each of the jacks when no printer circuit plug is inserted into either jack.

In its normal condition the line circuit is closed through the printer at station B, or by any other suitable means, to the ground 28. This will cause the relay 19 to be normally energized and the tongue 29 to be normally held against its front contact 31, which is insulated. However, when open condition occurs in the line circuit, occasioned by the calling operator at station B, the relay tongue 29 will drop to the back contact 32, connecting the tongue and the call signal circuit. The call signal circuit extends from ground 33 through battery 34, signal lamps 35 and 36, thence through the front contacts 37 of locking relay 38 and from the contacts 37 through the winding of locking relay 39, front contact 41 of the latter relay, and wire 42 to the back contact 32 and tongue 29 of relay 19, which is grounded at 43. It will be observed, therefore, that when open circuit condition occurs in the line the lamp circuit will be completed through the tongue of relay 19 and that the lamps will immediately light up. One lamp and one jack in each of the concen-

trator switchboard panels is provided for each line. Since the embodiment illustrated in Fig. 1 is of the type heretofore referred to, employing two concentrator switchboard panels, two lamps are shown.

As soon as the lamp circuit is completed through relay 39, the tongue 44 will be pulled up and close the contacts 41 of the relay thus establishing a locking circuit through the tongue 44 to the ground at 43. After a call signal has been sent over the line, the circuit will again resume its normal closed condition and the tongue 29 of the relay 19 will be drawn against its back contact, breaking the lamp circuit at this point. However, since the lamp circuit has been grounded at another point through the tongue of relay 39, the lamps will continue to burn after the call signal has been discontinued.

After a call signal has been transmitted from station B to station A, an operator at station A, who is idle at the moment will insert the line circuit plug of her machine into the jack corresponding to the calling line, which will be indicated by the associated lamp which is burning in the concentrator panel accessible to her. We will assume that plug 17 is inserted into jack 14 to answer the call. When this is done, the arrangement of the circuits is such that two things will take place. One of these will be the breaking of the signal lamp circuit. The other will be the automatic starting of the printer motor, which will place the printer in readiness to receive or transmit messages to station B.

First the operation of the circuit arrangement to open the lamp circuit will be described. When the plug is inserted into the jack 14, contacts 24 will open and break the branch circuit through relay 19, de-energizing the same and permitting the tongue 29 to fall upon the active contact 32. At the same time the contacts 45 will close, establishing a circuit from the grounded bus bar 46, through the bus bar 47, thence through relay 38 and the grounded battery 48, causing the relay 38 to be energized to pull the tongues over to the locking circuit contact 49. This accomplishes first an opening of the lamp circuit at the contact 37 and closing of a locking circuit from the battery 48, the windings of the relay 38, contacts 49 to the ground 43, via the tongue 29 of the relay 19 which, as already indicated, is now on its active contact. It should be observed, that when the lamp circuit is broken, relay 39 will be de-energized and the locking circuit therethrough will be broken by the tongue 44 falling away from its live contact.

After the communications between office A and B have been completed, the operator at office A will withdraw the plug of her machine from the line jack. The plug 17, having been removed from the jack 14, the contacts 45 will open and break that branch of the circuit through the relay 38. At the same time, contacts 24 will close again and the line circuit will be reestablished through the relay 19, causing the same to be energized, lifting the tongue 29 to its back contact, thereby breaking the other branch of the circuit through relay 38.

In this manner the relay 38 will be de-energized and permit its tongues to move over and close the contacts 37. It will be noted that this connects the lamp circuit again through its relay 39 and the wire 42, but the lamp circuit is not completed to the ground because, as already indicated, the circuit through the grounded tongue 44 of relay 39 was opened previously and the removal of the plug from the jack caused the relay 19 to be re-energized breaking the other ground circuit at the contacts 32, thereby initiating the sequence of operation just recounted. It will be observed further that this sequence of operation causes the lamp circuit to be opened at contact 32 before contacts at 37 close, preventing the circuit from being completed and setting up a false signal, which might occur if the circuit through relay 37 were closed at the same instant that relay 19 was connected back into the line.

