

E. POPE.
TELEGRAPH SYSTEM.
APPLICATION FILED JUNE 25, 1910.

1,052,513.

Patented Feb. 11, 1913.

3 SHEETS—SHEET 1.

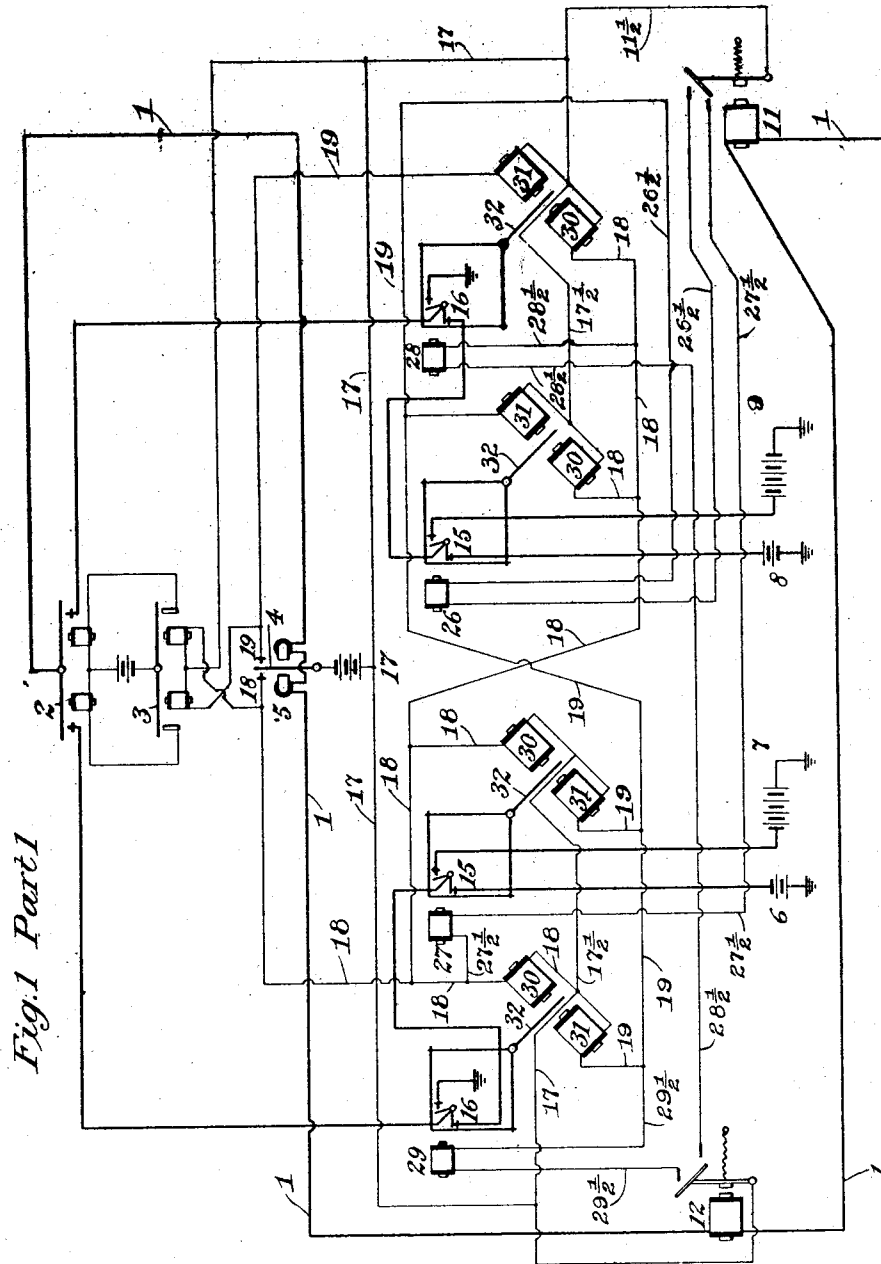


Fig. 1 Part I

Witnesses:

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William H. Mohr

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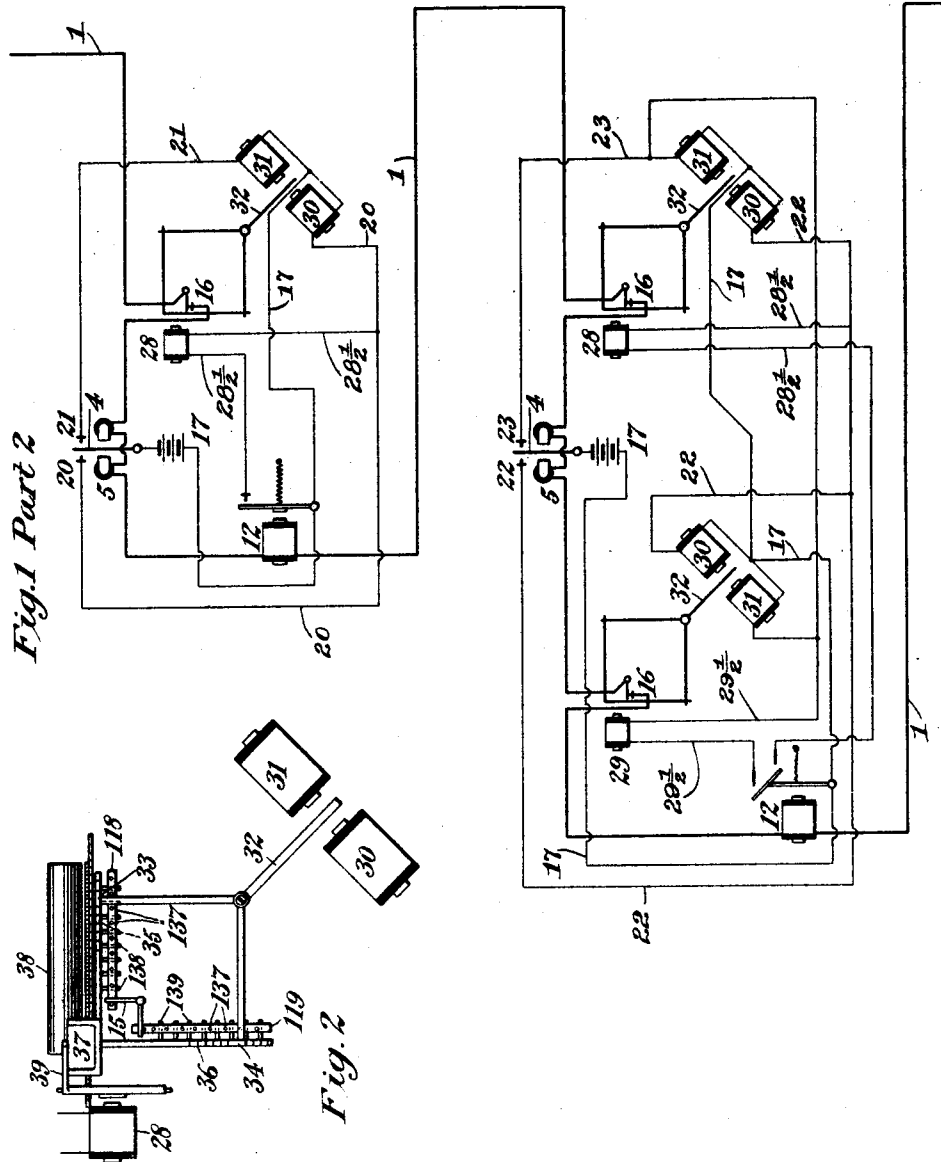
Edwin Pope
by *Andrew Wilson*
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3 SHEETS—SHEET 2.



