

June 1, 1937.

E. M. MOWTON

2,082,075

PRINTING TELEGRAPH SYSTEM

Filed Nov. 10, 1933

2 Sheets-Sheet 1

FIG. 1

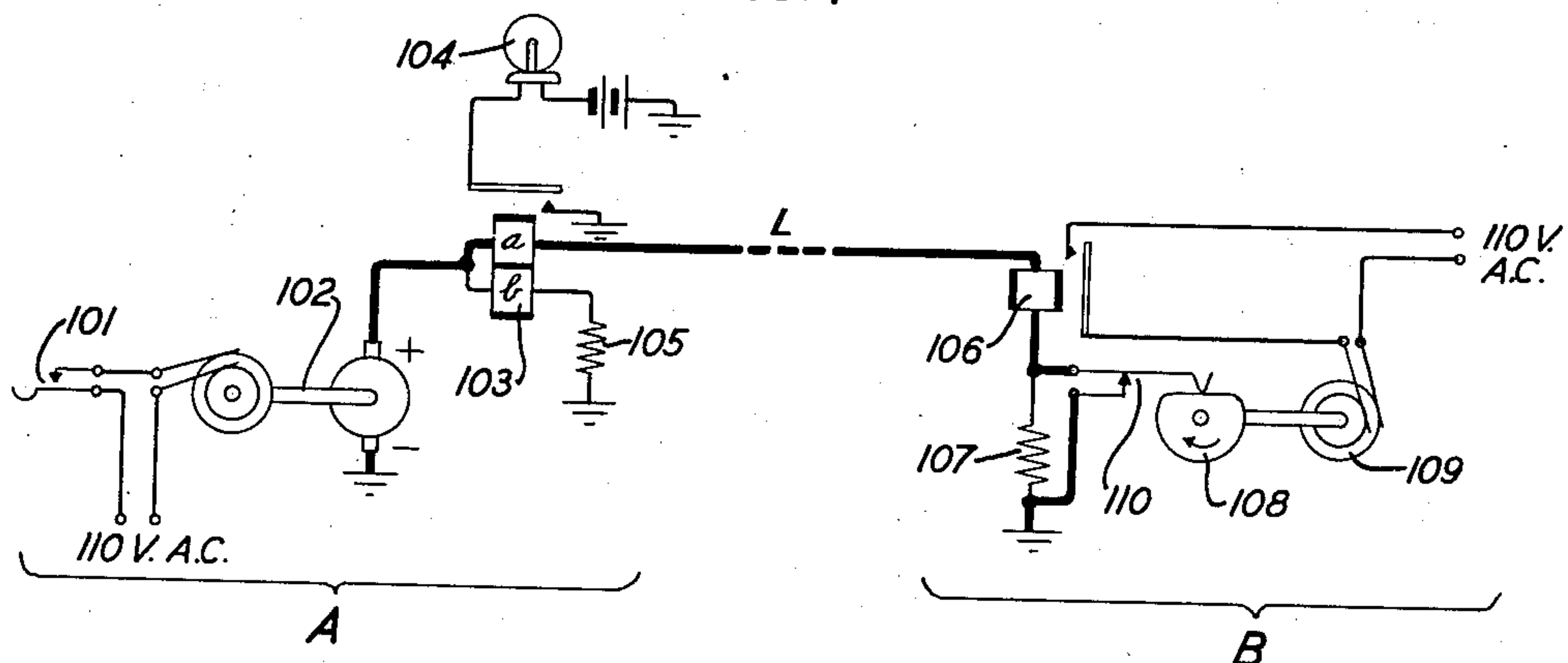
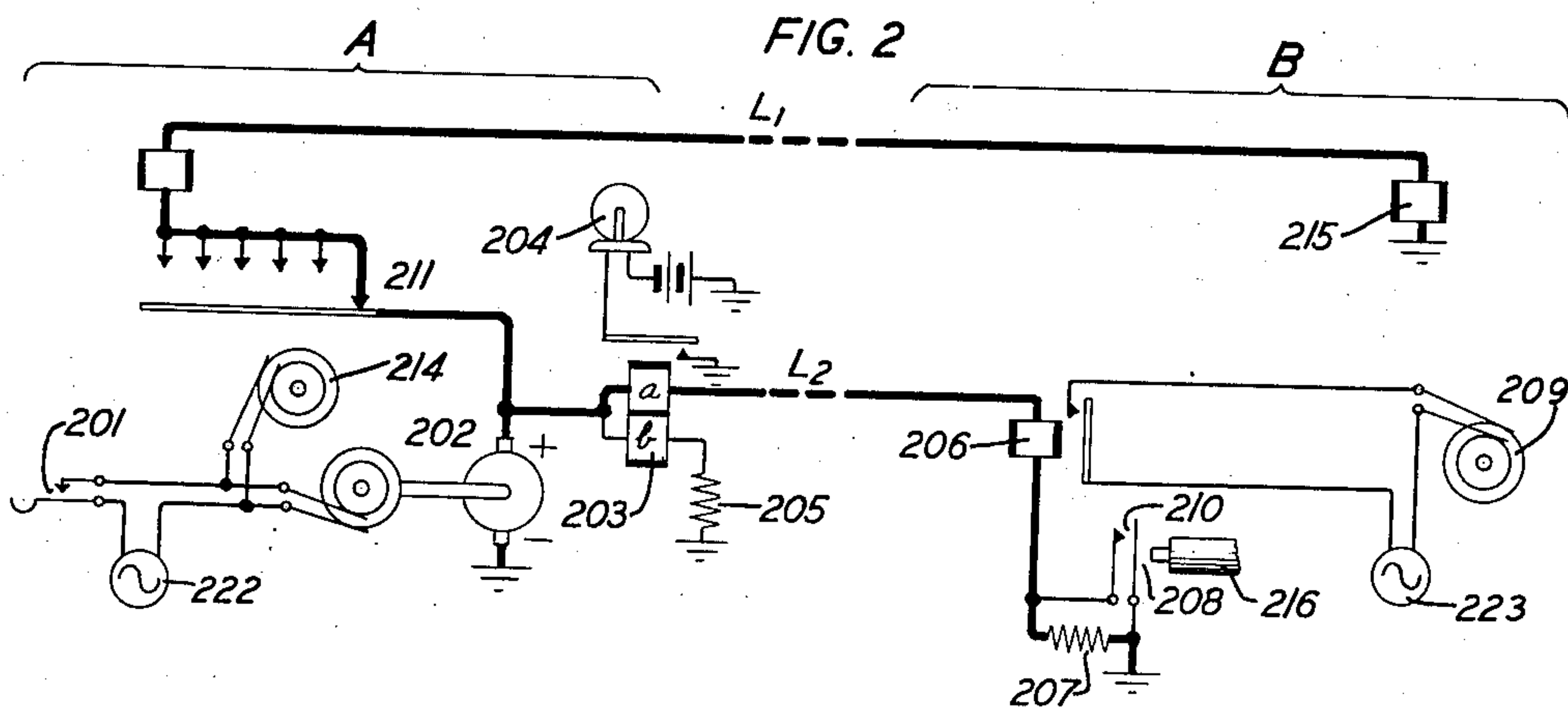


