

June 3, 1941.

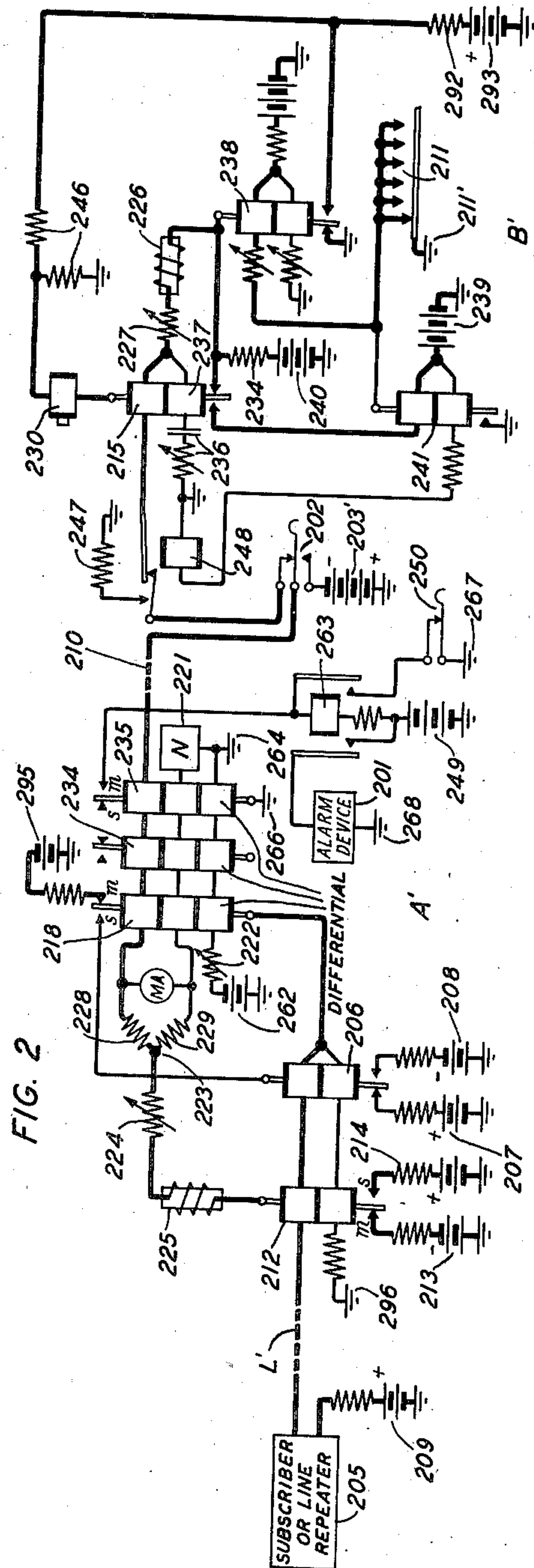
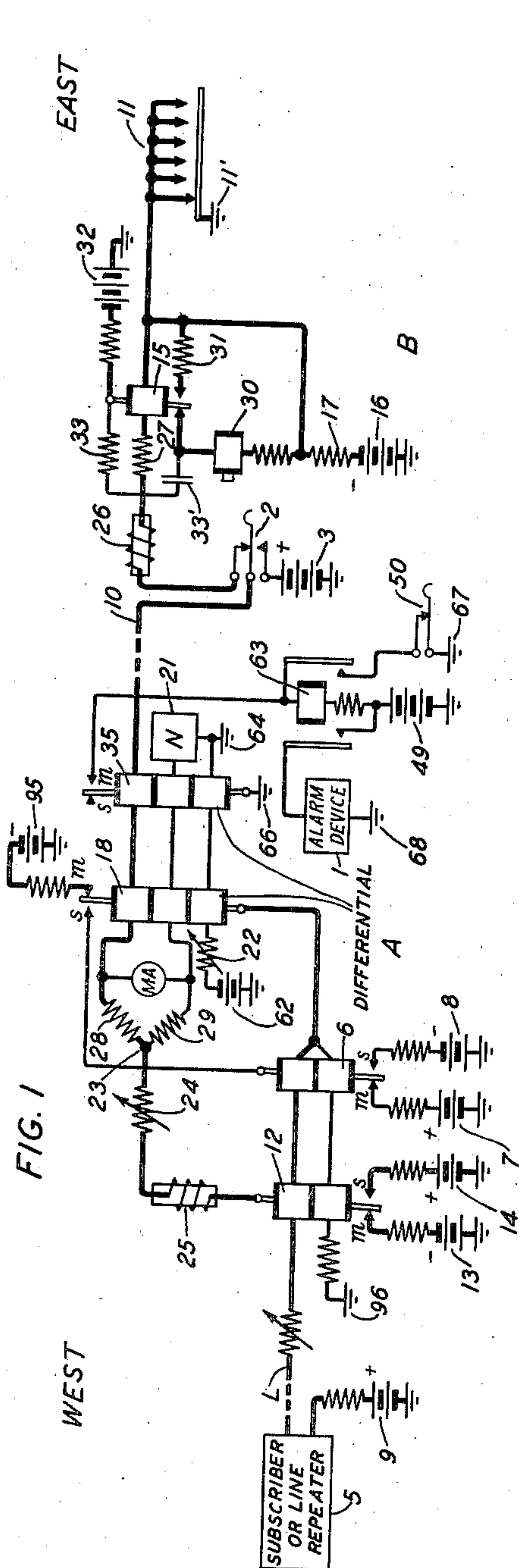
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2,244,597