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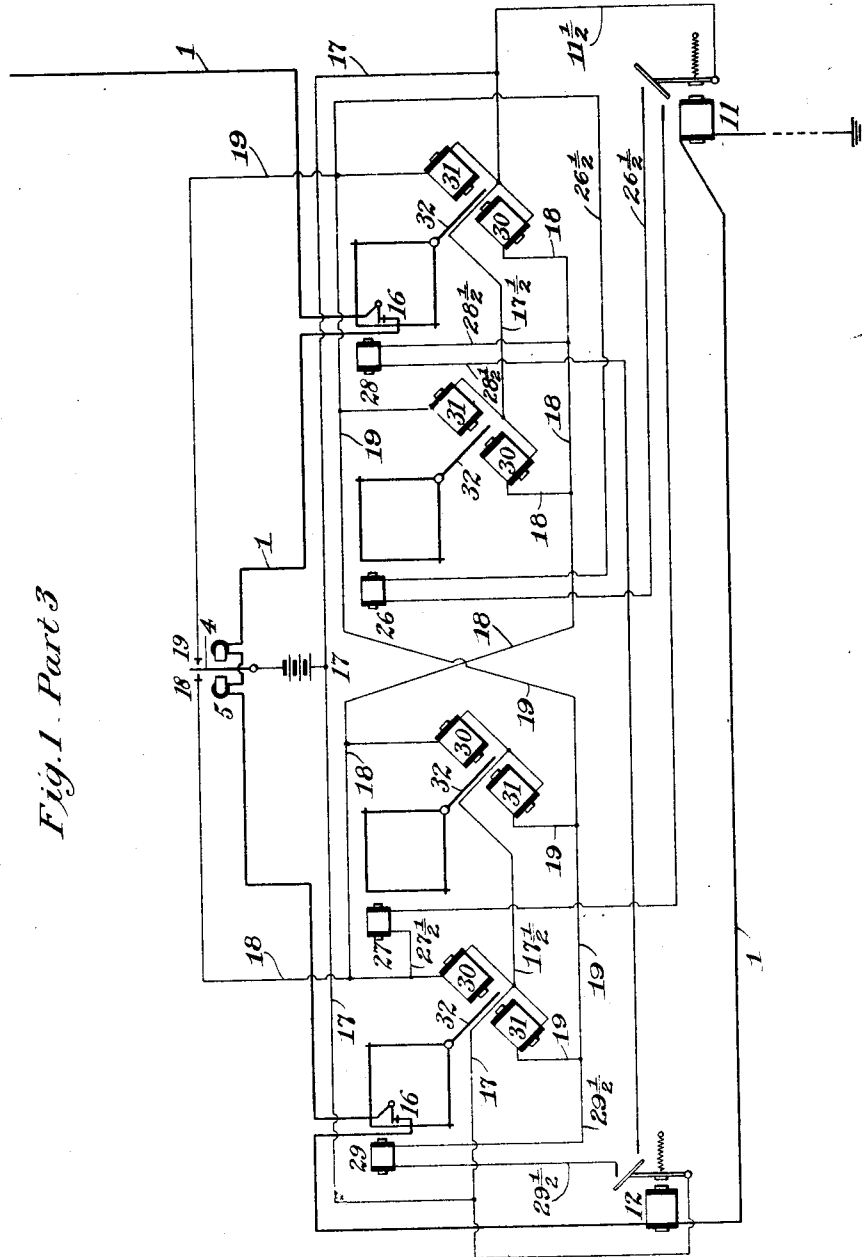
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3 SHEETS—SHEET 3.

Fig. 1. Part 3



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TELEGRAPH SYSTEM.

1,052,513.

Specification of Letters Patent.

Patented Feb. 11, 1913.

Application filed June 25, 1910. Serial No. 568,767.

To all whom it may concern:

Be it known that I, EDWIN POPE, a subject of the King of Great Britain, residing at Quebec, in the Province of Quebec and Dominion of Canada, have invented certain new and useful Improvements in Telegraph Systems, of which the following is a specification.

My invention relates to a system of telegraphy whereby a number of independent messages may be simultaneously transmitted over the same wire and recorded without interfering one with another; and my improvements consist in so arranging the elements of the system that a continuous series of electrical reversals, alternations or impulses, affecting all the instruments on the circuit, may be modified in different ways by the sending operators at different stations, so as to accomplish the desired results in a simple manner and at a fair rate of speed.

My invention may be described broadly as the use in a telegraph system of a continuous stream of automatic alternations sent over a line wire and operating a polar relay at each station on the line, whose armature either directly or through a local connection, makes a record at every double alternation. At each line station there is also a neutral relay in the circuit, whose armature is adjusted to respond to either an increase, or to a decrease in the normal current; and out of these two armature movements and the two alternate movements of the polar-relay armature, four combinations may be made, each combination governing a local magnet. Of these combinations, one is produced by a heavy current thrown on the line with a negative alternation; another by an interval of no current following a positive alternation; a third by a heavy current thrown in with a positive alternation; and a fourth by an interval of no current following a negative alternation. By using one of these combinations at each of four different stations I divide the impulses into groups and record them. The system provides, at each one of four sending stations, the means to superimpose one of the above combinations on the wire, and