The operation of the system will now be described relative to the automatic starting and stopping of the printer drive motor when the printer circuit cord is inserted in one of the line jacks. When a call signal is sent from an outside or distant station such as station B (Fig. 1), the signal lamps 35 and 36 operate and the operator of one of the printing machines at the concentrator station A will plug into the line jack corresponding to the signal lamp which is burning. Assuming that plug 17 of the printer circuit of station A is inserted into jack 14, the line circuit will then be established through the printer. Referring to the jack 14, the line circuit comes in on the bus 26 to the sleeve contact 27 of the jack. From the contact 27 connection will be made through the sleeve 51 of the plug 17 and the printer circuit cord to the sending keyboard 12 and receiving magnet 11 and through a relay 53 included in the circuit, thence back through the cord to the tip 54 of the plug. When the plug is in the jack, the contacts 24 are opened and the tip of the plug engages the tip contact 55 of the jack which is connected with grounded battery 15.

The telegraph printer is supplied with a motor 56 illustrated diagrammatically. The circuit for the motor connects at one side through wire 57 to a power line. The other side of the motor circuit includes a series relay 58 and two circuit closing contact members 59 and 61 associated with relays 53 and 58 respectively. The motor circuit may be completed through either or both of these relays and wire 62 leading to the other side of the power line.

As soon as the plug 17 is inserted in the jack, current will flow from the battery 15 through the printer circuit and energize relay 53 causing the motor circuit to be closed through the contacts 59 and energize the relay 58. When the relay 58 is energized, the circuit will be closed at another point through the contacts 61. It is a well known characteristic of motors that the current passing through them, or in other words, current drawn by them, is relatively heavy when the circuit is first closed and that the amount of current decreases as the speed of the motor accelerates and the counter electromotive force builds up, becoming a minimum when the motor reaches normal operating speed. The windings of the relay 58 are, preferably, of low resistance or low impedance. Windings having a value of about one half ohm have been found satisfactory. The relay is so arranged that it will hold its tongue on the front contact against the tension of the spring 63 during the period in which the motor is accelerating until the current passing through the windings has dropped to a point obtaining just prior to the time when the motor reaches its normal speed. At this point, the energy of the relay will have decreased sufficiently to be overcome by the effort of the spring 63 and the circuit will be open. In other

words, when the motor circuit has once been closed, the relay 58 will serve to maintain the circuit closed independent of the relay 53 until the motor has reached substantially normal speed. On the other hand, if the operator has inserted the plug 17 into the wrong jack or otherwise established a false connection, she will in all probability immediately withdraw the plug and cause the relay 53 to become de-energized after only a momentary energization. But for the function of the series relay 58 as just described, the de-energization of the relay 53 would result in the motor circuit being opened almost as soon as it was closed and during a period when the motor is drawing a heavy current. An opening of the motor circuit at this time would cause excessive arcing between the motor circuit contacts. However, if the motor circuit is maintained closed until the motor has reached substantially its normal speed, a relatively small amount of current will be flowing through the motor circuit and a very small amount of arcing will result, which may be readily provided for in the design of the circuit closing elements.

After the proper connection has been established to the printer circuit and the motor has attained substantially normal speed, the motor circuit is opened at the relay 53 and is thereafter maintained closed through relay 53 which is sufficiently slow not to respond to signal frequency. When the communication between the two stations has been completed, the operator at station A will withdraw her plug from the jack and the motor circuit will be opened at relay 53 and the motor thereby stopped. In other words, after the motor has reached substantially normal speed, the circuit will be opened entirely as soon as the relay 53 has become de-energized or inactive. Ordinarily relay 53 would become inactive and open the circuit at contacts 59 each time an open or reverse circuit condition occurred in the telegraph line during the sending of signals between the stations A and B. These signals are of relatively short duration, however, and a relay having a slow-to-release characteristic will not respond to open circuit conditions obtaining during the transmission of message signals over the line. It has been found in practice that a relay which will release within one-third to one-fourth of a second is sufficiently slow to be unresponsive to message signals. Such a relay may be made to have a quick closing characteristic and at the same time embodying a slow-to-release characteristic. It is further desirable that the relay 53 be one of low inductance so as to not interfere with or weaken the signals traversing the printer circuit.

From the foregoing it will be observed that a telegraph system has been provided which will permit the printers to be connected and disconnected with the telegraph line through line jacks and which will automatically start and stop the printer drive motor when the plug is inserted and removed from the line jack. At the same time, a control circuit for the motor has been devised which will prevent the motor circuit from being opened during the period of acceleration of the motor when a relatively heavy current is being drawn thereby, thus obviating excessive arcing at the motor circuit contacts when the printer circuit cord is withdrawn from the jack after momentary connection in to the telegraph line. With the control arrangement of the character described, simple and inexpensive type of circuit closing relays can be employed in the motor circuit without danger of being damaged by arcing between the contacts which difficulty has been experienced heretofore in this type of motor control system.