TELEGRAPH SYSTEM

Filed Feb. 7, 1940

2 Sheets-Sheet 1



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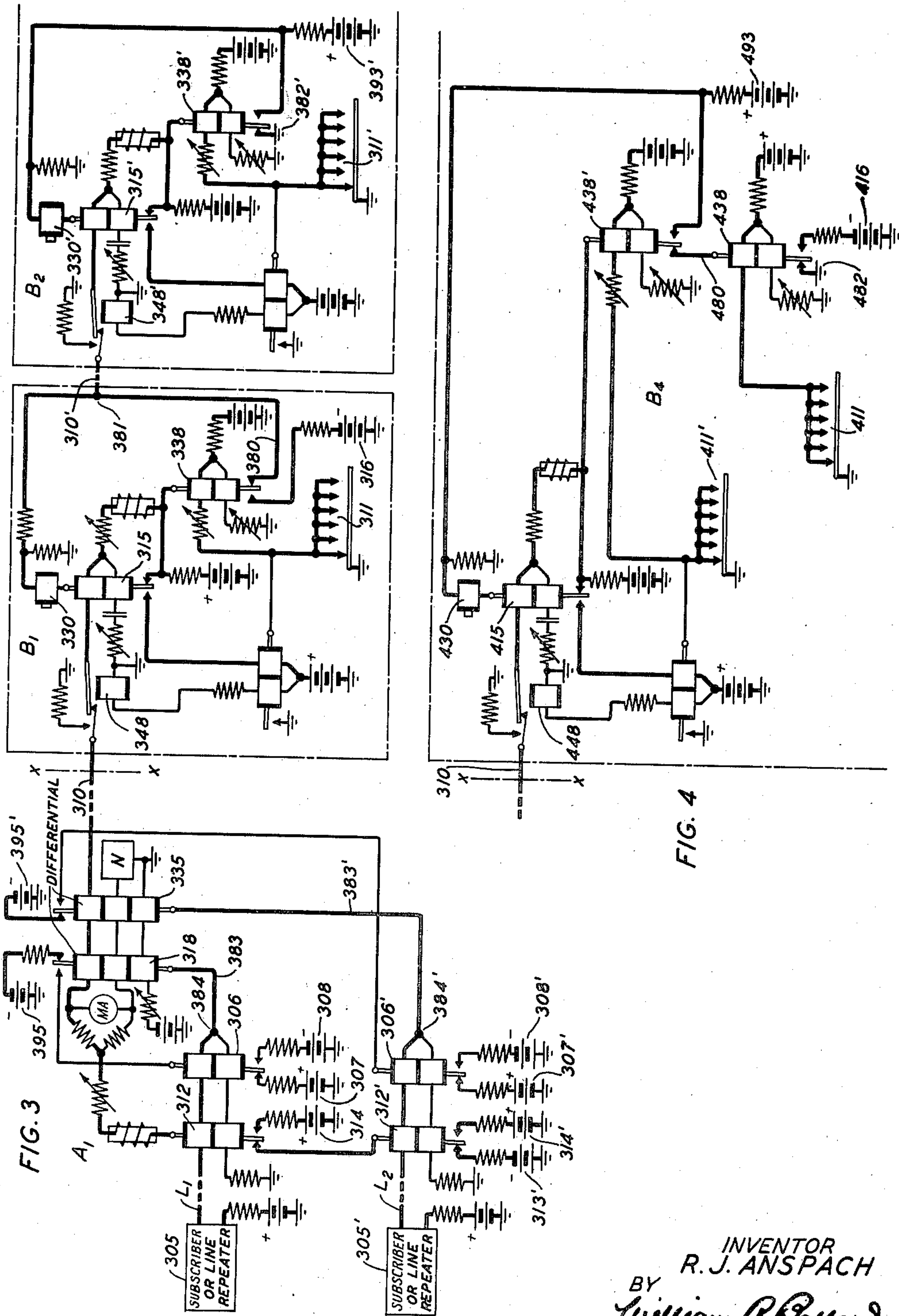
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2,244,597

TELEGRAPH SYSTEM

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15 Claims. (Cl. 178—2)

This invention relates to printing telegraph systems and, more particularly, to calling-in circuits for use with such systems.

