No. 822,579. PATENTED JUNE 5, 1906.

C. G. & E. J. BURKE.

ELECTRIC SYSTEM OF TRANSMISSION.

APPLICATION FILED JAN. 9, 1904.

3 SHEETS—SHEET 1.

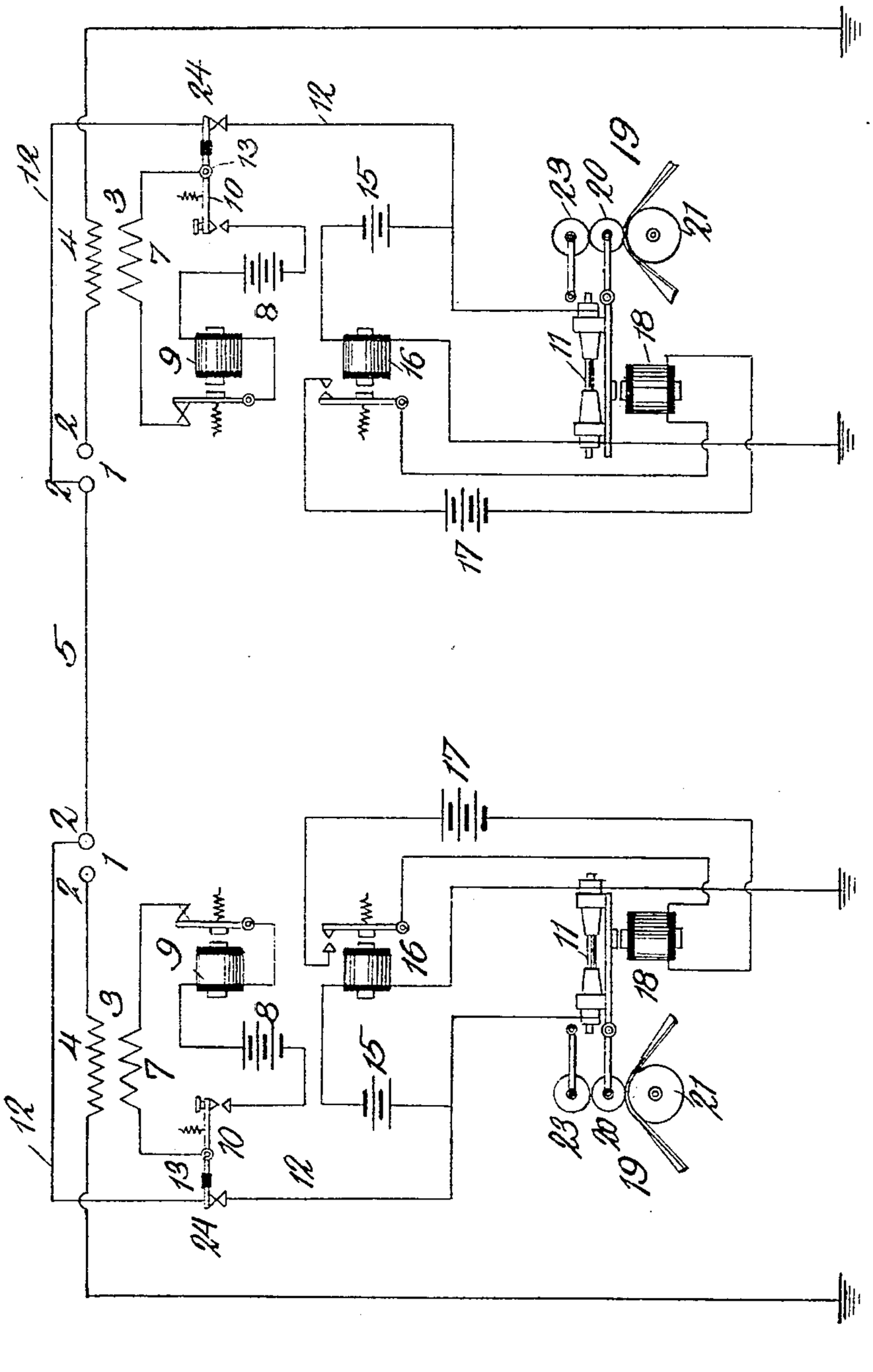

Fig. 1.