Referring now to Fig. 2, a circuit diagram illustrating a modification of this invention is shown. In this modification the slow-to-release type of relay and the series relay in the motor circuit have been combined. With this arrangement it is necessary to have only one set of motor circuit contacts provided to carry the relatively heavy motor current. Also, the relay in the printer circuit may be of the ordinary fast type having a relatively low inductance.

The whole signal arrangement has been omitted from this circuit diagram and only that part of the circuit shown which is necessary to illustrate the operation of the motor control system. The central station is represented by station A and the outer or distant station represented by station B. The telegraph line 10 extends from station B to station A through the concentrator switchboard jack 14, thence through battery 15 to ground. The printers at each station are diagrammatically represented by the receiving magnet windings 11 and the transmitting keyboards 12. The printer at the central office is connected into the telegraph line through jack 14 by means of a printer circuit cord plug 17. In the printer circuit is included a low inductance relay 71 arranged to close contact 72 when the printer is connected to the telegraph line. The motor 56 for the printer is illustrated diagrammatically and is connected into the motor circuit, one side of which is connected to the power line through wire 57. The relay 73 is provided for controlling the motor circuit. The wire 62, forming the other side of the motor circuit, leads to contacts 74 of relay 73 and thence through the series winding 75 of the relay to the other side of the power line. This winding is of a low impedance type and may be of substantially the same value as used in connection with the relay 58 of the foregoing embodiment. The relay 73 has an additional winding 76 which is connected through contacts 72 of relay 71 and a resistance 77 to opposite sides of the power line or to any other suitable source of current potential.

When the printer circuit is connected into the telegraph line, the relay 71 closes the contacts 72 energizing the winding 76 of the combination relay which will cause the contacts 74 to be closed completing the motor circuit. As soon as the contacts 74 are closed current will flow through the series winding 75 of the relay and will exert an additional effort tending to hold the contacts 74 closed. This winding 75 is so arranged as to supply sufficient flux to maintain the contacts 74 closed independent of the winding 76 until the motor has reached substantially normal speed. In this manner the motor circuit will be maintained closed during the period of acceleration of the motor, even though the contacts 72 may be opened to cause a de-energization of the winding 76. On the other hand, after the motor has reached substantially normal speed, if the connection between the printer and the telegraph line is maintained the motor circuit will be kept closed by the action of the relay winding 76. In order to take care of momentary open circuit conditions occurring during the transmission of mes-

sage signals, the relay 73 is arranged to have a slow-to-release characteristic similar to the relay 53 of the foregoing embodiment. In this manner even though the contacts 72 may be momentarily opened and closed in response to the current fluctuations in relay 71 due to signal transmission, the contact 74 will nevertheless remain closed until the removal of the plug 17 from the line jack causes an extended open circuit condition.

From the foregoing it will be observed that the relay 73 is arranged to embody the combined characteristics of the two motor circuit control relays 53 and 58 of the foregoing embodiment. With this arrangement, a relatively simple type of relay should be used in the printer circuit which need not be of a slow-to-release characteristic and only one set of circuit closing contacts will be required in the motor circuit. This results in a simplified control system for the printer motor. Furthermore it is evident that by a suitable circuit arrangement the relay 71 might be dispensed with. This might be accomplished by arranging the contacts 72 to be closed by the act of inserting the plug 17 into a line jack or by any suitable arrangement for completing the circuit through the winding 76 of the combined relay when the printer cord plug is inserted into a line jack.

Although both of the foregoing motor control systems have been described as being responsive to the insertion and removal of the printer circuit cord plug from the line jack, it will be apparent to those skilled in the art that they may be as effectively employed in a system having the printer continuously connected in the telegraph line. The relay actuated through the printer circuit may be made suitably responsive to a pre-determined line condition, such as an open circuit of short duration, to close the motor circuit, unresponsive, after the motor circuit has been closed, to message signals for permitting the motor circuit to remain closed and responsive to another pre-determined line condition to open the motor circuit. At the same time the series relay in the motor circuit furnishes protection against a premature opening of the motor circuit, should the line condition for opening the motor circuit closely follow the line condition for closing the motor circuit.

Referring now to Fig. 3 still another modification as shown therein will be described. In this embodiment two relays are illustrated as employed in the motor control system. However, as is evident from the foregoing description, one relay embodying the combined features of the two relays illustrated may be effectively employed. In this modification the relay energized when the printer is connected into the telegraph line is not included in the signal circuit of the printer but is energized by a shunt circuit completed through the printer plug and jack connection. Therefore, the motor control system is not effected by the current fluctuations in the telegraph line due to the transmission of signals; furthermore the weakening effect of an extra inductance included in the signal circuit of the printer is obviated.