In printing telegraph systems, particularly exchange systems, there is a possibility that a message transmitted from one station in the system might not be correctly recorded by the station intended to receive the message because of the failure, incorrect adjustment, or improper functioning of apparatus at the receiving station. The trouble at the receiving station might be of such nature that it would not cause any indication to be registered at the sending station to inform the sending operator that the message is not being correctly recorded. The trouble might also be of such nature that it would prevent the receiving subscriber at an outlying station from transmitting a message to inform either the sending operator or a central office operator of the existence of this trouble and that a maintenance man should be sent to correct it.

Accordingly, it is an object of this invention to provide a printing telegraph system with a calling-in circuit for enabling a subscriber at an outlying station to cause a signal device at another station or at a central office to be operated as an indication that something is wrong with the subscriber's printing telegraph apparatus and that a maintenance man should be sent to correct it.

Another object of the invention is to provide a printing telegraph system having a plurality of outlying stations with means for enabling an operator at one station to communicate with an operator at another station by transmitting permutation code signals composed of impulses of positive current and ground and for enabling an operator at a third station to communicate with an operator at a fourth station by transmitting signals composed of impulses of negative current and ground.

Still another object of the invention is to provide a printing telegraph system having a plurality of stations with means for enabling an operator at a first station to communicate with an operator at a second station by transmitting permutation code signals composed of impulses of positive current and ground and also for enabling the operator at the first station to communicate with an operator at a third station by transmitting signals composed of impulses of negative current and ground.

These and other objects of the invention are accomplished by modifying printing telegraph systems to include the calling-in circuit. The description of the invention is directed to the use of

the invention with systems shown and described in Patent 2,131,870, granted October 4, 1938, to W. W. Cramer. The disclosure of this Cramer patent is incorporated herein by reference as a part of this specification. However, the invention is not limited to the modified Cramer systems shown in the drawings as these are the preferred embodiments of the invention and are shown and described in order to illustrate and explain the features and principles of operation of the invention. Other modifications may be made without exceeding the scope of the invention.

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

Figure 1 represents a printing telegraph system somewhat similar to that shown in Fig. 1 of the Cramer patent but which includes an alarm device and a calling-in circuit;

Fig. 2 illustrates a system corresponding somewhat to the system shown in Fig. 2 of the Cramer patent but including an alarm device and a calling-in circuit;

Fig. 3 shows a system having four outlying stations connected to a main station for communication by various kinds of permutation code signals, such as signals composed of impulses of positive current and ground and signals composed of impulses of negative current and ground; and

Fig. 4 illustrates a subscriber's station having two sets of transmitting apparatus for use with a portion of the system shown in Fig. 3.

Fig. 1 shows a printing telegraph system which is somewhat similar to the system shown in Fig. 1 of the Cramer patent but which has been modified in accordance with the invention to include an alarm, or signaling, device 1, a calling-in key 2, a positive battery 3, and a polarized relay 35. It has also been modified to include a subscriber's station or line repeater 5, another polarized relay 6, and batteries 7, 8 and 9. The normal operation of the system is somewhat similar to that described in the Cramer patent. For west-to-east transmission, signals are sent over line L from the point 5 which may be either a subscriber's station or a line repeater. If point 5 is a subscriber's station, then the subscriber would initiate the transmission of signals; but, if it is a line repeater, then it would repeat signals originating at another station connected by a communication channel to the device 5.

In any event, the device 5 causes significant current variations to be made in the positive current from grounded battery 9. These current variations travel over line L from battery 9 and the device 5 to station A where they pass through

the upper windings of polarized relays 12 and 6 and then over the armature of polarized relay 18 to grounded negative battery 95. At this same time, there is a path for current to pass from negative battery 95 over the armature of the receiving relay 18, and through the lower windings of relays 6 and 12 to ground 96. The fluctuations in the current from battery 9 cause the armatures of relays 6 and 12 to travel back and forth between their marking and spacing contacts.

The armature of relay 12 thus applies either negative battery 13 or positive battery 14 to a path leading through the induction coil 25 and the variable resistance 24 to the point 23. Here the current divides, one portion going through the resistance 29, middle windings of polarized relays 18 and 35, and then through the balancing network 21 to ground 64. The other portion of the current travels through the resistance 28, top windings of relays 18 and 35, and out over line 10 to the distant station B. The top and middle windings of relays 18 and 35 are wound differentially so that the effect on their armatures of the current from battery 13 or battery 14 in their top windings is opposed and neutralized by the effect of this current in their middle windings. Since the top and middle windings of relays 18 and 35 are oppositely wound, the armatures of these relays will not be operated by signaling current from batteries 13 and 14. However, these same windings are in a series aiding connection for currents originating from any battery applied at station B to the line 10. The poling is such that the effect of negative battery applied at station B to line 10 is spacing on relays 18 and 35 while positive battery has a marking effect. The application of ground 11' at station B to line 10 has a marking effect on both relays 18 and 35 but this is not sufficient to operate the armature of relay 35 due to the spacing bias on this relay.