four distinct and separate messages may be thereby transmitted and recorded simultaneously, as the change superimposed at either station on the stream of automatic alternations, does not interfere with the records at the stations having the other combinations. These impulses may be recorded as such, being divided into groups to correspond with a previously arranged system. For instance, if the characters used are regarded as being arranged in a table having seven lines of seven characters each, any character may be referred to by indicating its line and line position; thus the third character in the fourth line may be designated by a group of four impulses followed by a group of three impulses, the record whereof may be diagrammatically expressed as . . . / . . . ; and it will be readily understood that each character on the table may be designated and recorded in a similar way. The groups of impulses may be recorded as such, as I have just mentioned; but I prefer to translate them into their corresponding characters in ordinary type, and to print the character, automatically, as the message is transmitted, and for this purpose I employ a special machine, one form of which I have shown in a separate application to be filed simultaneously herewith, and which I will not, therefore, describe in detail herein, beyond referring to certain elements thereof to make clear the operation of my system.

In the drawings, Figure 1, on Sheets 1, 2 and 3, illustrates a telegraph system embodying my improvements and embracing one terminal station and three intermediate or way stations with their appropriate connections and with their instruments diagrammatically indicated; and Fig 2 is a view, on an enlarged scale, showing some of the more important elements of one of the machines diagrammatically indicated in Fig. 1.

Similar letters of reference designate similar parts in all the figures.

The main line 1, 1, of an electric circuit is grounded at one end, and into it reversals are sent at the other end through a pole-changer 2, which is shown as operated through the local circuits of the transmitter 3 governed by the armature 4 of the polar relay 5 in the

main circuit. A normal positive current, of for instance one hundred volts, is furnished by battery 6, while the battery 7 furnishes a much stronger positive current, of for instance three hundred volts. The battery 8 furnishes a negative current of for instance one hundred volts, while the battery 9 furnishes a much stronger negative current of for instance three hundred volts.

The terminal or main station is provided with a polar relay 5 and with neutral relays 11, 12, while the intermediate stations are each provided with a polar relay 5 and one or two of the neutral relays 11 and 12 as required. The line being closed, normally, reversals will be sent over it from the batteries 6 and 8 which will energize the polar relays 5, 5, causing their armatures 4, 4, to oscillate, these oscillations being utilized to open and close local circuits actuating the sending and receiving machines, which are identical in construction and which I will hereinafter refer to as the operators' machines. Under the influence of the normal currents from batteries 6 and 8 the neutral relays 11 are not powerful enough to operate their armatures. But when the stronger currents from the batteries 7 and 9 are thrown into the main line, the neutral relays 11 will close their armatures, with the results in the local circuit hereinafter described. The neutral relays 12 hold their armatures closed so long as there is any current passing over the line. The opening and closing of the switches 15, 15, and of the switches 16, 16, is governed by the operator's machine.

It will be seen that at the terminal station the movements of the armatures 4, 4, will, under the influence of the positive current, close the local circuit 17, 18, causing the local current to pass to the right through the line 17, dividing and following the line 17½ and the line 18, and its branches, energizing the first pair of magnets 30, 30, again dividing over the second line 17½ and line 18 and its branches and energizing the second pair of magnets 30, 30, and returning through the line 18; and, under the influence of the negative current the armatures 4, 4, will close the circuit 17, 19, causing the local current to pass to the left through the line 17, dividing and following 17½ and the line 19, and its branches, energizing the first pair of magnets 31, 31, again dividing over the second line 17½ and line 19 and its branches, energizing the second pair of magnets 31, 31, and returning through the line 19; and at the way stations, under the influence of the positive current the armatures 4, 4, will close the circuit 17, 20, causing the local current to pass from line 17 through the line 20; energizing the magnet 30, and returning through the line 20, and