FIG. 2



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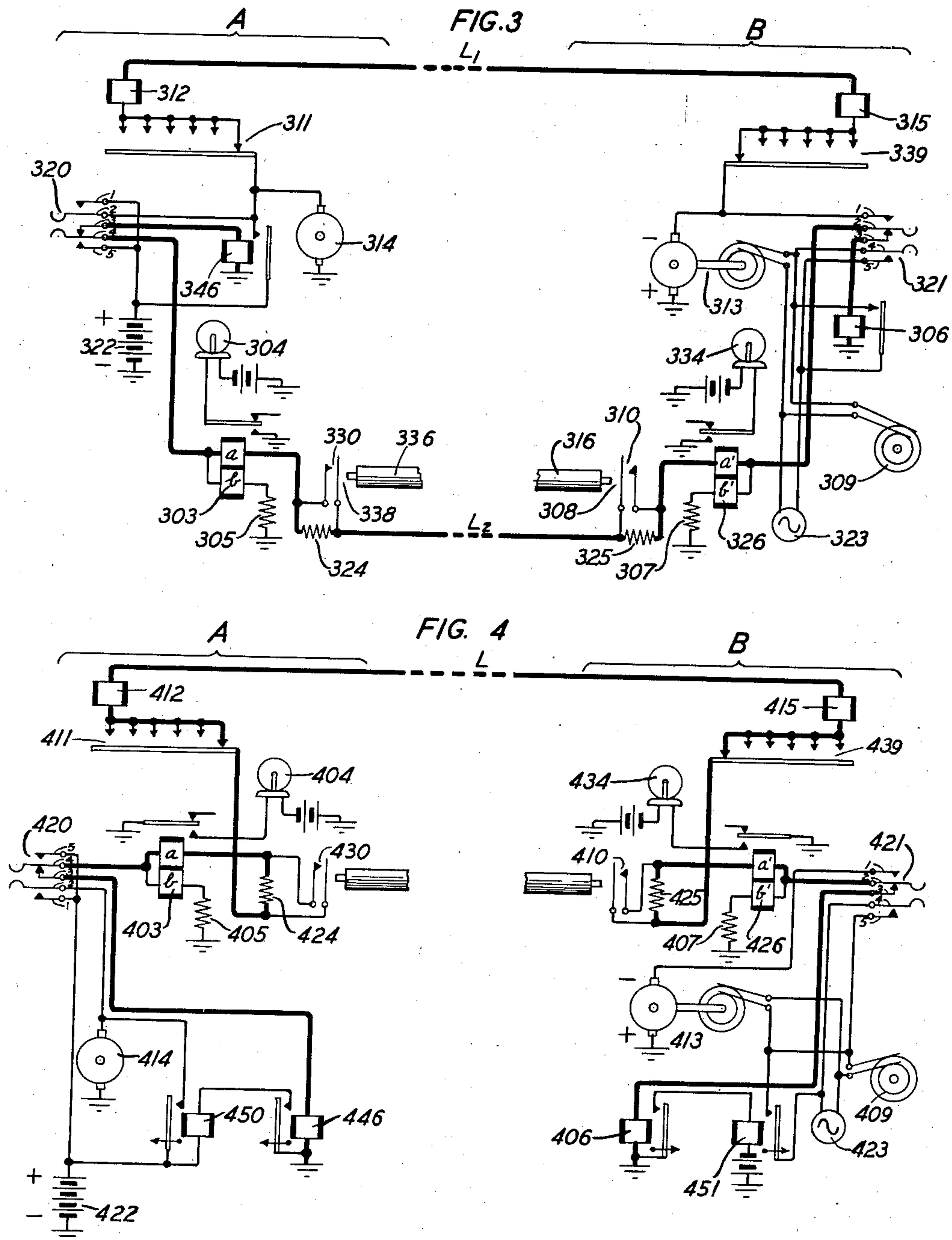
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2 Sheets-Sheet 2