Diagrammatically illustrated in Fig. 3 are the essential circuits at a central station A embodying the automatic motor circuit control and distant station B embodying a printer connected in a telegraph line. The printers at both offices are illustrated diagrammatically by the receiving magnet windings 11 and the transmitting keyboards 12. The printer at the central station is connected into a telegraph line 10 through jack 14 by means of a printer circuit cord plug 17.

The printer is provided with a motor 56 having a motor circuit, one side of which is connected to the power line through wire 57. Relay 81 is provided for closing the motor circuit in accordance with the connection and disconnection of the printer with the telegraph line. The wire 62 forming the other side of the motor circuit leads to contacts 82 operated by the relay 84 and thence to the other side of the power line. Contacts 85 close the motor circuit at another point and are operated by the series relay 84 connected in the motor circuit. The relay 81 is energized by a winding 86 which is in a circuit grounded at one end through a resistance 87. The other side of the circuit connects through wire 88 to the outer contact 51 of the plug 17. When the printer is connected in the telegraph line, the circuit through the relay coil 86 is completed through the jack to the battery 15 or other potential applied to the telegraph line. Current is bled off through the shunt circuit for energizing the relay from the line potential source. In this manner, the relay does not form a part of the printer signal circuit and is not effected by open circuit conditions of the telegraph line, nor does it add inductive impedance to or in any other manner directly affect the efficiency of the telegraph line for signal transmission.

The automatic control of the motor circuit is accomplished substantially in the following manner. When a call is received over the telegraph line through a signal system, such as described in connection with the embodiment in Fig. 1, an operator of the printer at the central station who is idle will insert the plug 17 into the line jack 14 thus connecting her machine into the calling line. When this connection is made, the auxiliary or shunt circuit through the winding of the relay 81 will be completed, energizing the relay which will act to close the motor circuit through contact 82. As soon as the motor circuit is closed, current flowing therein will traverse the winding 83 of the relay 84 and close the motor circuit at another point through the contact 85. The relay 84 is similar to the series relays in the foregoing embodiments in that it has a low impedance winding and is arranged to maintain the contacts 85 closed only while energized by the relatively heavy current drawn by the motor as it starts and until it reaches substantially normal speed when the force of the relay acting on the movable contact member will be overcome by spring 89 to open the contacts. In this manner, the motor circuits will remain closed from the instant it is closed by the main control relay 81 until the motor has reached substantially normal speed independent of the latter relay. In this manner a motor control system is provided having substantially the same characteristics for automatically starting and stopping the motor and for preventing the motor circuit from being opened while the motor is drawing a heavy current during the starting period.

From the foregoing description, it will be seen that we have provided a motor control system for automatically starting and stopping the drive motors of telegraph printers or printing machines as the signal circuit of the machine is connected to and disconnected from the tele-

graph line. In its preferred embodiment the motor is started merely by the insertion of the printer circuit cord plug into the line jack and is stopped when the plug is removed from the jack. Furthermore, we have provided a circuit control arrangement which may be employed in connection with telegraph printing machines of various types now in use. As heretofore indicated, it is particularly adapted to telegraph systems employing concentrator units and simplex printers. However, it may be readily applied to other systems as well.

It is to be understood that our circuit control system may embody types and combinations of relays other than those described herein for carrying out this invention.

While we have shown this invention in but three forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible to various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or as are specifically set forth in the appended claims.

What we claim is:

1. In a telegraph system, a telegraph line circuit, a printer, means for connecting the printer in the line circuit, a motor for driving the printer, a circuit for the motor, and a control system for the motor comprising a first relay operative upon connection of the printer in the line circuit to close the motor circuit, and a second relay operative upon closing the motor circuit to maintain the motor circuit closed independent of the first relay until the motor has reached substantially its normal speed.

2. In a telegraph system, a telegraph line, a printer embodying a printer circuit, means for connecting the printer circuit in the line, a motor for driving the printer, a circuit for the motor, and a control system for the motor comprising a first relay responsive to a momentary connection of the printer circuit in the line to close the motor circuit and a second relay operative upon closing the motor circuit to maintain the motor circuit closed, independent of the relation between the printer circuit and the line, until the motor has reached substantially normal speed.

