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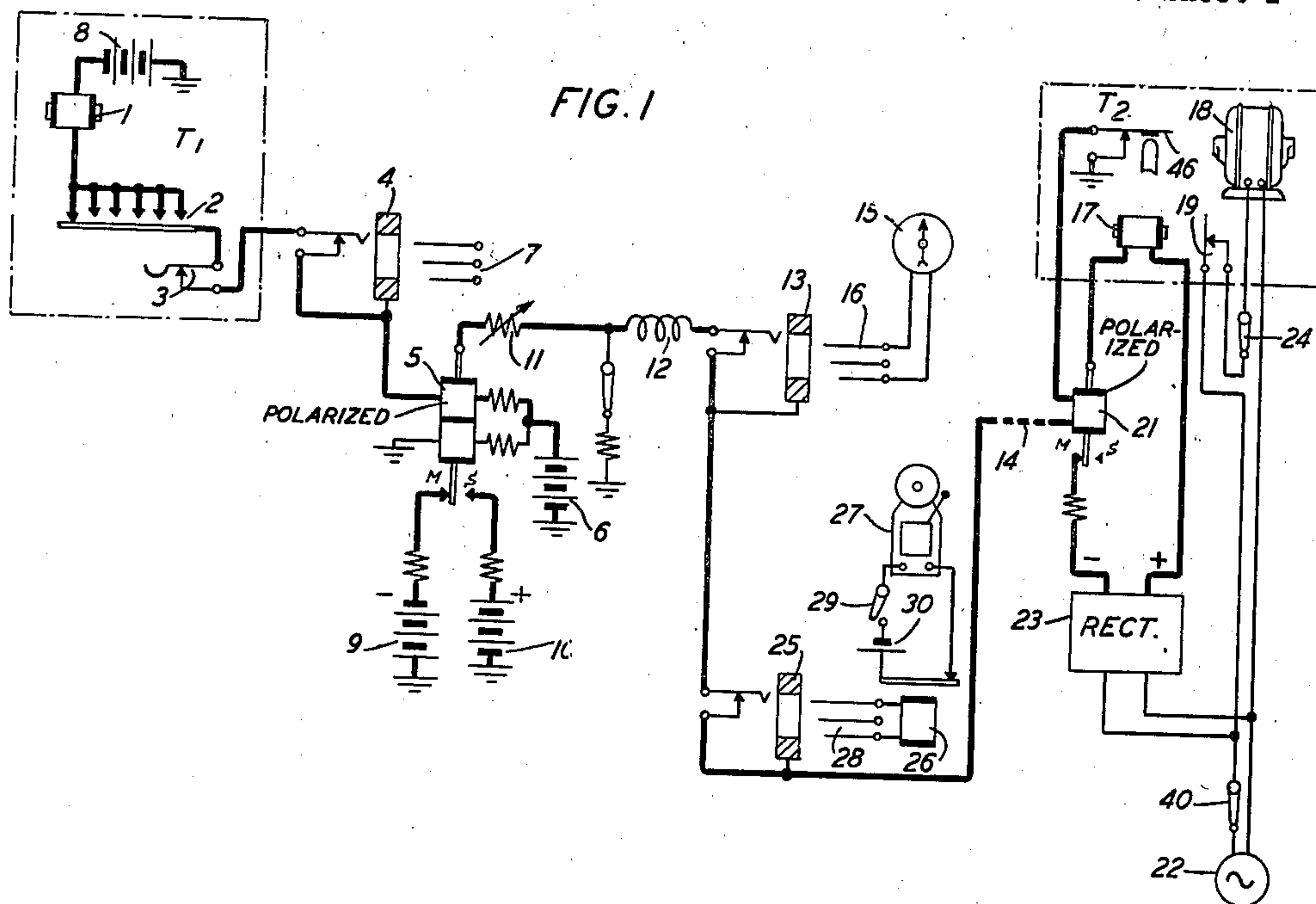
**C. J. VOTAW**