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PRINTING TELEGRAPH SYSTEM

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22 Claims. (Cl. 178—4.1)

This invention relates to communication systems, and more particularly to printing telegraph systems in which it is desired to obtain a check upon the operability of receiving teletypewriters.

5 It is an object of this invention to provide an arrangement for warning an operator at a sending printing telegraph station of the improper functioning of apparatus at either the sending printing telegraph station or a receiving printing telegraph station connected to the sending station.

10 In printing telegraph systems, there is often the possibility that an operator might send messages to another station at which the printer motor could not be started due, perhaps, to some local circuit trouble. Normally, the sending operator would have no immediate knowledge of the fact that these messages had not been received and would keep on sending messages. 15 Since these messages would not be printed by the receiving teletypewriter, their transmission would be a waste of time, money and energy. There is also the possibility that confusion might result from the sending operator believing that the messages had been received, especially if the messages were orders to do something immediately, such as to buy or sell stock. In order to obviate this undesirable contingency, it is necessary to employ some arrangement for informing a sending operator when a receiving station is not functioning properly. 20

25 The object of this invention is to provide such an arrangement, but this invention is not restricted to printing telegraph systems as it may be applied to any communication system in general. However, for the purpose of illustration, this invention will be described chiefly with reference to its application to a printing telegraph system.

30 Heretofore, in printing telegraph systems, it has been common practice to install apparatus at a receiving station for retransmitting messages received at that station back to the sending station. The objections to this procedure are that it cannot be readily applied to any printing telegraph system and that it requires additional apparatus which is expensive. 35

40 In accordance with this invention, a simple and inexpensive arrangement is provided which may readily be applied to any printing telegraph system for checking the operation of apparatus at a receiving printing telegraph station. With this arrangement, whenever a sending operator wishes to know if apparatus at a receiving printing telegraph station is functioning properly, the operator transmits a preassigned signal composed of significant current variations over the message transmission line to the receiving station by means of her sending teletypewriter. In transmitting this signal, the sending teletypewriter 45 causes the operation at the receiving station of

a contact which is so arranged as to short-circuit a resistance also at the receiving station. This resistance is in series with a control line leading from the receiving station to the sending station. 5

A differential polar relay located at the sending station has one of its windings in series with the control line and is normally balanced so that its armature is in a certain position. When the contact at the receiving station is operated by the reception at the receiving station of the preassigned signal transmitted over the message transmission line by the sending teletypewriter, the resistance is shunted out of the control line. This causes the balance of the differential polar relay at the sending station to be disrupted thereby causing its armature to go to its opposite position. In this opposite position, the armature of the differential polar relay closes a path for current to light a signal lamp at the sending station. 10 15 20

When the operator at the sending station transmits another signal, which may be any character, over the message transmission line, the contact at the receiving station is put back into its normal position thereby putting the resistance in series with the control line again. This restores the balance of the differential polar relay at the sending station thereby causing its armature to go back to its first position. In so doing, the armature opens the energizing circuit for the signal lamp and causes the lamp to go out. Failure of the lamp to light or to go out at the proper time indicates to the sending operator that there is something wrong with the apparatus at either the sending station or the receiving station. 25 30 35

The arrangement described above may be modified to have the resistance normally short-circuited and to be put into the control line in response to the reception at the receiving station of the preassigned signal transmitted by the sending teletypewriter. According to this modification, the insertion of the resistance into the control line would throw the differential polar relay out of balance. Then, the transmission of any other signal would short-circuit the resistance thereby restoring the balance of the differential polar relay. Another modification of this invention provides for two-way use of this checking arrangement. Still another modification of this invention enables this checking operation to be performed between two stations which are connected by only one transmission line instead of two transmission lines. 40 45 50 55

The invention will be better understood from the following detailed description with reference to the accompanying drawings in which:

Figure 1 illustrates the broad principle of the 60

invention which may be applied to any communication system in general;

Fig. 2 represents the invention applied for one-way use with two transmission lines;

Fig. 3 shows how the invention may be applied for two-way use with two transmission lines; and

Fig. 4 represents the invention applied for two-way use with only one transmission line.