WITNESSES:

Edwin Seger

John M. Hellehrt

INVENTORS

Charles G. Burke.

Edward J. Burke.

by F. F. Brampton.

ATTORNEY

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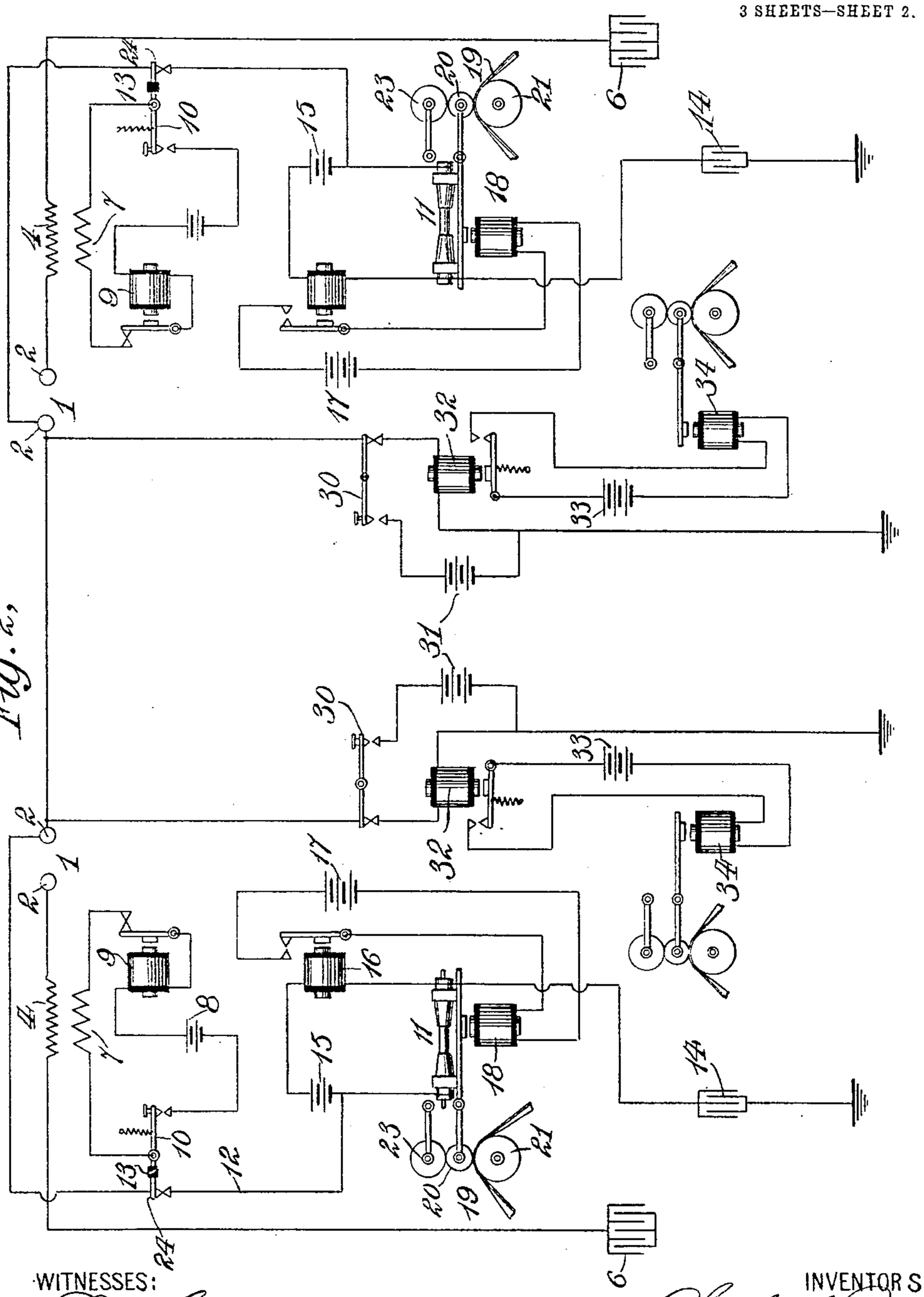

Fig. 2.

WITNESSES:

Edwin Seger

John M. Pellehrst

INVENTORS

Charles G. Burke

Edward J. Burke

by F. F. Caimpton

ATTORNEY

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3 SHEETS—SHEET 3.