will close the circuit 17, 22, causing the local current to pass from line 17, dividing and returning through the two branches of the line 22, energizing the magnets 30, 30 and returning through line 22; and under the influence of the negative current, the armatures 4, 4, will close the way station circuit 17, 21, causing the local current to pass from line 17 through the line 21, energizing the magnets 31, and returning through line 21, and will also close the local circuit 17, 23, causing the local current to pass from line 17, dividing and returning through the two branches of line 23, energizing the magnets 31, 31, and returning through line 23. It will also be seen that, under the influence of the strong current, the neutral relay 11 will bring the electro-magnet 26, into the local circuit 17, 19 by closing the switch of relay 11 and causing the local current to pass from line 17½ through line 11½ and the switch to line 26½, energizing magnet 26, completing the circuit through line 19, and also will bring the electromagnets 27, 27, into their local circuit 17, 18, by closing the switch of neutral relay 11, and causing the local current to pass from line 17½ through line 11½ and the switch 11 to line 27½, energizing magnet 27, and completing the circuit through line 18. And when the current is cut off, the neutral relays 12, 12, will release their armatures allowing their switches to fall back and close, throwing the lines 28½, 28½ into the circuits 17, 17½, 18 above described and energizing magnets 28, 28, also throwing lines 29½, 29½ into circuit with 17, 17½, 19 above described, and energizing magnets 29, 29; also throwing lines 28½, 28½ into circuit 17, 20, above described, and energizing its magnet 28, also throwing lines 28½, 28½ into circuit 17, 22, above described and energizing its magnet 28; and also throwing lines 29½, 29½ into circuit 17, 23 above described and energizing magnet 29. This alternate cutting out and in of the local circuits by the armatures 4, 4, will cause the electro-magnets 30, 31 to vibrate their armature bars 32, 32, thereby providing mechanical power to drive the operators' machines. This mechanical power can be communicated to the machines in any suitable way, as for instance through pawls 33, 34 on the ends of the armature-bars' arms, which engage with movable ratchet racks 35 and 36 and communicate thereto lateral and forward movements, respectively, by means of which movements an elastic type-plate 37 may be adjusted in two directions so as to bring any desired character thereon into definite printing position over a printing roller 38 of the machine. The throwing of the electro-magnets as 26, 27, into their circuits will furnish an additional me-

chanical power which may be utilized to limit the extent of the lateral and the forward adjustments of the type-plate and to print the letter by bringing down a hammer 5 39 to force the type toward the printing roller.

The switches 15, 15 and 16, 16 are controlled by the operators, each of whom, by adjusting his machine, fixes the time at 10 which its switch shall be turned and the next impulse of the main circuit be modified. This may be accomplished by the operator causing a contact to be made between one of a series of points 138, 138 or 15 139, 139 on the racks 35, 36, with one of a series of stops as 137, 137 in movable bars 118, 119, so that when the rack bar 34, 35, is advanced the determined distance it will push forward its bar 118, 119, as the case 20 may be, and cause it to turn the switch 15 or 16, changing the character of the next impulse in the main line and causing the neutral relays of the particular machine and of its corresponding machine or ma- 25 chines in other parts of the circuit to bring the local magnets controlled by them into their respective local circuits to change the movement of the type-plate effecting the printing and, preferably, moving the paper 30 holder. When, therefore, the operator of a machine controlling the negative impulses, causes a strong negative impulse to be thrown into the main line, that negative impulse will affect the neutral relays 11, 35 closing only the local circuits which embrace electro-magnets 26, and the same movements will take place in all machines having such local circuits. Likewise, if the operator of a machine controlling the posi- 40 tive impulses, causes a strong positive impulse to pass over the line, that positive impulse will affect the neutral relays 11, closing the local circuits which embrace electro-magnets 27, and the same movements 45 will take place in all machines having such local circuits. If, however, the operator of a machine prevents a negative impulse from passing into the line, by opening the line, the neutral relays 12 will release their 50 armatures and close the local circuits which embrace the electro-magnets 28, producing the same movements in all machines having such local circuits, and corresponding results will take place if an operator prevents a positive impulse from 55 passing into the line, and thereby brings the electro-magnets 29 into action. All of these operations may take place simultaneously; for it is obvious that the changes in 60 the character of the impulses which determine the movements of the respective pairs or groups of machines, do not interfere with the changes in the impulses which determine the movements of the other pairs or

groups of machines, so that four separate 65 messages may be sent at the same time over the same line, all depending for their primary motive force upon a common series of electrical reversals, which are independently modified in four different ways, so as to 70 produce four different classes of impulses upon the line, which do not interfere one with another; that is, a series of normal positive and negative impulses varied by strong negative impulses; a series of normal 75 positive and negative impulses varied by strong positive impulses; a series of normal positive and negative impulses varied by intervals of no current after negative impulses; and a series of normal positive and 80 negative impulses varied by intervals of no current after positive impulses. These four messages may be sent to any station equipped to receive them; and two messages may be sent, in either direction, in any 85 order, between any stations properly equipped.