A biasing circuit is provided extending from grounded battery 62, through the variable resistance 22, through the bottom winding of relay 18 in one direction, through the bottom winding of relay 35 in the reverse direction, and then to ground 64. This biasing circuit holds the armature of the receiving relay 18 on its marking contact and the armature of relay 35 on its spacing contact during west-to-east transmission.

At station B, the current passes over the calling-in key 2, through the induction coil 26, resistance 27, through the winding of the receiving relay 15, and then through the sending contacts 11 to ground 11'. Also at station B are two negative batteries 16 and 32, the resistances 17, 31, and 33, a condenser 33', and a printer magnet 30, all of which perform the same functions as in the circuit shown in Fig. 1 of the Cramer patent. Since the functions of this apparatus are the same as described in the Cramer patent, it is not necessary to repeat the description here because the disclosure of the Cramer patent has been incorporated herein by reference. It is sufficient to state that marking impulses are transmitted from the outlying station B to the main station A by applying ground 11' to the line 10 and that spacing impulses are transmitted from negative spacing battery 16 and negative battery 32 by removing ground 11' from line 10 to render effective the combined negative current from batteries 16 and 32.

When ground 11' is connected to the sending contacts 11, which is the normal marking condition, the armature of relay 18 remains on its

marking contact and the armature of relay 35 stays on its spacing contact as shown in Fig. 1. When ground 11' is removed from contacts 11, the combined negative potentials of batteries 16 and 32 are applied to line 10 to produce a spacing effect on relays 18 and 35. The armature of relay 18 moves at this time to its spacing contact to apply positive current from battery 7 over the armature of relay 18, through the upper windings of relays 6 and 12, and out over line L to the device 5. As the armature of relay 35 is already on its spacing contact, it is held there more securely now by both the biasing current in the bottom winding of relay 35, which is wound in a direction which is the reverse of that of relay 18, and also by the incoming current from batteries 16 and 32. Consequently, transmission of ordinary message signals over line 10 in either direction will not cause the operation of the armature of relay 35.

In the event that the equipment at the outlying station B becomes out of order and the subscriber at that station wishes to notify the operator at the main station A as described above, the subscriber at station B momentarily operates the calling-in key 2 to its lower contact, thereby removing ground 11' from the line 10 and substituting positive current from battery 3. It is to be noted that the polarity of battery 3 is the opposite of that of the spacing battery 16. As was stated above, the application of positive battery at station B to line 10 produces a marking effect on relays 18 and 35. As the armature of relay 18 is normally already on its marking contact, it is now held there more securely by both the biasing current from battery 62 and the incoming current from battery 3. This application of positive battery 3 to line 10 also causes the armature of relay 35 to move to its marking contact.

When the armature of relay 35 moves to its marking contact, it closes a path for current to pass from grounded battery 49 through the winding of the control relay 63 and over the armature of relay 35 to ground 66. Relay 63 now operates its armatures, the right armature closing a locking-up circuit for relay 63 from battery 49 and over the non-locking restoring key 50 to ground 67. At the same time, the left armature of relay 63 closes a path for current to pass from battery 49 through the alarm device 1 to ground 68, thereby operating the alarm device 1 which may be any suitable audible or visible indicating device, such as a lamp, bell, or buzzer. The operation of the alarm device 1 serves to indicate to the operator at station A that something is wrong with the apparatus at station B and that a maintenance man should be sent to correct it.

The alarm, or indicating, device 1 remains operated until the attendant at station A momentarily operates the non-locking restoring key 50 to open the locking-up circuit of relay 63. This causes relay 63 to release its armatures, thereby opening the energizing circuit of the alarm device 1 which, consequently, discontinues its operation.

As was stated above, Fig. 2 illustrates a system which is somewhat similar to the system shown in Fig. 2 of the Cramer patent but which includes the modifications described above in connection with Fig. 1 except that, due to the use of positive spacing battery 293 at the subscriber's station B', battery 203', is negative. The use of positive spacing battery 293 at station B' in Fig. 2 instead of the negative spacing battery 216 used

in the system shown in Fig. 1 requires that the top and middle windings of relays 218, 234, and 235 be reversed with respect to the poling used in the system shown in Fig. 1. Accordingly, in the system shown in Fig. 2, the effect of positive battery applied to line 210 at station B' is spacing on relays 218, 234, and 235 while the effect of negative battery applied at station B' to line 210 is marking on relays 218, 234, and 235. The application of ground 211' at station B' to line 210 has a marking effect on relays 218, 234, and 235 but this is not sufficient to operate the armature of relay 235 due to the spacing bias on this relay. Messages are transmitted over the system shown in Fig. 2 in a manner similar to that described in the Cramer patent but including the additional transmitting point 205 which may be either a subscriber's station or a line repeater and which operates in a manner similar to that described above in connection with Fig. 1.