3. In a telegraph system, a telegraph line, a printer, a circuit for the printer connected in the telegraph line, a motor for driving the printer, a circuit for the motor and a control system for the motor comprising a relay in the printer circuit, responsive to a predetermined line condition for closing the motor circuit and a relay in the motor circuit operative upon closing of the motor circuit for maintaining the latter closed independently of the first relay until the motor has reached substantially its normal speed.

4. In a telegraph printer, a motor for driving the printer and a control system for the motor comprising a motor circuit, a first relay operative when a communication circuit is established with the printer for closing the motor circuit and a second relay actuated by the current traversing the motor circuit for maintaining the latter closed until the motor has reached substantially its normal speed.

5. In a printing telegraph system, a line, a printing apparatus associated with said line, a motor for driving said printing apparatus, means responsive to a line condition for starting said motor, and means independent of all line conditions for maintaining said motor in operation for at least a predetermined period.

6. In a telegraph system, a telegraph line, a printer, means for connecting the printer in the line, a motor for driving the printer, a circuit for the motor, and a control system for the motor comprising means operative upon connection of the printer in line to close the motor circuit and means operative upon closing the motor circuit to maintain the latter closed until the latter has reached substantially its normal operating speed.

7. In a telegraph system, a telegraph line, a printer, means for connecting the printer in the line, a motor for driving the printer, a circuit for the motor, and a control system for the motor comprising means for holding the motor circuit closed while the printer is connected in the line and means operative upon closing the motor circuit to maintain the motor circuit closed independent of the first named means until the speed of the motor has reduced the current drawn thereby to a predetermined value.

8. In a printing telegraph system, a line, a printing apparatus normally disconnected from said line, a driving motor for said apparatus, means for connecting said apparatus to the line, and substantially simultaneously therewith, starting said motor, and means independent of said line connection for maintaining said motor in operation until it obtains a substantial speed.

9. In a telegraph printer having a circuit adapted to be connected to and disconnected from a telegraph line, a motor for driving the printer, and a control system for the motor comprising a motor circuit, a relay in the printer circuit having a "slow to release" characteristic and operative when the printer is connected to the line to close the motor circuit, and a relay in the motor circuit actuated at the time the motor circuit is closed for holding the motor circuit closed until the current in the motor circuit is decreased to a predetermined value, obtained just before the motor has reached substantially normal speed.

10. In a telegraph system, a telegraph line, a printer connected in the telegraph line, a motor for driving the printer, a circuit for the motor, and a control system for the motor comprising electro-magnetic means responsive to a predetermined line condition but unresponsive to line signal condition to effect closing of the motor circuit and electro-magnetic means energized in accordance with the current flowing through the motor and operative upon the closing of the motor circuit to maintain the motor circuit closed independent of the first named means until the motor has reached substantially its normal operating speed.

11. In a telegraph system, a telegraph line, a printer, a circuit for the printer, means for connecting the printer circuit in the telegraph line, a motor for driving the printer, a circuit for the motor, and a control system for the motor comprising a low inductance relay in the printer circuit having a "slow to release" characteristic and operative upon connection of the printer circuit in the line to close the motor circuit and a low impedance relay in the motor circuit, actuated by the current traversing the motor circuit when the motor has started and operative to effect closing of the motor circuit independent of the first named relay and to maintain the motor circuit closed until the motor has reached substantially its normal operating speed.

12. In a telegraph system, a telegraph line, a printer, a circuit for the printer, means for connecting the printer circuit in the telegraph line, a motor for driving the printer, a circuit for the motor and a control system for the motor comprising means responsive to a momentary completion of the line circuit through the printer to effect closing of the motor circuit, means responsive to a prolonged interruption of the line circuit but unresponsive to signal interruptions tending to open the motor circuit and means responsive to the starting current in the motor circuit to maintain the motor circuit closed independent of the first named means until the current in the motor circuit has dropped to substantially its normal value.

13. In a telegraph system, a telegraph line, a printer, a circuit for the printer, means for connecting the printer circuit in the telegraph line, a motor for driving the printer, a circuit for the motor, a control system for the motor comprising a relay adapted to close and open the motor circuit and embodying first and second windings, either of which alone is capable of operating the relay, means for energizing the first winding to close the motor circuit when the printer is connected to the line and means operative after the motor circuit has been closed for energizing the second winding in accordance with the speed of the motor, whereby the motor circuit will be held closed independent of the first named winding until the motor has substantially reached its normal speed.