In Fig. 1 is shown an arrangement by means of which an operator at a communication station A can control the operation of electrically operated rotating or reciprocating equipment at another communication station B and obtain an indication which will indicate whether or not the controlled equipment at station B is functioning properly.

When the operator at station A wishes to put the equipment at station B in operation, she closes the power switch 101 thereby starting motor-generator 102 which supplies a direct current voltage between the ground and the common point of the windings *a* and *b* of the differential polar relay 103. Current from the motor-generator 102 is supplied with two paths. One path leads from motor-generator 102 through the biasing winding *b* of the differential polar relay 103 and then through the resistance 105 to ground. The other path leads from motor-generator 102 through the line winding *a* of the differential polar relay 103, over the line *L* to the control relay 106 at station B. From the control relay 106, the current passes through contact 110 to ground. The magnitude and direction of the line current flowing through the winding *a* of the relay 103 are such as to overcome the effect of the biasing current flowing through the winding *b*, thus preventing the relay 103 from being operated by the biasing current. Since the relay 103 is not operated, its armature remains unoperated thereby holding open the circuit passing through signal lamp 104.

The line current flowing through the winding of the control relay 106 causes it to operate its armature thereby closing a path from the 110 volt alternating current source at station B to any controlled equipment, such as the motor 109.

When the controlled equipment (motor 109) is in operation, some interrupting device, such as the cam 108, is also set in operation and opens and closes the contacts 110 periodically.

When the contacts 110 open, the resistance 107 is placed in the line circuit in series with winding *a* of the differential polar relay 103. The addition of the resistance 107 to the line circuit reduces the line current sufficiently to allow the current through the biasing winding *b* of relay 103 to predominate and to cause relay 103 to operate its armature. When relay 103 operates, the circuit through the signal lamp 104 is closed thereby causing the lamp 104 to light. However, the line current still remains large enough to keep the control relay 106 operated.

When the cam 108 allows the contacts 110 to close, the resistance 107 is short-circuited and the current through the line winding *a* of relay 103 is increased to its former value. This will cause relay 103 to release its armature thereby opening the circuit through lamp 104 and causing lamp 104 to be extinguished.

Thus, the operation of the cam 108, which is dependent on the operation of the controlled equipment (motor 109), causes a periodic signal to be given to the operator at station A indicating that the controlled equipment at station B is functioning properly. Failure of lamp 104 to light or go out at the proper time indicates to the operator at station A that the equipment at sta-

tion B is not functioning properly. The invention is not limited to the use of a signal lamp for informing the operator. Any other type of an alarm device could be used, such as a bell or buzzer.

To shut down the equipment at station B, the operator at station A opens the power switch 101 which stops the motor-generator 102. When the motor-generator 102 stops, no current will be supplied to the winding of the control relay 106 which consequently releases. Upon the release of relay 106, the path leading from the 110 volt alternating current power supply to the controlled equipment (motor 109) is opened thereby causing the controlled equipment to stop operating.

The circuit shown in Fig. 2 is essentially that of Fig. 1 applied to a printing telegraph circuit. At the sending station A is shown the sending teletypewriter 211 which operates to transmit significant current variations over the message transmission line *L*₁ to the receiving teletypewriter 215 at the receiving station B.

When the operator at station A wishes to communicate with the operator at station B, she closes the power switch 201 which closes a path from power source 222 to the printer motor 214 and the motor-generator 202 and starts them in operation. The motor-generator 202 causes current to flow out over line *L*₁ and also in two paths similar to those mentioned in the description of the operation of the circuit shown in Fig. 1. One of these two paths leads from motor-generator 202, through the biasing winding *b* of the differential polar relay 203, and then through the resistance 205 to ground. The other path leads from motor-generator 202 through the line winding *a* of relay 203, over the control line *L*₂, through the winding of the control relay 206, and then through resistance 207 to ground.

The passage of current through the winding of control relay 206 causes it to operate its armature and thereby connect power from source 223 to the receiving teletypewriter motor 209. Also, the passage of current through the line winding *a* of the differential polar relay 203 tends to cause it to operate. However, the magnitude and direction of the biasing current flowing through the winding *b* of relay 203 is such as to oppose the effect of the current flowing through winding *a* and prevents relay 203 from operating.

When the operator at sending station A wishes to know if the teletypewriter apparatus at station B is functioning properly, she transmits, by means of the sending printer 211, a preassigned signal, such as a carriage return signal, over the message transmission line *L*₁. When this signal is received by the receiving teletypewriter 215, the carriage 216 of the receiving teletypewriter 215 moves to its carriage return position. In so doing, a contact arm 208 on the carriage 216 causes the contacts 210 to close. When contacts 210 close, they short-circuit resistance 207 and shunt it out of control line *L*₂. With the resistance 207 out of line *L*₂, the line current flowing through the winding *a* of relay 203 increases sufficiently to overcome the effect of the biasing current flowing through the winding *b* and to cause relay 203 to operate its armature. The operation of the armature of relay 203 closes the circuit through signal lamp 204 thereby lighting lamp 204.