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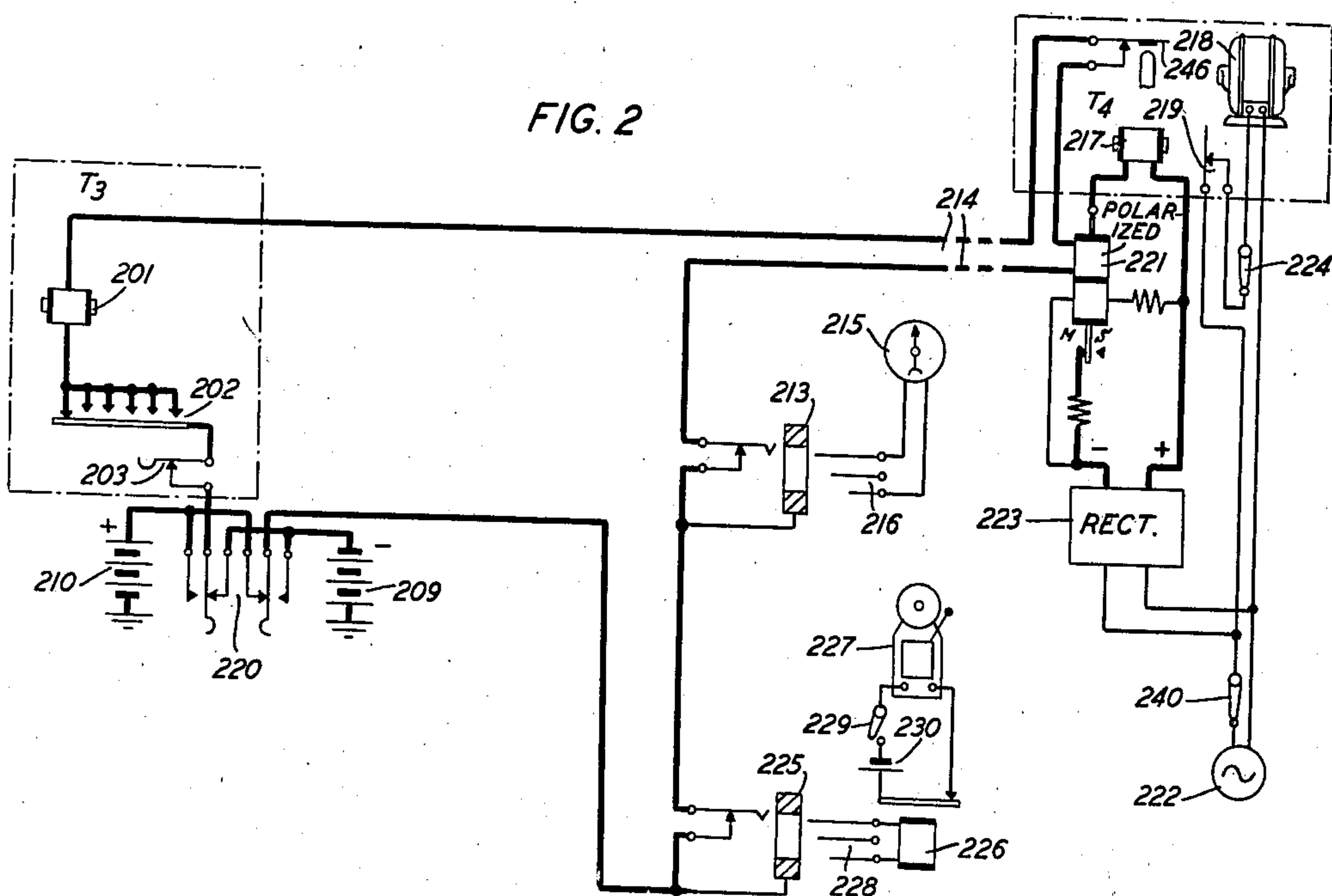
TELETYPEWRITER INDICATING SYSTEM