Operation of the calling-in key 202 in Fig. 2 applies negative current from battery 203' to the line 210, thereby causing relay 235 to move its armature to its marking contact. As the armatures of relays 218 and 234 are normally already on their marking contacts, they are now held there more securely by both the incoming negative current from battery 203' and the biasing current from battery 262. The movement of the armature of relay 235 to its marking contact closes a path for operating the control relay 263 which operates its armatures and locks up in the manner described above. Operation of the left armature of relay 263 causes the operation of the alarm, or signaling, device 201 which remains operated until the attendant at station A' momentarily operates the non-locking restoring key 250 to unlock relay 263.

Thus, in either system, by adding to the outlying subscriber's station B, a battery which is of opposite polarity to the spacing battery at that station, a calling-in signal can be effected at the main station A without causing the operation of the armature of the receiving relay at the main station. This is of particular advantage because it permits the outlying station B to signal the main station A without interrupting any communication between station A and other stations in the system, such as the station 5 or any other station connected to the device 5.

For purposes of illustration, the invention has been described with reference to its application for effecting a calling-in signal in the systems shown in Figs. 1 and 2 of the Cramer patent. It is to be understood that the invention is not limited to use only with these systems but can be applied to other systems. Furthermore, the invention is not limited to effecting a calling-in signal but may be used for performing other functions, such as for enabling an operator at one station to communicate with a subscriber connected to relay 18 by applying negative battery and ground to the line 10 and for enabling an operator at an additional station to communicate with a subscriber connected to relay 35 by applying positive battery and ground to the line 10. Such a system is shown in Fig. 3 which is a modification of the system shown in Fig. 2.

In Fig. 3, the main station, or central office, A₁, has two subscriber, or line repeater, stations 305 and 305' connected thereto by lines L₁ and L₂. The main transmission line 310 extending from station A₁ has two subscribers' stations B₁ and B₂ connected therein in series, each being somewhat similar to the station B' in Fig. 2. Station

A₁ is somewhat similar to the station A' in Fig. 2 but is provided with an additional set of relays 312' and 306' and batteries 313', 314', 307', and 308' for use with the additional station 305'.

Permutation code signals transmitted over line L₁ from station 305 cause the armature of relay 312 to fluctuate between its contacts to apply either positive current from battery 314 or negative current from battery 313' to the line windings and balancing windings of the differential relays 318 and 335. This procedure is somewhat similar to that described above for Fig. 1. These signals pass over the line 310 to station B₁. Here the signals pass over the armature of relay 348, through relay 315, over the armature of relay 338, and then along conductor 380 to junction 381. Here the signals pass over line 310' to station B₂ where they travel over the armature of relay 348', through relay 315', and then over the armature of relay 338' to ground 382'. This causes the armatures of relays 315 and 315' to fluctuate between their contacts for controlling the printer magnets 330 and 330' which, in turn, cause the signals to be recorded at both stations B and B'.

Similarly, permutation code signals transmitted over line L₂ from station 305' cause the armature of relay 312' to fluctuate between its contacts to apply either positive current from battery 314' or negative current from battery 313' to relays 318 and 335. These signals travel over lines 310 and 310' and are recorded at both stations B₁ and B₂ in a manner similar to that in which signals from station 305 are recorded at stations B₁ and B₂.

The subscriber at station B₁ can cause messages to be recorded at station 305' by operating the sending contacts 311 to cause the armature of relay 338 to fluctuate between its contacts to apply either negative current from battery 316 or ground 382' (located at station B₂) to line 310. The negative current comes from battery 316 over the armature of relay 338, through relay 315, and then over the armature of relay 348 to line 310. The path from ground 382' at station B₂ extends over the armature of relay 338', through relay 315', over the armature of relay 348', out over line 310' to junction 381 at station B₁, conductor 380, and then over the path just traced from the armature of relay 338 to line 310. Due to relays 318 and 335 being differentially wound, as described above in regard to Fig. 2, relay 335 will respond to these signals but relay 318 will not. This is similar to the operation of relays 218 and 235 in Fig. 2.

The signals from station B₁ thus cause the armature of relay 335 to fluctuate between its contacts to apply either negative current from battery 305' or positive current from battery 307' to conductor 383' leading to junction 384'. Here the currents from batteries 305' and 307' pass through relays 306' and 312' out over line L₂ to station 305' where they operate receiving apparatus to record the permutation code signals originating at station B₁.