When a sending operator opens the circuit after a negative impulse, the break takes place before the arm of the pole- 90 changer at the main station reaches the stop which connects it with the positive battery, and all the relays remain with their armatures on the negative side until the connection is remade by the sending machine, by 95 the release and return of the switch 16 to its normal position, sending a positive current into the line and continuing the reversals. By this means the pole-changer is kept at rest while the line is open. When 100 the circuit closes a positive current goes through the line and the reversals are resumed. Corresponding results take place when an operator opens the circuit after a positive impulse. 105

By using double wound relays and working the current duplex, eight messages may be sent between two terminal stations, four in each direction; but in that case the circuit must not be broken, but the line is put 110 to ground so as to preserve the connection.

The pole-changer may of course be operated mechanically instead of electrically; and the rapidity of the electrical reversals may be modified by introducing resistance 115 in the local transmitter circuits; and strong impulses may be used for sending and weaker impulses for printing and feeding. Having thus described my invention, what I claim and desire to secure by Letters 120 Patent of the United States, is:—

1. The combination, with an electric circuit, of means for producing therein an initial and continuous series of current alternations severally constituting independ- 125 ently efficient signaling units, means for causing modifications of particular alternations, and thereby producing a plurality

of signal systems severally employing all of the alternations, each signal being formed by a sequence embracing unmodified alternations and a modified alternation as unit steps therein, and means for simultaneously transmitting said systems of signals.

2. The combination, with an electric circuit, of means for producing therein an initial and continuous series of current alternations severally constituting independently efficient signaling units, means for causing relatively independent modifications of particular alternations and thereby producing a plurality of signal systems severally employing all of the alternations, each signal being formed by a sequence embracing unmodified alternations and a modified alternation as unit steps therein, and means for simultaneously transmitting said systems of signals.

3. The combination, with an electric circuit, of means for producing therein an initial and continuous series of current alternations severally constituting independently efficient signaling units, means for causing relatively independent modifications of particular alternations and thereby producing a plurality of signal systems severally employing all of the alternations, each signal being formed by a sequence embracing unmodified alternations and a modified alternation as unit steps therein, and means for simultaneously transmitting and separately recording said systems of signals.

4. The combination, with an electric circuit, of means for producing therein an initial and continuous series of current alternations severally constituting independently efficient signaling units, means for arbitrarily causing modifications of particular alternations and thereby producing a plurality of signal systems severally employing all of the alternations, each signal being formed by a sequence embracing unmodified alternations and a modified alternation as unit steps therein, and a plurality of mechanisms severally responding to and recording all the unit steps of each of said different systems of signals.

5. The combination, with an electric circuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, means for arbitrarily giving secondary values to particular units and thereby producing a plurality of systems of signals each employing all of said alternations as unit steps therein, and a plurality of mechanisms all responding to and registering all of said signaling units, but each recording the secondary value of the units of only one system of signals.

6. The combination, with an electric cir-

cuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, means for arbitrarily giving secondary values to particular units and thereby producing a plurality of systems of signals each employing all of said alternations as unit steps therein, and a plurality of mechanisms all responding to and registering all of said signaling units, and being simultaneously differently affected by the primary or secondary value of the same signaling units.

7. The combination, with an electric circuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, means for arbitrarily giving secondary values to certain positive impulses of said alternations, and thereby producing a plurality of systems of signals each employing all of said alternations as unit steps therein, and a plurality of mechanisms all responding to and registering all of said signaling units, and being simultaneously differently affected by the primary or secondary value of said positive impulses.

8. The combination, with an electric circuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, means for arbitrarily giving secondary values to certain negative impulses of said alternations, and thereby producing a plurality of systems of signals each employing all of said alternations as unit steps therein, and a plurality of mechanisms all responding to and registering all of said signaling units, and being simultaneously differently affected by the primary or secondary value of said negative impulses.