Filed May 25, 1940

2 Sheets-Sheet 1



**FIG. 2**



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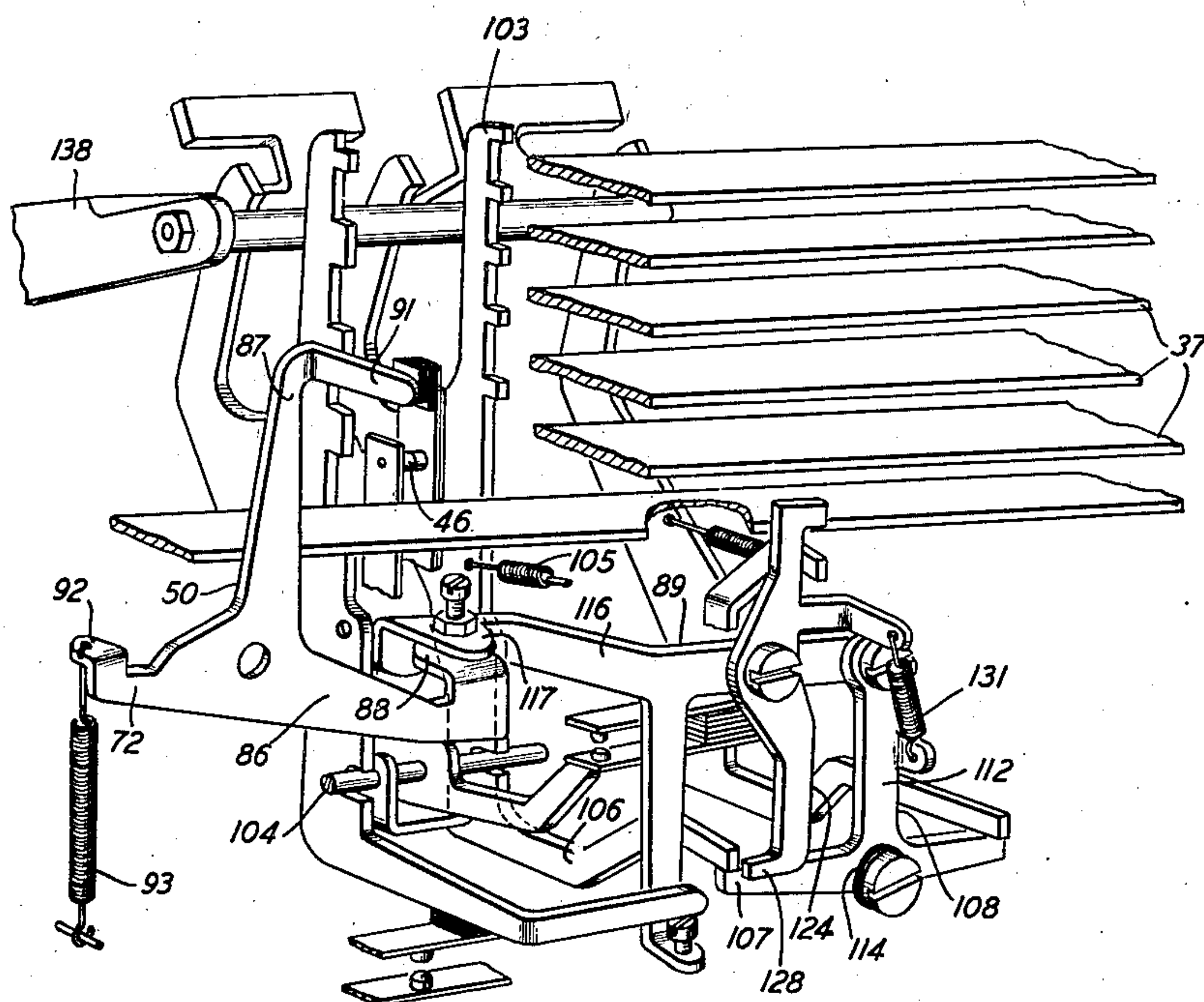
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2 Sheets-Sheet 2

FIG. 3



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## UNITED STATES PATENT OFFICE

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## TELETYPEWRITER INDICATING SYSTEM

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3 Claims. (Cl. 178—2)

This invention relates to printing telegraph systems and, more particularly, to improved means for infallibly determining whether a teletypewriter motor located at a distant station has actually been stopped in response to the transmission of a stop signal.

Various arrangements have been designed heretofore for acknowledging the reception of a stop signal but such arrangements do not provide an infallible indication that the teletypewriter motor itself has actually stopped.