The operator at station A now transmits any other signal over the line *L*₁. When this signal is received by the receiving teletypewriter 215 at station B, it causes the carriage 216 of the teletypewriter 215 to move from its carriage return

position. This opens the contacts 210 thereby removing the short-circuit from the resistance 207 and causing the control line current to drop to its original value. The balance is now restored to relay 203 which releases its armature and thereby opens the circuit through signal lamp 204 causing lamp 204 to be extinguished. The lighting and extinguishing of the signal lamp 204 at the proper times indicates to the operator at station A that the teletypewriter apparatus at station B is functioning properly. It is to be understood that any other type of alarm device could be used instead of the signal lamp 204.

The functioning of the signal lamp alarm circuit of Fig. 1 differs from that of Fig. 2 in that resistance 107 in Fig. 1 is normally short-circuited whereas resistance 207 in Fig. 2 is normally in control line L₂. The signal lamp 104 is lit when the contacts 110, which short-circuit the resistance 107, are opened and the resistance 107 is put in the circuit. In Fig. 2 the signal lamp 204 is lit when the contacts 210 are closed to short-circuit resistance 207. Attention is called to the fact that either method of controlling the operation of the signal lamp is satisfactory and that the methods may be interchanged if desired. If the method of Fig. 1 is used in Fig. 2, the contacts 210 must be arranged so that they are opened by the contact arm 208 when the printer carriage 216 is in the carriage return position.

In Fig. 3 the stations A and B are arranged so that they may be used for either sending or receiving depending upon the position of the keys 320 and 321. With the keys 320 and 321 in their normal position, as shown in Fig. 3, the teletypewriter apparatus of both stations A and B is in the receiving position. Stations A and B are identical in their manner of operation and differ only in that station A is operated from a direct current source 322 while station B is operated from an alternating current source 323.

When the operator at station A wishes to communicate with the operator at station B, she operates the key 320 which applies the direct current source 322 to the direct current teletypewriter motor 314 through the contacts 1 and 2 of key 320. The direct current source 322 also sends current through the contacts 4 and 5 of key 320 through the biasing winding b of the differential polar relay 303, through resistance 305, and then to ground. Current from the direct current source 322 also passes through the line winding a of the differential polar relay 303, through resistance 324, out over the control line L₂, through resistance 325, and then to winding a' of the differential polar relay 326 where it is provided with two paths. One path leads through winding b', resistance 307, and then to ground. The other path leads through contacts 2 and 3 of key 321, to control relay 306, and then to ground. The passage of current through the winding of the control relay 306 causes it to operate its armature. When relay 306 operates its armature, it closes a path from the alternating current source 323 to both the motor-generator 313 and the receiving teletypewriter motor 309. The generator of motor-generator 313 is connected so as to aid rather than oppose battery 322.

Then, as was explained in the description of the circuit of Fig. 2, the operator at station A transmits a preassigned signal, such as a carriage return signal, over the message transmission line L₁ by means of her sending teletypewriter 311. When this carriage return signal is received by the receiving teletypewriter 315 at

station B, it causes the carriage 316 of the receiving teletypewriter 315 to move to the carriage return position. With the carriage 316 in this position, the contact arm 308 is made to close the contacts 310.

When contacts 310 close, they short-circuit the resistance 325 which causes an increase of the current in the control circuit over control line L₂ to a value equal to the current in the winding b. Since relays 303 and 326 are adjusted to hold their armatures on either contact until differential current in their windings causes them to operate their armatures to the other contact, lamp 304 will not be lit at this time.

At the same time, the carriage 336 of the sending teletypewriter 311 at station A will move to its carriage return position and will cause its contact arm 338 to close contacts 330. When contacts 330 close, they short-circuit the resistance 324 which causes a further increase of the current in control line L₂. This further increase of the current in control line L₂ causes the differential polar relay 303 to operate. As was the case with the apparatus shown in Fig. 2, this procedure causes the lighting of the signal lamp 304.

In case one of the teletypewriters 311 and 315 is not functioning properly, its corresponding contacts (330 or 310, respectively) will not be closed. Consequently, the current in control line L₂ will not be increased sufficiently to cause the differential relay 303 to operate. Thus, lamp 304 will not be lit thereby indicating to the operator at station A that the teletypewriter apparatus at either station A or B is not functioning properly.

The above description applies to Fig. 3. Contacts 310 and 330 are normally open when operation is commenced. If these contacts (310 and 330) are closed when operation is commenced, lamp 304 will light and remain lit upon failure of either teletypewriter 312 or 315 to function.

If lamp 304 lights, thereby indicating that the teletypewriter apparatus at both stations A and B is functioning properly, the operator at station A then sends any other signal over the message transmission line L₁. This causes the carriage 316 of the receiving printer 315 to move from its carriage return position thereby opening the contacts 310. In the same way, contacts 330 will also be opened. When both contacts 310 and 330 open, the line current will be restored to its normal value. This will cause relay 303 to release thereby extinguishing the signal lamp 304. The extinguishing of lamp 304 also indicates to the operator at station A that the teletypewriter apparatus at both stations A and B is performing its functions properly.