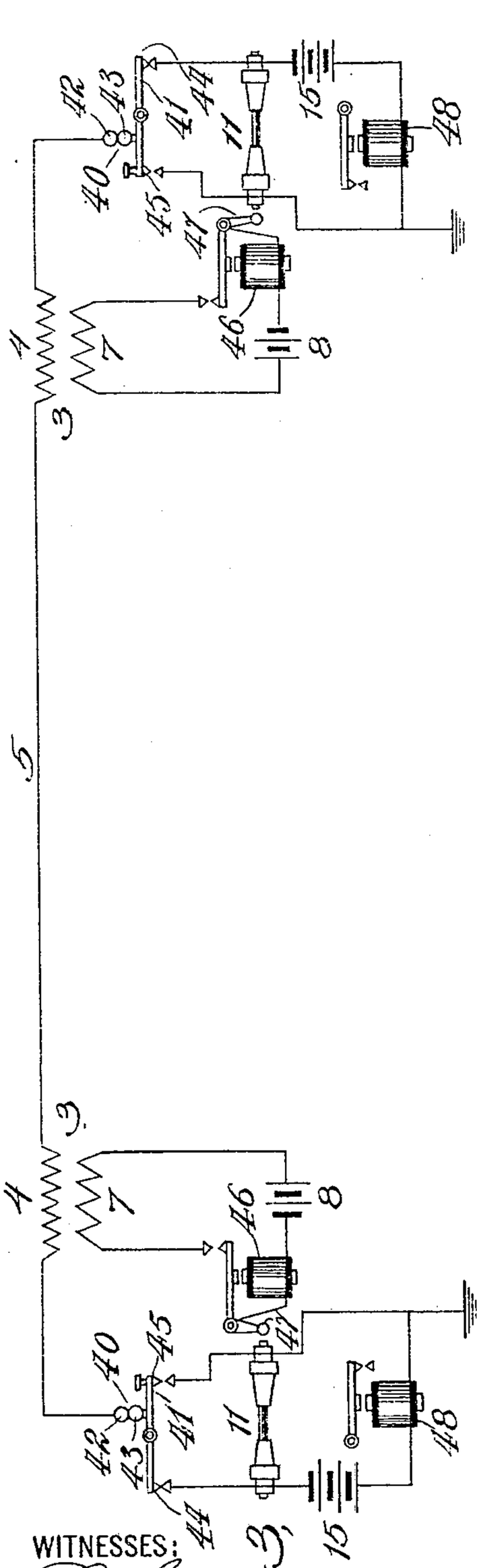

Fig. 3.