Consequently, it is an object of this invention to provide a teletypewriter system with means for infallibly indicating that the transmission of a stop signal has failed to stop a teletypewriter motor located at a distant station.

It is also an object of the invention to provide a teletypewriter system with improved means for indicating that a teletypewriter motor at a distant station is running and operating its teletypewriter.

In accordance with the invention, a printing telegraph system, whether polar or neutral, provides the control station with a jack in series with the line. To obtain an indication of the condition of a teletypewriter motor at a distant station, an attendant at the control station connects an indicating device, such as an ammeter, into the line by plugging into the jack. Then, by employing any suitable means to change the normal marking condition of the line to a spacing condition, the line will be opened by the break contacts in the teletypewriter at the distant station if the motor at that station has not been stopped. This opening of the line will be indicated to the attendant at the control station by movement of the needle of the ammeter. However, if the teletypewriter motor has been stopped, then the break contacts will not be opened in response to the spacing condition of the line and there will be no fluctuation of the ammeter needle. If desired, an audible signal device may be either optionally or additionally inserted into the line for similar operation.

These and other features of the invention will be more fully described in connection with the following detailed description of the invention in which:

Fig. 1 illustrates the invention applied to a polar printing telegraph system;

Fig. 2 represents the invention applied to a neutral printing telegraph system; and

Fig. 3 shows the mechanism for opening the break contacts whenever the blank function lever

in the teletypewriter at the distant station is operated.

In Fig. 1, a printing telegraph control station, which may be a central office, is represented at the left and is shown to include a teletypewriter T<sub>1</sub> comprising a printer magnet 1, sending contacts 2, and a break key 3. Teletypewriter T<sub>1</sub> is connected to the contacts of a jack 4 which is connected to the operating winding of a polarized relay 5 and then to positive battery 6. Battery 6 is also connected through the biasing winding of relay 5 to ground. A dummy plug 7 is provided for insertion into jack 4 for opening the circuit leading from battery 8 to battery 6. The armature of relay 5 is designed to fluctuate between its contacts to apply current from either battery 9 or 10 through a variable resistance 11 and a noise killer 12 and then over the contacts of jacks 13 and 25 to the communication channel represented by line 14. An ammeter 15 is designed to be connected into the communication channel whenever plug 16 is inserted in the jack 13. A relay 26, which controls a bell 27, is connected to a plug 28 which is adapted for insertion into jack 25.

A distant station, which may be a subscriber's station, is represented at the right in Fig. 1 and is illustrated as comprising a teletypewriter T<sub>2</sub>. The teletypewriter T<sub>2</sub> is shown as a receiving-only machine and is equipped with a printer magnet 17, a motor 18, stop contacts 19, and a set of break contacts 46 which are shown in more detail in Fig. 3. The communication channel is shown to extend from line 14 through a polarized relay 21 and then through the break contacts 46 to ground. A suitable source of power supply 22 is provided for operating the motor 18 and for energizing the rectifier 23 which supplies current over the armature of relay 21 to the printer magnet 17. A manually operable switch 24 is provided for enabling the subscriber to disconnect the power supply 22 from the motor 18. The rectifier 23 is usually operating continuously, but a manually operable switch 40 is provided for enabling the subscriber to disconnect the power supply 22 from the rectifier 23 when desired.

In operating the system shown in Fig. 1, it will be noted that, in this embodiment of the invention, the communication line is normally closed with negative current from battery 9 passing over the armature of relay 5, out over line 14, through the winding of polarized relay 21, and then over the break contacts 46 to ground. If desired, some suitable means, such as that disclosed in Patent 1,931,672 granted October 24, 1933, to S.



Morton et al., may be employed for enabling an attendant at the central office to start the teletypewriter motor 18 at the distant subscriber's station. The disclosure of this Morton et al. Patent 1,931,672 is incorporated herein by reference as a part of this specification. In accordance with the Morton et al. disclosure, the subscriber's motor is started by means not shown in the drawings in response to an opening of the communication line 14 for a preassigned interval of time followed by a closure of line 14. The armature of relay 5 will now fluctuate between its contacts to apply current from either battery 9 or 10 to the line 14. The significant current variations sent out over line 14 by the fluctuations of the armature of relay 5 comprise polar signals which correspond to the permutation code signals formed by the sending contacts 2.