14. In a telegraph system, a telegraph line, a printer, a circuit for the printer, means for connecting the printer circuit in the telegraph line, a motor for driving the printer, a circuit for the motor embodying current closing switch contacts and a control system for the motor comprising a control relay for actuating the switch contacts in the motor circuit to control the motor, a first winding for said relay, other relay means actuated through the printer signal circuit when the latter is connected in the line to effect energization of said first winding to close said switch contacts for starting the motor, and a second winding for said relay energized by the current flowing through the motor and operative upon closing the motor circuit to cause the control relay to maintain the motor circuit closed independent of said first winding until the motor has attained a speed at which it will draw substantially normal current.

15. In a telegraph system, a telegraph line, a printer, a circuit for the printer, means for connecting the printer circuit in the telegraph line, a motor for driving the printer, a circuit for the motor and a control system for the motor comprising a relay adapted to close and open the motor circuit and having first and second windings either of which alone will operate the relay, said relay having a "slow to release" characteristic whereby the motor circuit will not be opened due to momentary de-energization of said first winding, means for energizing the first winding to close the motor circuit when the printer is connected to the line, and means for energizing the other winding in accordance with the speed of the motor after the motor circuit has been closed, whereby the relay will maintain the motor circuit closed independent of the first named winding until the motor has reached substantially normal speed.

16. In a telegraph system, the combination of a telegraph line, a printer, a circuit for the printer, means for readily connecting and disconnecting the printer and the telegraph line, a motor for driving the printer, a circuit for the motor, and a control system for the motor, comprising a relay operative to close and open the motor circuit, said relay being energized by a circuit independent of the printer circuit and which is completed and broken by the means employed for connecting and disconnecting the printer and the line, and a relay in the motor circuit operative upon closing of the motor circuit to maintain the same closed until the motor has reached substantially its normal speed.

17. In a telegraph system, the combination of a telegraph line, a printer, a circuit for the printer, means for readily connecting and disconnecting the printer and the telegraph line, a motor for driving the printer, and a control system for the motor comprising a motor circuit and electro-magnetically operating means for closing and opening the motor circuit, said means embodying an element energized by a circuit, independent of the printer circuit, which is completed and broken at the time of connecting and disconnecting the printer circuit and the line, said means also embodying an element energized by the current flowing through the motor and operative upon closing the motor circuit to maintain the same closed until the current drawn by the motor has dropped to a pre-determined point, as the speed of the motor accelerates to normal.

18. In a telegraph system, the combination of a plurality of telegraph lines, one or more concentrator switchboards, each of said telegraph lines connecting to a jack in each of said switchboards, one or more telegraph printers corresponding to each switchboard, each of said printers being provided with means for connecting the printer with any one of the lines through its jack on the corresponding switchboard, and a drive means for each of the printers embodying a motor and a control system for the motor comprising a motor circuit, means operative upon connecting the printer in any one of the lines to close the motor circuit, and other means operative upon closing the motor circuit to maintain the same closed until the motor has reached substantially its normal operating speed.

19. In a telegraph system, the combination of a plurality of telegraph lines, one or more concentrator switchboards, each of said lines connecting to a jack in each of said switchboards, one or more telegraph printers corresponding to each switchboard, each of said printers being provided with means for connecting the printer with any one of the lines through the line jack on the corresponding switchboard, a drive means for each of the printers embodying a motor and a control system for the motor comprising a motor circuit, means for holding the motor circuit closed while the printer is connected with any one of the lines, and means operative upon closing the motor circuit to maintain the same closed independent of the first means until the motor has reached substantially its normal speed, whereby the motor circuit having been closed, the same will not open after a momentary connection has been made between the printer and a telegraph line until the motor has attained substantially its normal speed.

20. In a telegraph system, a plurality of telegraph lines, one or more concentrator switchboards, each of said telegraph lines connecting to a jack in each of said switchboards, a call

system including a signal device associated with each jack for identifying the calling line, one or more telegraph printers corersponding to each switchboard, each of said printers being provided with means for connecting the printer through the line jack on the respective switchboards, a drive means for each of the printers embodying a motor and a control system for the motor comprising a motor circuit, means operative upon connecting the printer in any one of the lines to close the motor circuit, and means operative upon closing the motor circuit to maintain the motor circuit closed independent of the first means until the motor has reached substantially its normal speed.

21. In a printing telegraph system, a line, a printing apparatus connected to said line, a drive motor for said apparatus means responsive to a line condition for starting the drive motor, means independent of said line conditions for maintaining said motor in operation for at least a sufficient time to bring the motor substantially up to normal speed, and means responsive to a different line condition for stopping the motor.

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