The subscriber at station B₂ can cause messages to be recorded at station 305 by operating his sending contacts 311' to cause the armature of relay 338' to fluctuate between its contacts to apply either positive current from battery 309' or ground 382' to the armature of relay 338'. The transmission path extends from the armature of relay 338', through relay 315', over the armature of relay 348', out over line 310' to junction 381 at station B₁, conductor 380, over the

armature of relay 338, through relay 315, over the armature of relay 348, and then out over line 310 to station A₁. Due to relays 318 and 335 being differentially wound, relay 335 will not respond to these signals but relay 318 will move its armature back and forth between its contacts in response to the signals originating at station B₂ in the same manner that relay 212 actuated its armature in response to signals from station B' in the system shown in Fig. 2 described above. Relay 312 will thus apply either negative current from battery 395 or positive current from battery 397 to conductor 383 leading to junction 384. From this point, the signals pass through relays 306 and 312 and out over line L₁ to station 305 where they operate receiving apparatus to record the permutation code signals originating at station B₂.

Any suitable timing or circuit controlling means known to those skilled in the art may be employed to control the system so that simultaneous transmission of signals from more than one of the four stations 305, 305', B₁, and B₂ will be prevented. Such circuit controlling means are not absolutely essential to the system shown in Fig. 3 as various other arrangements can be employed for governing transmission. For example, the first quarter of an hour could be assigned for transmission by the subscriber at station 305, the second quarter of the hour could be assigned for transmission by the subscriber at station 305', the third quarter could be assigned to the subscriber at station B₁, and the fourth quarter to the subscriber at station B₂.

If desired, only one subscriber's station may be connected to the line 310 instead of the two stations B₁ and B₂ shown in Fig. 3. A single subscriber's station B₄ connected to line 310 for communication with both stations 305 and 305' is illustrated in Fig. 4. Station B₄ is somewhat similar to the station B' shown in Fig. 2, except that station B₄ is provided with two sets of sending contacts 411 and 411', has a negative battery 416 in addition to the positive battery 493, and has both a relay 438 and a relay 438' with their associated apparatus. The line 310 extending from station B₄ is to be considered as equivalent to line 310 extending from station A₁ in Fig. 3. It is to be understood that the line 310 in Fig. 4 leads from station B₄ to a main station, or central office A₁, similar to that shown in Fig. 3, and that this station A₁ has two other stations 305 and 305', similar to those shown in Fig. 3, connected thereto for communication with station B₄.

Permutation code signals originating at either station 305 or 305' are transmitted to station A₁ and travel over line 310 to station B₄ where they pass over the armature of relay 443, through relay 415, and then over the armatures of relays 438' and 438 to ground 482. These signals cause the armature of relay 415 to fluctuate between its contacts to control the printer magnet 430 which causes the signals to be recorded by the teleprinter at station B₄.

The subscriber at station B₄ can communicate with the subscriber at station 305' by operating the sending contacts 411 which cause the armature of relay 438 to fluctuate between its contacts to apply either negative current from battery 416 or ground 482 to a path extending along conductor 430, over the armature of relay 438', through relay 415, over the armature of relay 443, and then out over the line 310 to station A₁. At station A₁, the signals originated by the operation of the sending contacts 411 at station B₄

cause the armature of relay 335 to repeat the signals into the same circuit leading to station 305' that was described above in the description of the operation of the system shown in Fig. 3. During this period, the status of relay 318 will be non-responsive to the signals from contacts 411.

The subscriber at station B₄ can likewise communicate with the subscriber at station 305 by operating the sending contacts 411' to cause the armature of relay 438' to fluctuate between its contacts to apply either positive current from battery 493 or ground 482 to the path just traced leading over line 310 to station A₁. At station A₁ the signals initiated by the sending contacts 411' at station B₄ cause relay 318 to change its status to operate its armature for repeating the signals into the same circuit leading to station 305 that was described above in the description of the operation of the system shown in Fig. 3.

As was stated above in connection with the description of the operation of the system shown in Fig. 3, a circuit controlling or timing device could be incorporated into the system employing the station B₄ to prevent the transmission of messages by more than one subscriber at a time. To avoid the expense of such a circuit controlling arrangement, separate transmitting periods could be assigned to each of the transmitting stations in the system. For example, the first quarter of the hour could be assigned for transmission by the subscriber at station 305, the second quarter in the hour could be assigned for transmission by the subscriber at station 305', the third quarter of the hour could be allotted to the subscriber at station B₄ for transmission to the subscriber at station 305, and the last quarter could be assigned for transmission by the subscriber at station B₄ to the subscriber at station 305'.

Since various changes and modifications embodying the principles and features of operation of the invention can be made without exceeding the scope of the invention, the invention is to be limited only by the claims appended hereto. In construing the appended claims it is to be understood that the term "relay" is sufficiently broad to include various types of electron discharge relay devices, such as either vacuum or gas-filled tubes, and that the term "differential relay" is sufficiently broad to include such devices associated with circuits and current sources as to have a differential effect.