After communication has ended, or at the end of a business day, an attendant may wish to stop the teletypewriter motor 18 at the distant subscriber's station. This can be done by transmitting a stop signal in the manner described in the Morton et al. Patent 1,931,672 or by any other suitable arrangement. As is described in the Morton et al. patent, the transmission of the stop signal will effect the opening of the stop contacts 19 which will open the circuit from the power supply 22 to the motor 18.

In order to determine whether the motor 18 has actually been stopped or whether it is still running due to a failure of the stop apparatus to properly respond to the transmission of the stop signal, the attendant at the central office inserts plug 16 into jack 13. This opens the contacts of jack 13 and connects ammeter 15 in series with the line circuit. The attendant then inserts the dummy plug 7 into jack 4 thereby opening the circuit from the central office teletypewriter T<sub>1</sub> to the polarized relay 5. The opening of this circuit permits the biasing winding of polarized relay 5 to move the armature of relay 5 to its spacing contact to apply positive spacing current from battery 10 to the line circuit. This positive spacing current on the line circuit causes the polarized relay 21 at the distant station to move its armature to its spacing contact.

Now, if the motor 18 has been stopped by the proper functioning of the subscriber's equipment in response to the stop signal, there will be no response to the application of spacing current to the line circuit.

However, if, because of improper adjustment of the stop contacts or for any other reason, motor 18 failed to stop in response to the stop signal, it will be operating the teletypewriter T<sub>2</sub> when the spacing current is applied to the line circuit. The continuous spacing current on the line will now have the same effect as a so-called "blank" signal and will cause the selecting mechanism in the teletypewriter T<sub>2</sub> to select the blank function lever 103 in the manner described in Patent 1,904,164 granted April 18, 1933, to S. Morton et al. and in Patent 1,980,284 granted November 13, 1934, also to S. Morton et al. Both of these Morton et al. patents are incorporated herein by reference as a part of this specification. The blank function lever 103 will consequently be operated as described in these Morton et al. patents to effect the operation of the break contacts 46 as will be described more fully hereinafter in connection with Fig. 3. The opening of the break contacts 46 opens the line circuit and causes a movement of the needle of

the ammeter 15. This provides a visible indication to the attendant at the central office that the transmission of the stop signal failed to stop the motor 18 at the distant station.

As will be described hereinafter, the break contacts 46 only open momentarily and then close thereby causing the needle of ammeter 15 to return to its initial position. However, since spacing current still remains on the line, the selecting mechanism in the subscriber's teletypewriter T<sub>2</sub> will again select the blank function lever 103 for momentary operation to again open the break contacts 46 momentarily to again move the needle of the ammeter 15. This causes a continuous fluctuation of the needle of ammeter 15.

The central office attendant then withdraws plug 16 from jack 13 and plug 7 from jack 4 thereby restoring marking current from battery 9 to the line circuit to discontinue the selection of the blank function lever 103. The attendant may then transmit another stop signal and test the motor 18 again. If a series of stop signals fails to stop motor 18, the attendant at the central office may communicate by any convenient means, such as by telephone, with the distant subscriber to inform him that the motor 18 is running. The subscriber can then go to the teletypewriter T<sub>2</sub> and stop the motor 18 by manually opening the switch 24 to disconnect the power supply 22 from the motor 18.

An additional, or optional, indication may be obtained by the central office attendant by inserting plug 28 into jack 25 to connect relay 26 into the line circuit. The line current energizes relay 26 which operates its armature. The attendant closes the manual switch 29 to prepare a circuit for current from battery 30 to operate the signal bell 27. When the break contacts 46 open the line circuit, relay 26 releases its armature. This completes the circuit for current from battery 30 to operate bell 27 to provide the central office attendant with an audible signal.