9. The combination, with an electric circuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, means for arbitrarily giving secondary values to certain positive and negative impulses of said alternations, and thereby producing a plurality of systems of signals each employing all of said alternations as unit steps therein, and a plurality of mechanisms all responding to and registering all of said signaling units, but some thereof being simultaneously differently affected by the primary or secondary values of said positive impulses and others thereof being simultaneously differently affected by the primary or secondary values of said negative impulses.

10. The combination, with an electric circuit, of means for producing therein an initial and continuous series of current alter-

nations severally constituting independently efficient signaling units, a plurality of local circuits all affected by all of said signaling units, a plurality of relays severally affecting the local circuits, and means for giving to particular signaling units secondary values which shall modify their effect upon certain of said relays thereby producing a plurality of signal systems severally employing all of the alternations, and each signal being formed of a sequence embracing unmodified alternations and a modified alternation as unit steps therein.

11. The combination, with a main electric circuit, of means for producing a continuous series of current alternations therein, means for arbitrarily producing changes in said current alternations, a plurality of polar relays in the main circuit, a plurality of local circuits severally controlled by said polar relays, a plurality of neutral relays, in the main circuit, grouped with each polar relay, potentially associated with said local circuits, and each adapted to be actuated by a different change in a main circuit impulse so as to modify a local circuit.

12. The combination, with a main electric circuit, of means for producing a continuous series of current alternations therein, a plurality of local circuits, a plurality of polar relays in the main circuit each adapted to reproduce its vibrations in one of said local circuits, a plurality of neutral relays in the main circuit each adapted to modify the vibrations produced in a local circuit by a polar relay, and means for producing distinct changes in main circuit impulses independently affecting each of said neutral relays, whereby two systems of mechanical movements are produced in each local circuit.

13. The combination, with a main electric circuit, of means for producing a continuous series of current alternations therein, a plurality of local circuits, a plurality of polar relays in the main circuit each adapted to reproduce its vibrations in reversed character in one of said local circuits, a plurality of neutral relays in the main circuit each adapted to modify the vibrations produced in a local circuit by a polar relay, and means for producing distinct changes in main circuit impulses independently affecting each of said neutral relays, whereby two systems of mechanical movements are produced in each local circuit.

14. The combination, with a main electric circuit, of means for producing a continuous series of current alternations therein, a plurality of local circuits, a plurality of polar relays in the main circuit each adapted to reproduce its vibrations in reversed character in one of said local circuits, a plurality of neutral relays in the

main circuit each adapted to modify the vibrations produced in a local circuit by a polar relay, and means for producing distinct changes in main circuit impulses independently and arbitrarily affecting each of said neutral relays, whereby two systems of mechanical movements are produced in each local circuit, and means for correlating said mechanical movements.

15. The combination, with a main electric circuit, of means for producing a continuous series of current alternations therein, a plurality of local circuits, a plurality of polar relays in the main circuit each adapted to reproduce its vibrations in reversed character in one of said local circuits, a plurality of neutral relays in the main circuit each adapted to modify the vibrations produced in a local circuit by a polar relay, means for producing distinct changes in main circuit impulses independently and arbitrarily affecting each of said neutral relays, whereby two systems of mechanical movements are produced in each local circuit, means for correlating said mechanical movements, and means for reproducing said movements at another point in the main circuit.

16. The combination, with a main electric circuit, of means for producing a continuous series of current alternations therein, a plurality of corresponding groups of relays each including a polar relay and neutral relays, local circuits controlled by said relay, means for producing corresponding electrical conditions in corresponding local circuits in the several groups without affecting the others, and means for transforming such electrical conditions into mechanical movements, whereby different systems of signals may be exchanged between different corresponding local circuits independently and simultaneously.

17. The combination, in an electric circuit, of means for producing therein an initial and continuous series of current alternations severally constituting independent transmitting instruments each using each of said alternations as a distinct unit step in its signal system and each being adapted to arbitrarily introduce a distinct system of modifications therein to produce a system composed of signals each formed by a sequence embracing unmodified alternations and a modified alternation, and a plurality of receiving instruments each adapted to receive and record the signals transmitted by one of said sending instruments.