What is claimed is:

1. A telegraph system comprising in combination a telegraph station having a first and second differential relays, each with a plurality of windings and an armature, a communication channel extending from the station for the transmission of signals, each of said relays having one of its windings connected in series with the communication channel, transmitting means for transmitting signals comprising permutation code combinations composed of both current impulses of a preassigned polarity and ground over the communication channel to the telegraph station, control means for allowing only the first of the differential relays to operate its armature to follow the permutation code signals received over the communication channel, means for transmitting current of a polarity opposite to the said preassigned polarity over said communication channel to the telegraph station, and means for causing the second differential relay to operate its armature in response to the transmission over the communication channel to the station of cur-

rent of a polarity opposite to said preassigned polarity.

2. A telegraph system comprising in combination a telegraph station having a first and second electroresponsive devices, a communication channel extending from the station for the transmission of signals, transmitting means for transmitting signals comprising permutation code combinations composed of both current impulses of a preassigned polarity and ground over the communication channel to the telegraph station, control means for causing only the first of said electroresponsive devices to follow said permutation code signals, means for transmitting current of a polarity opposite to said preassigned polarity over the communication channel to the telegraph station, and means for causing the second of said electroresponsive devices to change its status in response to the transmission over the communication channel to the telegraph station of current of a polarity opposite to said preassigned polarity.

3. A telegraph system comprising in combination a first telegraph station, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of marking and spacing impulses, means for transmitting a marking impulse from the second station to the first station in response to the application of ground at the second station to the communication channel, means for transmitting a spacing impulse from the second station to the first station in response to the application of current of a preassigned polarity at the second station to the communication channel, said first station having a receiving relay and a polarized relay connected into the communication channel, both said receiving relay and said polarized relay each having an armature, said first station also having an indicating device, an energizing circuit for operating said indicating device, a control relay for controlling the opening and closing of said energizing circuit, means for controlling the energization of said control relay in response to a certain operation of the armature of said polarized relay, and means for directly operating only the armature of said polarized relay in response to the application at the second station to the communication channel of current of opposite polarity to said preassigned polarity.

4. A telegraph system comprising in combination a first telegraph station, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of marking and spacing impulses, means for transmitting a marking impulse from the second station to the first station in response to the application of ground at the second station to the communication channel, means for transmitting a spacing impulse from the second station to the first station in response to the application of current of a preassigned polarity at the second station to the communication channel, said first station having a receiving relay and a polarized relay connected into the communication channel, both said receiving relay and said polarized relay each having an armature, said first station also having an indicating device, an energizing circuit for operating said indicating device, a control relay for controlling the opening and closing of said energizing circuit, a normally open energizing circuit for said control relay, means for closing said normally open energizing circuit in response to a certain operation of the armature of the polarized relay, a

locking-up circuit for maintaining the control relay energized after its energizing circuit has been closed by the operation of the armature of the polarized relay and for maintaining the indicating device operated, means for directly operating only the armature of said polarized relay in response to the application at the second station to the communication channel of current of opposite polarity to said preassigned polarity, and means for opening said locking-up circuit for effecting the deenergization of the control relay and for discontinuing the operation of the indicating device.

5. A telegraph system comprising in combination a first telegraph station having a signaling device, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of marking and spacing impulses, means for transmitting one kind of said impulses from the second station to the first station in response to the application of ground at the second station to the communication channel, means for transmitting the other kind of said impulses from the second station to the first station in response to the application of current of a preassigned polarity at the second station to the communication channel, and means for effecting the operation of said signaling device at the first station in response to the application at the second station to the communication channel of current of opposite polarity to said preassigned polarity.

6. A telegraph system comprising in combination a first telegraph station having an electroresponsive device and an indicating device, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of marking and spacing impulses, means for transmitting one kind of said impulses from the second station to the first station in response to the application of ground at the second station to the communication channel, means for transmitting the other kind of said impulses from the second station to the first station in response to the application of current of a preassigned polarity at the second station to the communication channel, means for effecting the operation of said electroresponsive device in response to the application at the second station to the communication channel of current of opposite polarity to said preassigned polarity, and means for effecting the operation of said indicating device in response to the operation of the electroresponsive device.

7. A telegraph system comprising in combination a first telegraph station, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of marking and spacing impulses, means for transmitting one kind of said impulses from the second station to the first station in response to the application of ground at the second station to the communication channel, means for transmitting the other kind of said impulses from the second station to the first station in response to the application of current of a preassigned polarity at the second station to the communication channel, said first station having a plurality of relays connected into the communication channel, each of said relays having an armature, said first station also having an indicating device, means for effecting the operation of the indicating device in response to a certain operation of the arma-

ture of a preassigned one of said plurality of relays, and means for directly operating only the armature of said preassigned relay in response to the application at the second station to the communication channel of current of opposite polarity to said preassigned polarity.