If the motor has stopped in response to the stop signal, as will be evidenced by steady deflection of ammeter 15, or no response of signal bell 27, the attendant may remove plugs 16 and 28 but should not remove dummy plug 7 if teletypewriter T<sub>2</sub> is to remain in out-of-service or non-responsive condition for a period of time. The reason for this is that the spacing condition into which the line is placed preparatory to testing for stopping of the motor corresponds to the condition which is established as the first phase of starting the motor by remote control, and, accordingly, the first phase of the motor starting function as disclosed in Patent 1,931,672 is performed, the function being incomplete, however. If, after the test, the line is restored to marking condition, the second phase of the motor starting function will be performed and the motor will be restarted. In order to avoid such restarting of the motor the line should be left in the spacing condition until the next transmission period, and this is the normal out-of-service condition for systems of the type shown in Fig. 1.

The neutral printing telegraph system shown in Fig. 2 comprises at the left a control station, such as a central office, which is provided with a teletypewriter T<sub>3</sub> having a printer magnet 201, sending contacts 202, and a break key 203. The teletypewriter T<sub>3</sub> is connected over the inner left set of contacts of control key 220 to negative marking battery 209. Positive battery 210 is connected over the inner right set of contacts



of control key 220 to the contacts of jacks 213 and 225. An ammeter 215 is connected to a plug 216 which is adapted for insertion into jack 213. A relay 226, which controls a bell 227, is connected to a plug 228 which is adapted for insertion into jack 225.

A communication line 214 extends from the central office to a subscriber's station shown at the right in Fig. 2. The subscriber's station is shown to be equipped with a receiving-only teletypewriter T<sub>4</sub> having a printer magnet 217, a motor 218, stop contacts 219, and a set of break contacts 246 similar to the break contacts 46 shown in Fig. 3. The subscriber's station is also provided with a suitable source of power supply 222 for operating the motor 218 and for energizing the rectifier 223. Rectifier 223 supplies current to the printer magnet 217 and also to the biasing winding of polarized relay 221 which has its operating winding connected into the line 214. A manually operable switch 224 is provided for enabling the subscriber to disconnect the power supply 222 from motor 218. Another manually operable switch 240 is provided for enabling the subscriber to disconnect the power supply 222 from rectifier 223.

The system shown in Fig. 2 is also equipped with means, similar to those disclosed in Morton et al. Patent 1,931,672, for enabling an operator at the central office to start the subscriber's motor 218 by opening the normally closed line 214 for a certain length of time and then closing it again. After motor 218 has been started, the operator at the central office operates the sending contacts 202 to originate the transmission of permutation code signals out over line 214. In this connection, it is to be noted that the line circuit is normally closed by current passing from negative battery 209, over key 220, through the teletypewriter T<sub>3</sub>, out over the top side of line 214, through break contacts 246 at the subscriber's station, operating winding of relay 221, back over the bottom side of line 214, contacts of jacks 213 and 225, key 220, and then to positive battery 210. Permutation code signals composed of significant current variations can now be sent from the central office out over line 214 to the subscriber's station. At the subscriber's station, the significant current variations cause the armature of polarized relay 221 to fluctuate between its marking and spacing contacts thereby causing corresponding variations in the current passing through the printer magnet 217.

When the operator at the central office wishes to shut down the apparatus at the subscriber's station, a stop signal is transmitted which accomplishes the functions of the stop signal described in the Morton et al. Patent 1,931,672 since it is understood that the teletypewriter T<sub>4</sub> is equipped with the features disclosed in the Morton et al. patent. The transmission of the stop signal effects the opening of the stop contacts 219 thereby opening the circuit from the power supply 222 to the motor 218.

To detect the failure of the transmission of the stop signal to accomplish its purpose, the attendant at the central office inserts plug 216 into jack 213 thereby connecting the ammeter 215 in series with the line 214. The attendant then inserts plug 228 into jack 225 to connect relay 226 into the line circuit and closes the manual switch 229. The central office attendant next operates the control key 220 which connects the positive battery 210 over the outer left

contacts of key 220 to the top side of line 214 and connects battery 209 over the outer right contacts of key 220 to the bottom side of line 214. Thus, the operation of key 220 reverses the direction of the flow of current in line 214. The line current energizes relay 226 which operates its armature to open the circuit from battery 230 to the bell 227.