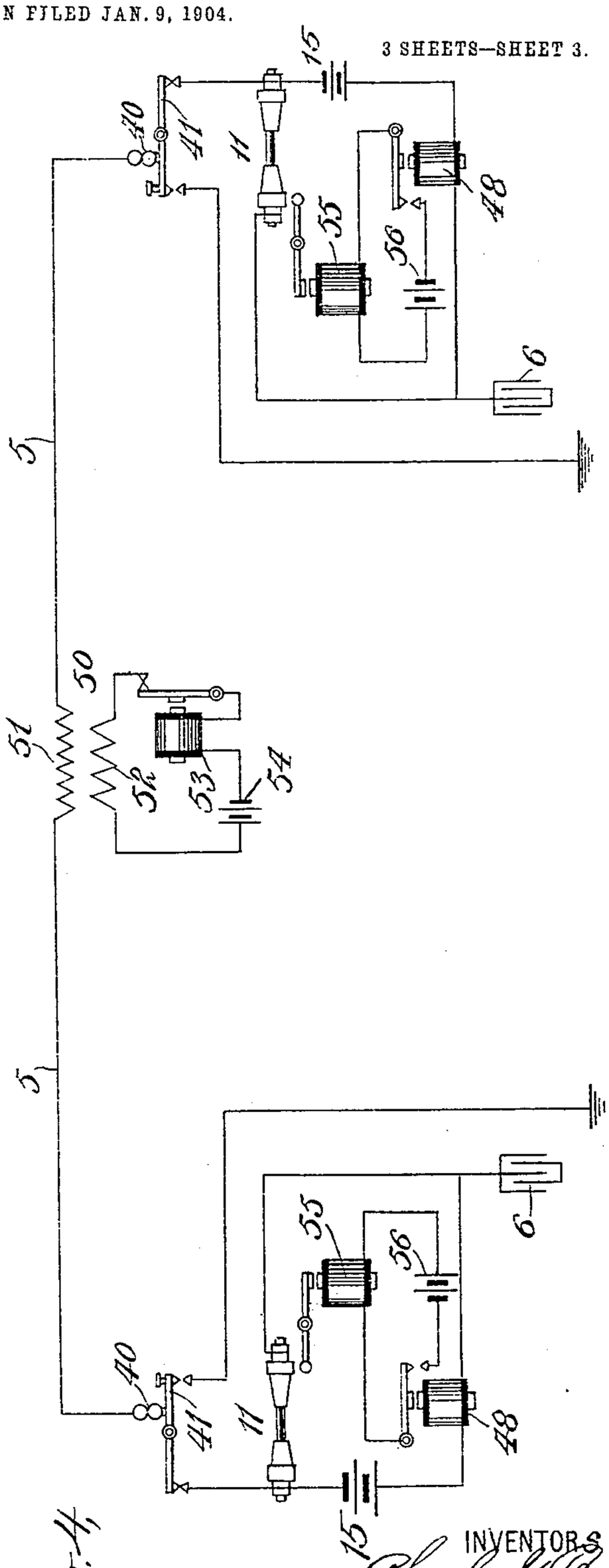

Fig. 4.

WITNESSES:

Edwin Seyfried

John M. Killebrew

INVENTORS

Charles G. Burke

Edward J. Burke

BY

F. P. Compton.

ATTORNEY

UNITED STATES PATENT OFFICE.

CHARLES G. BURKE AND EDWARD J. BURKE, OF BROOKLYN, NEW YORK, ASSIGNORS OF TWENTY-ONE THIRTIETHS TO JOHN Q. A. WHITTEMORE, OF BOSTON, MASSACHUSETTS.

ELECTRIC SYSTEM OF TRANSMISSION.

No. 822,579. Specification of Letters Patent. Patented June 5, 1906.

Application filed January 9, 1904. Serial No. 188,272.

To all whom it may concern:

Be it known that we, CHARLES G. BURKE and EDWARD J. BURKE, citizens of the United States, residing in the borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Electric Systems of Transmission, of which the following is a specification.

Our invention relates to electric systems of transmission, and it particularly relates to means for sending signals. It has for its object to provide means for sending signals over long lines and for sending signals which may be simultaneously used with the signals ordinarily used in telegraphy without interference therewith.

The invention consists in providing a means for producing disruptions in the electrical conditions of the system and detecting the disruptions.

The invention further consists in providing a spark gap for producing changes in the electrical conditions of the line and a coherer for detecting the said changes.

The invention further consists in providing an indicator, such as a sounder or a recorder, for indicating the electrical changes in the line.

The invention also consists in providing a system for communication wherein the impulses ordinarily used in telegraphy may be sent and received and disruptions of the electrical conditions of the lines may be produced and detected at the same time.

The invention also consists in other features of construction and arrangement of the parts, which appear in the accompanying drawings and in this specification.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 illustrates the invention when used for purposes of communication over conductors. Fig. 2 illustrates the invention as applied to another form of telegraph system and to be used simultaneously therewith. Figs. 3 and 4 illustrate a modification of the invention.

In the use of the telegraph systems now known in the art the signals are more or less retarded and weakened by the high resistance of the lines and the capacity of the lines. These important objections are almost completely obviated by our invention. If the main line in the systems of telegraphy commonly used becomes from any cause grounded, the signals are greatly impaired and frequently cannot be received at all. By our invention it is found that even if the line-wire becomes grounded the signals sent are not affected. This is true even if the grounding occurs at the station sending the signals or if it occurs at the station receiving the signals. This feature of the invention is an exceedingly important one. We have also found that by sending signals producing disruptions in the electrical conditions of the lines and indicating the same we can impose two sets of signals on the line at the same time. We are thus enabled to send signals by the ordinary instruments, and at the same time and independently thereto we are also enabled to send signals by means of producing disruptions in the electrical conditions in the line and indicating the same.