8. A telegraph system comprising in combination a first telegraph station, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of negative and positive current impulses, said first station having a plurality of relays connected into the communication channel, each of said relays having an armature, said first station also having an indicating device, an energizing circuit for operating said indicating device, a control relay for controlling the opening and closing of said energizing circuit, means for controlling the energization of said control relay in response to a certain operation of the armature of a preassigned one of said plurality of relays, and means for directly operating only the armature of said preassigned relay in response to the application of current of a certain polarity applied at the second station to the communication channel.

9. A telegraph system comprising in combination a first telegraph station, a second telegraph station, a communication channel for connecting the two stations for the transmission of permutation code signals composed of negative and positive current impulses, said first station having a plurality of relays connected into the communication channel, each of said relays having an armature, said first station also having an indicating device, means for directly operating the armature of only a preassigned one of said plurality of relays in response to the application to the communication channel of current of a certain polarity at the second station, means for effecting the operation of said indicating device in response to a certain operation of the armature of said preassigned relay, and means for discontinuing the operation of said indicating device.

10. A telegraph system comprising in combination a main telegraph station, a plurality of outlying telegraph stations, a plurality of communication channels for connecting the outlying stations to the main station, first transmitting means for transmitting one type of permutation code signals over one of the communication channels to the main station, second transmitting means for transmitting another type of permutation code signals over one of the communication channels to the main station, sending means at the main station for sending received permutation code signals to other of the outlying stations, and control means for controlling the operation of said sending means without the assistance of routing signals for sending only one type of received permutation code signals to one of the other outlying stations and for sending only the other type of received permutation code signals to another of the outlying stations.

11. A telegraph system comprising in combination a main telegraph station having a plurality of relays, each of said relays having an armature, a plurality of outlying telegraph stations, a plurality of communication channels for connecting the outlying stations to the main station, means for enabling an operator at one of the outlying stations to transmit over one of the communication channels permutation code signals composed of impulses of positive current

and ground to the main station for operating the armature of one of said relays for repeating the signals to one of the other outlying stations, and means for enabling an operator at another outlying station to transmit permutation code signals composed of impulses of negative current and ground to the main station for operating the armature of another of said relays for repeating the signals to still another of the outlying stations.

12. A telegraph system comprising in combination a main telegraph station, a first and second outlying telegraph stations, a first communication channel for connecting the main station and the first and second outlying stations in series, said main station having a first and second differential relays, each of said differential relays having one winding connected in series with said first communication channel, each of said differential relays having an armature, a third outlying telegraph station, a second communication channel for connecting the third outlying station to the armature of the first differential relay, a fourth outlying telegraph station, a third communication channel for connecting the fourth station to the armature of the second differential relay, first transmitting means for transmitting permutation code signals from the first station over the first communication channel to the main station and through windings of the differential relays, means at the main station for causing only the first of the differential relays to operate its armature to repeat said signals over the second communication channel to the third station, second transmitting means for transmitting permutation code signals from the second station over the first communication channel to the main station and through windings of the differential relays, and means at the main station for causing only the second differential relay to operate its armature to repeat said signals over the third communication channel to the fourth station.

13. A telegraph system comprising in combination a main telegraph station, a first outlying telegraph station, a communication channel for connecting the first station to the main station for transmission of signals, a second and third outlying stations connected to the main station, signal transmitting means at the first station for transmitting permutation code signals over the communication channel to the main station, control means at the main station for transmitting some of said signals to the second station to the exclusion of the third station and for transmitting other of said signals to the third station to the exclusion of the second station, and means when the system is in an idle condition for enabling messages to be transmitted from either the second or third stations through the main station and over the communication channel to the first station.

14. A telegraph system comprising in combination a main telegraph station, a first outlying telegraph station, a communication channel for connecting the first station to the main station for transmission of signals, a second and third outlying telegraph stations connected to the main station, signal transmitting means at the first station for transmitting permutation code signals over the communication channel to the main station, control means at the main station for transmitting some of said signals to the second station to the exclusion of the third station and for transmitting other of said signals to

the third station to the exclusion of the second station, means for causing the control means to transmit every one of the signals originating at the first station to the second and third stations selectively, said control means comprising two differential relays each having one of its windings connected directly in series with the communication line leading to the first station.

15. A telegraph system comprising in combination a main telegraph station, a first outlying telegraph station, a first transmission line for connecting the first station to the main station for transmission of telegraph signals, a second outlying telegraph station, a second transmission line for connecting the second station to the main station for transmission of telegraph signals, a third outlying telegraph station, a third transmission line for connecting the third sta-

tion to the main station for the transmission of telegraph signals, first transmitting means at the first station for transmitting a first type of telegraph signals over the first transmission line to the main station, second transmitting means at the first station for transmitting a second type of telegraph signals over the first transmission line to the main station, first repeating means connected into said first transmission line at the main station for repeating only the first type of said signals over only the second transmission line to the second outlying station, and second repeating means connected into said first transmission line at the main station for repeating only the second type of said signals over only the first transmission line to the third outlying station.

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