After the desired communication with station B has been completed, the operator at station A should move key 320 back to its normal position. This will disconnect the direct current source 322 and will restore both stations A and B to their normal receiving condition.

When the operator at station B wishes to communicate with the operator at station A, she operates the key 321 which applies the alternating current source 323 through the contacts 4 and 5 of key 321 to the alternating current teletypewriter motor 309 and to the motor-generator 313. When the motor-generator 313 operates, current is sent through contacts 1 and 2 of key 321, the a' winding of differential polar relay 326, through resistance 325, and out over line L₂ to station A. At station A, the line current

passes through resistance 324, the *a* winding of differential polar relay 303, contacts 4 and 3 of key 320, the winding of control relay 346, and then to ground.

5 The operator at station B then goes through the same procedure with her sending teletypewriter 339 as has just been described above for the operator at station A. If both the receiving teletypewriters 312 at station A and the sending teletypewriter 339 at station B are functioning properly, the signal lamp 334 will operate in the manner described above for lamp 304, thereby indicating to the operator at station B that the teletypewriter apparatus at both stations
10 A and B is functioning properly.

The circuit shown in Fig. 4 performs the same functions over the one line L as the circuit shown in Fig. 3 performs over the two lines L₁ and L₂. When the operator at station A wishes to communicate with the operator at station B, she
20 operates the key 420. When key 420 is operated, power from the direct current source 422 is supplied to the direct current teletypewriter motor 414 through contacts 1 and 2 of key 420. Also, current from direct current source 422 will pass through contacts 4 and 5 of key 420, the biasing winding *b* of the differential polar relay 403, resistance 405, and then to ground. Likewise, current from direct current source 422 will pass
30 through the *a* winding of relay 403, resistance 424, the sending teletypewriter 411, the receiving teletypewriter 412, and then out over line L to station B.

At station B, the line current passes through
35 the receiving teletypewriter 415, the sending teletypewriter 430, resistance 425, and then through the *a'* winding of differential polar relay 426. From here it passes through contacts 2 and 3 of key 421 to the control relay 406 and then to ground. This will cause control relay 406 to operate thereby putting ground on the relay 451 which, in turn, applies power from the alternating current source 423 to the alternating current teletypewriter motor 409 and the motor-generator 413. However, the direct current circuit of the motor-generator 413 is kept open by the contacts 1 and 2 of key 421. It is to be noted that relays 403 and 426 operate their armatures in the same manner as relays 303 and 326.

40 In the manner that has been explained in the description of the circuit shown in Fig. 3, the operator at station A will transmit a carriage return signal over the line L which, if the teletypewriter apparatus at both stations A and B is functioning properly, will cause the contacts 430 and 410 to be operated. The operation of contacts 430 and 410 will increase the current passing through relay 403 to an amount sufficient to operate it thereby lighting signal lamp 404.
45

50 It is recognized that, if signals are being transmitted during the period that contacts 410 and 430 are closed, the armature of the differential polar relay 403 may be chattering. This contingency might prevent lamp 404 from lighting.
55 To prevent this, it is advisable for the operator at station A to wait, after sending a carriage return signal, until lamp 404 has had time to operate before proceeding with the transmission of messages.
60

65 When any other signal is sent from station A to station B, the lamp 404 will be extinguished in the manner described for the circuit shown in Fig. 3. When key 420 is restored to its normal position by the operator at station A, the appa-
70

tus at both stations A and B will be restored to the normal receiving condition.

When the operator at station B wishes to communicate with the operator at station A, she will operate the key 421. This will apply current from the alternating current source 423
5 through the alternating current teletypewriter motor 409 and the motor-generator 413. The motor-generator 413 will now send current through the contacts 1 and 2 of key 421 and through the windings of differential polar relays 426 and 403. This will cause control relay 446 to operate which, in turn, will cause the operation of relay 450. When relay 450 operates, it closes a path from direct current source 422, through
10 the armature of relay 450, to the direct current teletypewriter motor 414 and then to ground.

The operator at station B, using the procedure described above for the operator at station A, will then test the teletypewriter apparatus at
15 both stations A and B to see if the signal lamp 434 will be lighted and extinguished as required to indicate that the teletypewriter apparatus of both stations A and B is functioning properly.

Attention is called to the fact that the control
20 relays 446 and 406 and also relays 450 and 451 are of the slow-to-release type. The purpose of this is to prevent unintentional operation of these relays due to momentary interruptions of the current in line L during the transmission of message
25 signal impulses.

The arrangements shown in the drawings and described above are illustrative of the operation of the invention and will serve to assist in interpreting the claims. The claims are not to be
30 restricted to the precise construction described above, but are intended to include all changes and modifications employing the principles and features of operation of the invention.