18. In combination, in an electric circuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, a plurality of independent trans-

mitting-recording instruments each using each of said alternations as a distinct unit step in its signal system and each being adapted to arbitrarily introduce a distinct system of modifications therein, and a plurality of receiving instruments, each adapted to receive and record the signals independently transmitted by one of said transmitting-recording instruments.

19. The combination, in an electric circuit, of means for producing therein a continuous series of current alternations each constituting an independently efficient signaling unit, a plurality of instruments each using each of said alternations as a distinct unit step in its signaling and adapted to introduce into said alternations a distinct system of current changes and to record, transmit or receive messages thereby, and a duplicate plurality of instruments adapted to receive all of said unit signal steps and to record the messages transmitted by the first mentioned instruments or to similarly record and transmit messages thereto.

20. The combination, in an electric circuit, of means for producing therein an initial and continuous series of current alternations severally constituting independently efficient signaling units, means for introducing a modification in the strength of selected current impulses of one polarity and thereby transmitting and recording a system of signals employing all of said alternations as unit steps, and means for independently introducing a modification in the strength of selected current impulses of the other polarity and thereby transmitting and recording another system of signals also employing all of said alternations as unit steps, some units having at the same time different potential signal values for each system, and each signal being composed of a sequence embracing unmodified alternations and a modified alternation as unit steps therein.

21. The combination, in an electric circuit, of means for producing a continuous series of current alternations therein, means for introducing a neutral interval after a negative impulse and before a positive impulse and thereby transmitting and recording a system of signals, and means for introducing a neutral interval after a positive impulse and before a negative impulse and thereby independently transmitting and recording another system of signals, both of said systems employing all of said alternations.

22. The combination, in an electric circuit, of means for producing a continuous series of current alternations therein, means for introducing a change in the strength of the negative impulses and thereby transmitting and recording a system of signals, means for introducing a change in the strength of posi-

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tive impulses and thereby simultaneously transmitting and recording another system of signals, means for introducing a neutral interval after a negative impulse and thereby simultaneously transmitting and recording another system of signals, and means for introducing a neutral interval after a positive impulse and thereby simultaneously transmitting and recording another system of signals, all of said systems employing all of said alternations.

23. The combination, with an electric circuit, of a plurality of receiving mechanisms each embodying a pair formed of a movable recorder and a register, means for transmitting through said circuit, a series of impulses all actuating each of said pairs, means for producing changes in the character of selected impulses, whereby the recorders and registers of the several pairs are differently adjusted relative to each other and caused to make dissimilar visible records.

24. The combination, of movable registers and recorders, with an electric circuit, means for transmitting a series of alternating impulses through said circuit each impulse constituting an independently efficient signaling unit, means for producing a change in the strength of impulses of one polarity whereby a movable recorder and a register are, by the operation of all of said alternations as unit steps, relatively adjusted and caused to make a visible record, and means for producing an independent change in the strength of impulses of the other polarity whereby another movable recorder and another register are also, by the operation of all of said alternations as unit steps, relatively adjusted and caused to make an independent, visible record.

25. The combination, of movable registers and recorders, with an electric circuit, means for transmitting a series of alternating impulses therethrough, means for producing a neutral interval after a positive impulse and before a negative impulse whereby a recorder and register are relatively adjusted and a visible record produced, and means for the independent introduction of a neutral interval after a negative impulse and before a positive impulse whereby another recorder and register are relatively adjusted and a second and independent visible record produced.

26. The combination, of movable registers and recorders, with an electric circuit, means for producing a continuous series of current alternations therein, a plurality of polar relays in said circuit, a plurality of local circuits opened and closed by each of said polar relays, a plurality of independently adjusted neutral relays in the main circuit near said local circuits, and means for modifying in different ways the character of the current

alternations so as to separately affect said neutral relays and through them local circuits.

27. The combination, with an electric circuit, of means for producing a continuous series of current alternations therein, a main station provided with a polar relay, and with two neutral relays adapted to be actuated respectively by increased impulses and an absence of impulses in the main circuit, local circuits governed by said relays, a way station provided with a polar relay and with

neutral relays adapted to be actuated respectively by increased impulses and an absence of impulses in the main circuit, and means for producing increased impulses or an absence of impulses in the main circuit to affect said neutral relays and through them their several local circuits, simultaneously and independently in four different ways. 15

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."