Referring to Fig. 1, 1 indicates a spark-gap having the terminals 2 2, which may be made adjustable in the manner well known in the art. One terminal of the spark-gap is connected to the main line, and the other terminal is connected to a capacity body, such as the earth or a condenser.

An induction-coil 3 is associated with the spark-gap 1. The secondary 4 of the induction-coil is connected to the spark-gap. As shown in the figure, the secondary 4 is connected to one terminal 2 of the spark-gap 1, and the remaining end of the coil is connected to the capacity body. In Fig. 1 the terminal of the secondary is shown as connected to the earth, and in Figs. 2 and 4 it is shown as connected to a condenser 6.

The primary 7 of the induction-coil 3 is connected in a local circuit containing a battery 8. A vibrator 9 may be connected in the circuit to produce pulsations of electricity in the secondary 4 in the manner well known in the art. A Ruhmkorff coil, however, may be used in place of the induction-coil and the vibrator 9. The local circuit-closer may be in form of the key 10. When the key is pressed, the circuit of the battery 8 is closed and pulsations of high potential are produced in the secondary 4 of the induction-coil 3. This will produce disruptions of the electrical conditions in the main line.

A coherer 11 is connected to the main line 5 at a point between the main line 5 and the terminal 2 of the spark-gap 1 by a connection 12. The connection 12 of the spark-gap to the main line 5 is controlled by the key 10. When the key 10 is closed to operate the vibrator and induction-coil, and consequently the spark-gap 1, the connection 12 is opened. The key 10 has at one end a contact 24, which is connected to the main line 5 and insulated from the body of the key by the insulation 13. When the key is pressed, the circuit of the battery 8 is closed, and the connection of the coherer to the main line is opened.

The remaining terminal of the coherer may be connected to the earth. A condenser 14 may be connected on one side to the coherer and on the other to the earth, as illustrated in Fig. 2. The condenser is preferably used when the invention is used in connection with an ordinary telegraph or cable system. It prevents short-circuiting of the transmitting means of the telegraph or cable system. The coherer 11 is connected in the circuit of the battery 15. A relay 16 is also connected in the local circuit of the battery 15, so that when the coherer is actuated by an impulse coming from the main line 5 and passing through the coherer the resistance of the coherer is greatly reduced in the manner well known in the art, which permits the current of the battery 15 to flow and energize the magnet of the relay 16. When the armature of the relay 16 is operated by the magnet, it closes the circuit of the battery 17, which in turn energizes the magnet 18. The magnet 18 may be used to operate any form of an indicator, such as a sounder or a recorder. In the system illustrated in the figures the magnet 18 is used to operate a recorder 19, which may be of the ordinary type.

In the form of the recorder illustrated in the figure a marking-roller 20 normally rests on a ribbon of paper which is being constantly fed during the operation of the system over the platen-roller 21. When the magnet 18 is energized, the roller is lifted off from the moving ribbon and the marking ceases. The line thus made by the roller is broken up by the pulsations produced upon the actuation of the coherer 11. The usual type of the inking-roller 23 is also used with the marking-roller which feeds a marking-ink to the marking-roller.

After the operation of the coherer the coherer is decohered by some decohering means. It may be decohered by means of a tapper in the manner well known in the art, or by any other means. It is preferred, however, to mount the coherer on the armature of the indicating means, and when the signal is reproduced, sounded, or recorded the coherer is decohered by the jar produced upon actuation of the armature. The coherer is then ready to receive the next impulse.

The same sending and receiving devices are located at the different stations and their connections with each other and to the main line 5 are the same as that described. In the figures the same devices of the two stations are indicated by the same reference-numbers. When a signal is sent out by the transmitter of one station, it is received by the receiving apparatus of the other station. In order to send signals by the system shown in Fig. 1, the key 10 is pressed and a circuit is closed through the battery 8 and the vibrator and induction-coil of that circuit.

When the key is pressed down, the connection of the coherer with the main line is opened. At the same time a pulsating-current is induced in the secondary coil 4, and when the adjustment of the terminals 2 2 correspond to the potential produced in the secondary 4 a spark is formed across the terminals. This electrical excitation or disruptive effect will pass along the main line to the other or another station and into the coherer of that station, the key 10 of that other station being open the connection of the coherer of that station with the main line will be completed. The impulse will pass through the coherer and to the earth. This will cause the resistance of the coherer to become greatly reduced, so as to allow the current of the battery 15 to flow through the magnet of the relay 16, which in turn will close the circuit of the battery 17 and operate the magnet 18, which will operate the recording means and at the same time decohere the coherer. The coherer is now in condition to operate again in the same way.