What is claimed is:

1. A communication system comprising in combination a first teletypewriter, a second teletypewriter, a first transmission line having a ground return for connecting the two teletypewriters for the transmission of significant current variations, a second transmission line having a ground return for connecting the two teletypewriters, and instrumentalities operating over the second transmission line for obtaining a check upon the capability of the second teletypewriter to correctly receive the current variations transmitted to it over the first transmission line by the first teletypewriter.
35

2. A printing telegraph system comprising in combination a first printing telegraph instrument, a second printing telegraph instrument, a first transmission line having a ground return for connecting the two instruments for the transmission of significant current variations, a second transmission line having a ground return for connecting the two instruments, and instrumentalities operating over the second transmission line for obtaining a check upon the capability of the second instrument to correctly receive the current variations transmitted to it over the first transmission line by the first instrument, said instrumentalities including an alarm device connected to the second transmission line and located near the first printing telegraph instrument for warning the operator of that instrument of the improper functioning of either instrument.
40

3. A communication system comprising in combination a first station having a teletypewriter, a second station having a teletypewriter, a transmission line connecting the two teletypewriters,
45

instrumentalities for informing the operator at the first station of the improper functioning of the teletypewriter at the second station, said instrumentalities including an alarm device located at the first station, a circuit for operating the alarm device, said circuit extending from the first station to the second station, a relay located at the first station in series with the circuit for operating the alarm device, a resistance located at the second station in series with the circuit, and a contact at the second station for shunting the resistance out of the circuit.

4. A communication system comprising in combination a first teletypewriter, a second teletypewriter, a first transmission line connecting the two teletypewriters for the transmission of significant current variations, a second transmission line connecting the two teletypewriters, instrumentalities operating over the second transmission line for obtaining a check upon the operability of each teletypewriter, said instrumentalities including an alarm device connected into the second transmission line, a polar relay connected into the second transmission line for operating the alarm device, a resistance connected into the second transmission line, and a contact for shunting the resistance out of the second transmission line, said contact being operated in response to the transmission and reception of a particular signal transmitted by the first teletypewriter over the first transmission line to the second teletypewriter.

5. In a communication system having two communication stations connected by a transmission line, instrumentalities for enabling an operator at one station to control the operation of electrically operated reciprocating equipment at the other station in response to the application of current to the transmission line, and signaling apparatus for indicating to the operator at the first mentioned station whether the controlled equipment at the second mentioned station is functioning properly, said signaling apparatus including a rotating cam located at the second station for periodically varying the amount of current in the line and a differential relay located at the first station for periodically opening and closing a circuit for operating an indicating device also at the first station in response to the periodic variations in the amount of the line current.

6. A two-way teletypewriter system comprising in combination two teletypewriter stations connected by two telegraph lines, instrumentalities at each station for enabling an operator at either station to control the operation of a teletypewriter located at the other station, and signaling apparatus at each station for indicating to an operator at one station whether the teletypewriter apparatus at the other station is functioning properly, said signaling apparatus being put into operation in response to the transmission and reception of a particular combination of significant current variations and being taken out of operation in response to the transmission and reception of any other combination of significant current variations.

7. A teletypewriter system comprising in combination a plurality of teletypewriter stations connected by a plurality of telegraph lines, instrumentalities at one station for enabling an operator at that station to control the operation of a teletypewriter located at another station, and signaling apparatus for enabling that oper-

ator to obtain an indication which will indicate whether the controlled teletypewriter is functioning properly, said signaling apparatus being put into operation in response to the transmission and reception of a particular combination of significant current variations and being taken out of operation in response to the transmission and reception of a different combination of significant current variations.

8. A teletypewriter system having two teletypewriter stations connected by a telegraph line, instrumentalities for enabling an operator at one station to control the operation of a teletypewriter located at the other station, and signaling apparatus for indicating to said operator whether the controlled teletypewriter is functioning properly, said signaling apparatus including an indicating device located at the station where the operator is, an electroresponsive device for operating the indicating device, said electroresponsive device being connected into the telegraph line and located at the station where the operator is, a resistance connected into the telegraph line and located at the station where the controlled teletypewriter is, and a contact for shunting the resistance into and out of the telegraph line, said contact being connected into the telegraph line and located at the station where the controlled teletypewriter is.

9. A printing telegraph system having two printing telegraph stations connected by a telegraph line, an indicating device located at one station, instrumentalities for operating the indicating device, said instrumentalities including a relay connected into the telegraph line and responsive to variations in the amount of current in the telegraph line, a resistance located at the other station and connected into the telegraph line, and a contact for varying the amount of current in the line by shunting the resistance into and out of the line.

10. A teletypewriter system comprising in combination two teletypewriter stations each having a teletypewriter and connected by a telegraph line, an indicating device located at one station, instrumentalities for operating the indicating device, said instrumentalities including a relay connected into the telegraph line and responsive to variations in the amount of current in the line, a resistance located at the other station and connected into the telegraph line, a contact for varying the amount of current in the line by shunting the resistance into and out of the telegraph line, said contact being opened and closed by different positions of the carriage of the teletypewriter located at the same station where the resistance is located.