At the subscriber's station, the reversal of current flow through the operating winding of polarized relay 221 assists the biasing current in moving the armature of relay 221 to its spacing contact. This opens the path from rectifier 223 through the printer magnet 217. If motor 218 has been stopped by the transmission of the stop signal, there will be no reaction to this movement of the armature of relay 221.

However, if the stop signal failed to stop motor 218, then the teletypewriter equipment will be running at the subscriber's station. In this event, the movement of the armature of relay 221 to its spacing contact will be registered in the teletypewriter T<sub>4</sub> as a "blank" signal. This will effect the selection and operation of the blank function lever 103 which will, in turn, effect the momentary operation of the break contacts 246 in the manner described in the Morton et al. Patent 1,980,284 mentioned above. The opening of the break contacts 246 opens the line circuit thereby causing the needle of the ammeter 215 to move. This provides a visible indication to the central office attendant that the motor 218 at the distant station is still running and operating the teletypewriter T<sub>4</sub>. At the same time, the opening of the line circuit causes relay 226 to release its armature to close the circuit from battery 230 to the bell 227. This causes the operation of bell 227 to provide an audible signal to the central office attendant.

The central office attendant may then withdraw plug 216 from the jack 213 and plug 228 from jack 225 and restore his control key 220 to its normal condition shown in Fig. 2. He may also open the switch 229 to discontinue the operation of bell 227. The attendant may then transmit more stop signals and test the motor 218 again. If the attendant detects that the stop signals have failed to stop motor 218, he may telephone the distant subscriber to request him to manually open switch 224 to disconnect the power supply 222 from motor 218.

If the test indicates that the motor at station T<sub>4</sub> had stopped as desired, he may remove plugs 216 and 228, leaving key 220 in the operated condition to maintain the communication circuit in spacing condition, which is the normal out-of-service condition for a system of the class disclosed in Fig. 2. Thus the completion of the motor start operation will be estopped.

The mechanism for opening the break contacts 46 and 246 in response to the selection and operation of the blank function lever 103 is illustrated in Fig. 3 which is somewhat similar to Fig. 7 of Morton et al. Patent 1,980,284 mentioned above. As is described in this Morton et al. patent, the transmission of a so-called "blank" signal effects the selection of the blank function lever 103 in the receiving teletypewriter which may be either T<sub>2</sub> or T<sub>4</sub>. Since a "blank" permutation code signal comprises a succession of spacing impulses, as is described in the Morton et al. patent, the application of spacing battery to the communication line instead of marking battery will simulate a "blank" permutation code signal. Thus, the substitution of spacing



battery causes a succession of "blank" signal combinations to be set up by the selector vanes 37 in the teletypewriter at the distant station thereby selecting the blank function lever 103 for clockwise rotation about its shaft 104 under the influence of the spring 105.

As is described in Morton et al. Patent 1,980,284, the clockwise movement of the blank function lever 103 causes its extension arm 106 to tilt arm 107 of T-lever 108 downward. This moves lever 108 counter-clockwise to its operated position where it is held by the spring washer 114. In rotating, arm 112 of lever 108 shoves T-lever 89 and intermediate lever 124 to the left. In moving laterally to the left, intermediate lever 124 rotates clockwise slightly, due to the pull exerted by spring 131, to cause its end portion 128 to bear against the side of the extension arm 106.

This completes the first cycle of operations as the blank function lever 103 is now restored to its normal position by the function bail 138 thereby elevating the extension arm 106. T-lever 108 is held in its operated position by the spring washer 114 but spring 131 is now able to pull the intermediate lever 124 further in a clockwise direction, because the elevation of extension arm 106 has disengaged arm 106 from the tip of the end portion 128 of lever 124. This permits the intermediate lever 124 to rotate sufficiently to swing its end portion 128 into the downward path of the extension arm 106 of the blank function lever 103.