In Fig. 2 the invention is illustrated as applied to the usual form of telegraph system, the telegraph instruments of each station being connected in the usual way. The invention is applied without changing the instruments for telegraphic purposes in any way. To apply the invention, a spark-gap is connected to the transmitting-key in the station—that is, to the main line—and the earth connections are made.

As stated above, the secondary coil 4 may be connected to a condenser or other form of a capacity instead of to the earth. Also when the invention is to be used in connection with a telegraph or cable system a condenser 14 may be connected with one terminal of the coherer and to the earth. This will prevent any possible short-circuiting of the battery used to operate the telegraph or cable instruments to which the invention may be applied. The instruments generally used in telegraphy consist of a key 30, which is connected to the main line. The key 30 may have two contacts, one contact being normally closed and the other being closed when the key is operated. When the key is in a normal position, the apparatus located at that station is in condition to receive the

signals. When the signals are to be sent, the key is pressed down and the circuit of the battery 31 is closed. The current passes through the key to the main line, to the other station or stations, and to the earth through a sounder or through a recording device. In the system illustrated, when a signal is received the current passes through a relay-magnet and to the earth. The relay closes a circuit of the battery 33. A recording-magnet 34 is connected in this circuit, which operates the marking-roller in the manner described above.

The impulses sent out by the key 30 do not affect the coherer and the receiving apparatus associated therewith, and the changes in the electrical conditions produced by the spark-gap, and the devices associated therewith, do not affect the telegraphic or cable apparatus commonly used. Two sets of impulses or signals may therefore be produced and received over the same wire and at the same time, thereby doubling the working capacity of the line.

In the modification illustrated in Figs. 3 and 4 the secondary 4 of the induction-coil 3 is located serially between the line and the sparking-gap. In this form of the invention the spark-gap is opened upon the operation of the key. When the spark is formed in the spark-gap, the coherer of the other station of the line is operated.

Referring particularly to Fig. 3, line 5 is directly connected to one terminal of the secondary of the induction-coil, and the other terminal of the secondary coil is connected to the spark-gap 40. The spark-gap 40 comprises two knobs 42 43. One of the knobs 43 is mounted on a key 41, which is used in sending the signals. The two knobs may be made adjustable relative to each other, so that when the key 41 is operated they will be separated a predetermined distance to form a spark-gap of the proper length. The spark-gap will thus be formed only during the interval that the key is pressed down, and signals will be sent during that period. The key 41 has two contacts 44 45. Contact 44 is normally connected with a contact leading to the coherer 11. The other contact 45 is connected to the earth through the main line when the key 41 is pressed down. When the key 41 is pressed down, the contact 44 is opened—that is, while a signal is being sent from one station the coherer of that station is disconnected from the line and the spark-gap is placed in condition for operation.

The primary 7 of the induction-coil 3 may be connected in a circuit with a vibrator, which is controlled by the transmitting-key or the vibrator may be continuously operated. We have shown a vibrator 46, which is normally in constant operation. The vibrator 46 is connected with the battery 8 on the one side and with the primary coil 7 on the other and causes normally a pulsating-current to flow from the battery 8 through the primary coil, which is in turn constantly affecting the secondary coil 4, and in this way the line is constantly affected.

As stated above, one terminal of the coherer 11 is connected to the contact 44. The other terminal of the coherer is connected to the earth. The terminals of the coherer are also connected to a battery and a sounder, a relay or other reproducer, or an indicator to indicate the signal sent from the other station. We have illustrated diagrammatically a sounder 48. When an electric impulse produced by the opening of the spark-gap passes through the coherer, the particles forming the imperfect contact of the coherer adhere to one another, and the resistance of the coherer is greatly reduced. This permits a flow of the current from the battery 15 through the indicating means 48. As soon as an impulse is received the particles of the coherer must be again placed in condition to receive the next impulse. We have provided a tapper 47, which may be used to tap the coherer, and thus separate the particles, when they cohere to one another, by jarring. The tapper 47 may be continuously operated or it may be operated only upon the operation of the indicating means 48. In Fig. 3 we have illustrated one which is mounted on the armature of the vibrator 46, which under normal operations of the system is continuously operated. The tapper is placed in such a position that it will continuously strike the coherer.