11. A teletypewriter system comprising in combination a teletypewriter station having a teletypewriter having a direct current motor and a source of direct current for operating that motor, a second teletypewriter station having a teletypewriter having an alternating current motor and a source of alternating current for operating that motor, a telegraph line for connecting the two teletypewriters, an alarm device connected to one teletypewriter for indicating to an operator of that teletypewriter the improper functioning of the other teletypewriter, and instrumentalities for operating the alarm device.

12. A teletypewriter system comprising in combination a teletypewriter station having a teletypewriter having a direct current motor and a source of direct current for operating that mo-

tor, a second teletypewriter station having a teletypewriter having an alternating current motor and a source of alternating current for operating that motor, a telegraph line for connecting the two teletypewriters, an alarm device connected to one teletypewriter for indicating to an operator of that teletypewriter the improper functioning of either teletypewriter, and instrumentalities for operating the alarm device.

13. In a communication system having two communication stations, apparatus at one station operated by direct current, apparatus at the other station operated by alternating current, a communication line connecting the apparatus at one station to the apparatus at the other station, instrumentalities at one station for controlling the operation of the apparatus at the other station, signaling apparatus for indicating whether the controlled apparatus is functioning properly, and instrumentalities for operating the signaling apparatus.

14. A teletypewriter system comprising in combination a communication line, a first teletypewriter station connected to the line, a second teletypewriter station also connected to the line, an indicating device located at the first station for indicating to an operator at that station that the teletypewriter at the second station is functioning properly, and instrumentalities for operating the indicating device, said instrumentalities including a contact adapted to be operated by one of the teletypewriters.

15. A teletypewriter system comprising in combination a telegraph line, a first teletypewriter station connected to one end of the line, a second teletypewriter station connected to another end of the line, each of the teletypewriters at said teletypewriter stations having a movable carriage, an indicating device located at the first station for warning an operator at that station of the improper functioning of either teletypewriter, and instrumentalities for operating the indicating device, said instrumentalities including a contact located at each station, each contact being adapted to be operated by the carriage of the teletypewriter at the same station.

16. A teletypewriter system comprising in combination a telegraph line, a first teletypewriter station connectable to one end of the line, a second teletypewriter station connectable to another end of the line, each of the teletypewriters at said teletypewriter stations having a movable carriage, an indicating device located at the first teletypewriter station for indicating to an operator at that station the improper functioning of a teletypewriter, and instrumentalities for operating the indicating device in response to a variation in the amount of current flowing over the line, said current variation being effected by a certain movement of the carriage of a teletypewriter.

17. A teletypewriter system having a first teletypewriter station, a second teletypewriter station, a communication line connecting the two stations, said line normally having current of a certain amount passing over it, a circuit for energizing and operating an indicating device at the first station, said circuit being normally open, control means for reducing the line current to an amount smaller than its normal amount but more than zero, and an instrumentality responsive to the reduction in line current for closing said normally open circuit.

18. A teletypewriter system having a first teletypewriter station, a second teletypewriter

station having a teletypewriter with a movable carriage, a communication line connecting the two stations, said line normally having current of a certain amount passing over it, a circuit for energizing and operating an indicating device at the first station, said circuit being normally open, control means operable by the carriage of the teletypewriter at the second station for reducing the line current to an amount smaller than its normal amount but more than zero, and an instrumentality responsive to the reduction in line current for closing said normally open circuit.

19. A teletypewriter system having a first teletypewriter station, a second teletypewriter station, a communication line connecting the two stations, said line normally having current of a certain amount passing over it, a circuit for energizing and operating an indicating device at the first station, said circuit being normally open, control means for reducing the line current to an amount smaller than its normal amount but more than zero, and a differential relay at the first station responsive to the reduction in the line current for closing said normally open circuit.

20. A transmission system having two communication stations, instrumentalities for enabling an operator at one station to control the operation of electrically operated rotating equipment at the other station, an indicating device for indicating to an operator at the first station whether the controlled equipment at the second station is functioning properly, a circuit for operating the indicating device, a rotatable cam located at the second station, and an instrumentality for continuously rotating the cam during the period of operation of the controlled rotating equipment, the rotation of said cam being adapted to periodically effect the operation of said indicating device.

21. A teletypewriter system having a first teletypewriter station, a second teletypewriter station, a communication line connecting the two stations, each of said stations having a teletypewriter motor, motor starting means at the first station for starting the motors at both stations, a normally unoperated indicating device at the first station, a source of line current, and means for applying it to the line, instrumentalities for reducing the line current to an amount less than its normal amount but more than zero, and a normally unoperated relay for controlling the operation of the indicating device, said relay being adapted to operate in response to the reduction in the line current to operate the indicating device.

22. A communication system having a first communication station, a second communication station, a communication line for connecting the two stations for the transmission of messages, normally unoperated apparatus at the second station, control means at the first station for putting said apparatus into operation, a normally unoperated indicating device at the first station for indicating that said apparatus is operating, a resistance located at the second station and connected into the line, and an instrumentality at the second station for varying the resistance of the line by short circuiting said resistance at intervals during the transmission of a message, said indicating device being adapted to operate in response to the variations in the line resistance.