Since spacing battery still remains on the line circuit, the selector vanes 37 again set up a blank code signal to again select the blank function lever 103 for operation. The resulting downward movement of extension arm 106 will now be intercepted by the end portion 128 of the intermediate lever 124. Lever 124 will now be urged downward to impart rotative motion in a counter-clockwise direction to T-lever 89 about its pivotal connection to lever 108. The consequent downward movement of arm 116 of T-lever 89 will now impart through its laterally disposed portion 117, which overlaps a laterally disposed portion 88 of arm 86 of lever 50, clockwise motion to lever 50. This clockwise rotation of lever 50 causes its vertical arm 87 with its laterally disposed arm 91 to move to the right a sufficient distance to open the break contacts 46 thereby opening the line circuit. In response to the opening of the line circuit by break contacts 46, the needle of the ammeter at the central office will move to indicate to the central office attendant that the teletypewriter motor at the distant station is still operating.

The opening of the line circuit is only momentary because the function bail 138 restores the blank function lever 103 to its normal position thereby elevating its extension arm 106. This removes the pressure of arm 106 on the end portion 128 of the intermediate lever 124 thereby permitting spring 131 to pull both the intermediate lever 124 and the T-lever 89 clockwise to remove the downward pressure of portion 117 of arm 116 of lever 89 on portion 88 of arm 86 of lever 50. This allows spring 93, which is attached to the laterally disposed portion 92 of arm 72 of lever 50, to restore lever 50 to its former position. The counter-clockwise movement of lever 50 causes its vertical arm 87 to move to the left to allow the break contacts 46 to close the line circuit.

In this connection it is to be noted that since

the teletypewriters T<sub>2</sub> and T<sub>4</sub> are of the receiving-only type, they have been modified to the extent that the latch 71, spring 82 and the keys 49 and 69, all shown in Fig. 6 of Morton et al. Patent 1,980,284, have been removed.

Since spacing current still remains on the line circuit, another blank signal will be set up by the selecting vanes 37 to again select the blank function lever 103 which goes through the cycle of operations just described above to again open the break contacts 46 momentarily. This opening and closing of the break contacts 46 and the line circuit continues until either the motor of the subscriber's teletypewriter is stopped or until the spacing battery is removed from the line circuit and the normal marking battery applied thereto.

It is to be understood that various modifications may be made in the circuits and apparatus shown in the drawings. For example, various other types of printing telegraph systems may be employed and other types of mechanical apparatus in the printers may be used. Also other types of signaling devices other than an ammeter or signal bell may be used if desired. Consequently, it is to be understood that the above described circuits and apparatus have been shown for the purpose of illustrating the principles and features of operation of the invention and that the invention is to be limited only by the claims appended hereto.

What is claimed is:

1. A printing telegraph system comprising in combination a control station, a distant station having a teletypewriter and a motor for operating the teletypewriter, a communication channel for connecting the two stations, means for applying current to the communication channel, operating means for operating the motor, means for transmitting significant current variations over the communication channel from said control station to the distant station, means for stopping the motor in response to the reception by the teletypewriter at the distant station of certain preassigned current variations transmitted from said control station, break means for opening the communication channel at the distant station, operating means for operating said break means in response to a certain variation of the current in the communication channel only when said motor is operating, an indicator at the control station, and means for connecting said indicator into the communication channel for indicating an opening of the communication channel by the operation of the break means.

2. A printing telegraph system comprising in combination a first station, a second station having a teletypewriter and a motor for operating the teletypewriter, a communication channel for connecting the two stations, means for normally applying marking current to the communication channel, operating means for operating the motor, means for transmitting significant current variations over the communication channel from the first station to the second station, means for stopping the motor in response to the reception by the teletypewriter at the second station of certain preassigned current variations transmitted from said first station, means for applying spacing current to the communication channel instead of marking current, break means for opening the communication channel at the second station, operating means for operating said break means in response to the application of spacing current to the communication channel instead



of marking current only when said motor is operating, an indicator at the first station, means for connecting said indicator into the communication channel, and means for operating said indicator in response to an opening of the communication channel by the operation of the break means to signify that the motor is being operated.

3. A teletypewriter system comprising a first station and a second station, a teletypewriter transmission channel connecting said stations, 10

said stations being provided with apparatus including a teletypewriter driving motor at one station having a normal condition in which said motor is stopped, means at said one station for controlling the operation of said motor, and means at the other station for indicating independently of said motor controlling means an abnormal running of said motor.

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