The instruments of the two stations are the same and are connected in the same way. The same reference-numerals have been applied to the same instruments of the two stations.

When a signal is to be sent, the key is pressed down for such a period of time which corresponds to the character of the signal to be sent in the manner well known in the art. The spark-gap is opened, and sparks are formed or disruptions are produced. The disruptions are detected by the coherer of the distant station, which causes the indicating means to be operated.

In the form of the invention illustrated in Fig. 4 but one induction-coil is employed, which is being constantly operated. The coil 50 is located at any point in the line. The secondary is connected serially with the line, and the primary 52 is connected in a local circuit which contains the vibrator 53 and the battery 54. The vibrator 53 causes a pulsating current to continuously flow through the primary coil 52 during the normal operations of the system. This continuously affects the coil 51, and consequently the line 5.

In the system illustrated in Fig. 4 the indicating means 48 is used to operate the tap-

per, the circuit of the battery 56 being closed thereby and the magnet of the tapper 55 being energized. This will operate the tapper to decohere the coherer, which is again in condition to control the indicating means 48.

Our invention may be varied by those skilled in the art without departing from the spirit thereof.

What we claim, and desire to secure by Letters Patent, is as follows:

1. In a system for communication the combination of a main line having spark-gaps, induction-coils coöperating with the said spark-gaps for producing disruptions of the electrical conditions in the said main line, means connected between the said spark-gaps for sending impulses of electricity over the said main line and separate and independent means for indicating the said disruptions and for indicating the said impulses.

2. In a system for communication the combination of a main line having spark-gaps and induction-coils connected to the said main line for producing disruptions in the electrical conditions in the said main line, coherers connected to the said main line, and means connected to the said main line and between the said spark-gaps for sending impulses of electricity, coherers connected to the said main line for detecting the said disruptions and means connected to the said main line between the said spark-gaps, for receiving the said impulses.

3. In a system for communication the combination of a main line having spark-gaps, induction-coils associated with the said spark-gaps, coherers connected to the said main line, means for causing the said induction-coils to affect a coherer and for opening the said connections of the said coherers, an indicator associated with each coherer for decohering the said coherer, a transmitter and a receiver for sending and receiving impulses of electricity connected to the line at points between the said spark-gaps.

4. In an electric system, the combination of a main line, a coherer, terminals of a spark-gap adapted to connect the said coherer with the said main line, means for opening the said terminals for sending signals and means for receiving the said signals.

5. In an electric system, the combination of a main line, a coherer, terminals of a spark-gap adapted to normally connect the said coherer with the said main line, a key for opening the said terminals to send signals and means for receiving the said signals.

6. In an electric system for communication the combination of a main line, terminals of a spark-gap normally closed, means for separating and closing the said terminals and thereby sending signals, coherers for receiving the said signals adapted to be connected through the said terminals to the said main line by the said means for separating and closing the said terminals.

7. In an electric system for communication the combination of a main line, a key, terminals forming a spark-gap, one of the said terminals being mounted on the said key whereby the said spark-gap will be opened and closed and means for receiving the said signals connected and disconnected to the said main line through the said spark-gap.

8. In an electric system for communication the combination of a main line, means for charging the said main line, a transmitter for opening and closing the said main line and thereby sending impulses during the periods that the said main line is opened and completing the signals during the periods that the main line is closed, and means for receiving the said impulses.

9. In an electric system for communication the combination of a main line, means for charging the said main line, a coherer, a transmitter for opening and closing the said main line at one point and thereby sending signals, and opening and closing the connection of the coherer to the main line.

10. In a system for communication the combination of a main line having spark-gaps, an induction-coil operatively connected with each spark-gap, coherers connected to the main line, a switch for closing the circuit through each of the said induction-coils to cause the same to effectively operate a coherer and at the same time for opening the connection of each of the said coherers to the main line.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CHARLES G. BURKE.
EDWARD J. BURKE.

Witnesses:
EDWIN SEGER,
FAUST F. CRAMPTON.