(No Model.) 2 Sheets—Sheet 1.

C. R. J. WILLOT.

TELEGRAPHY.

No. 540,477. Patented June 4, 1895.

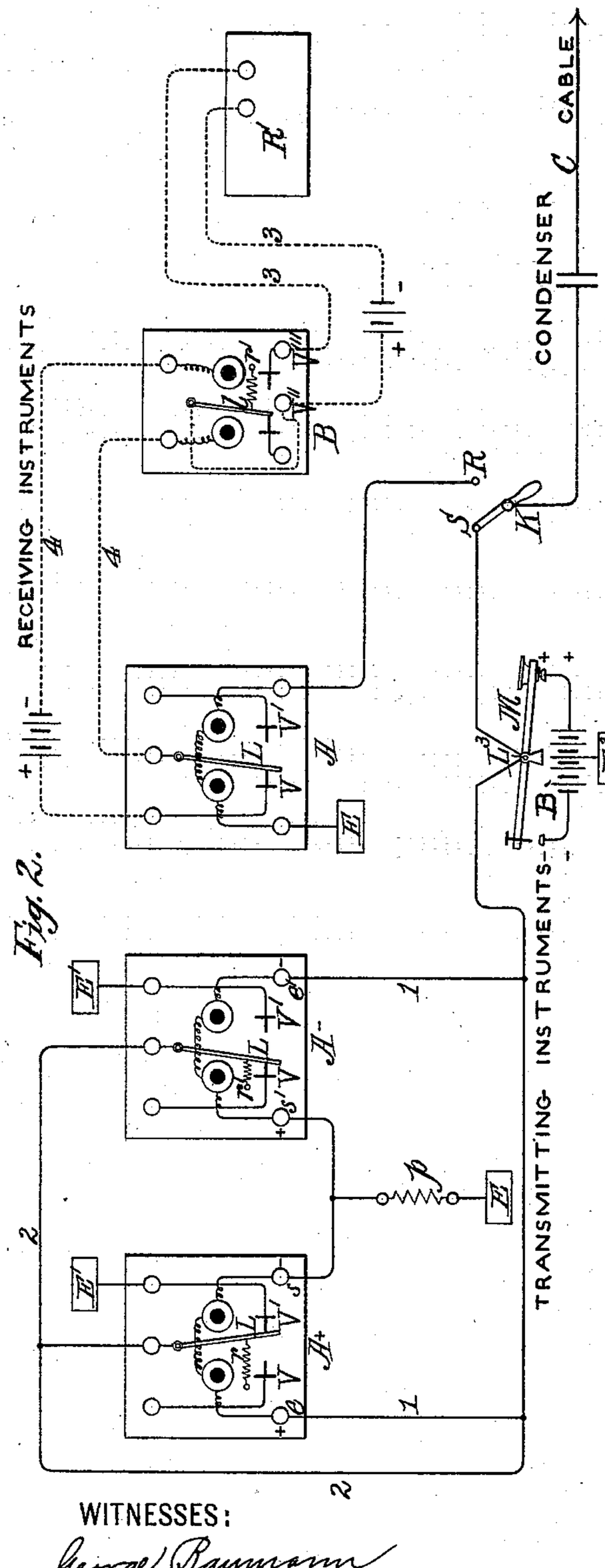

Fig. 2.

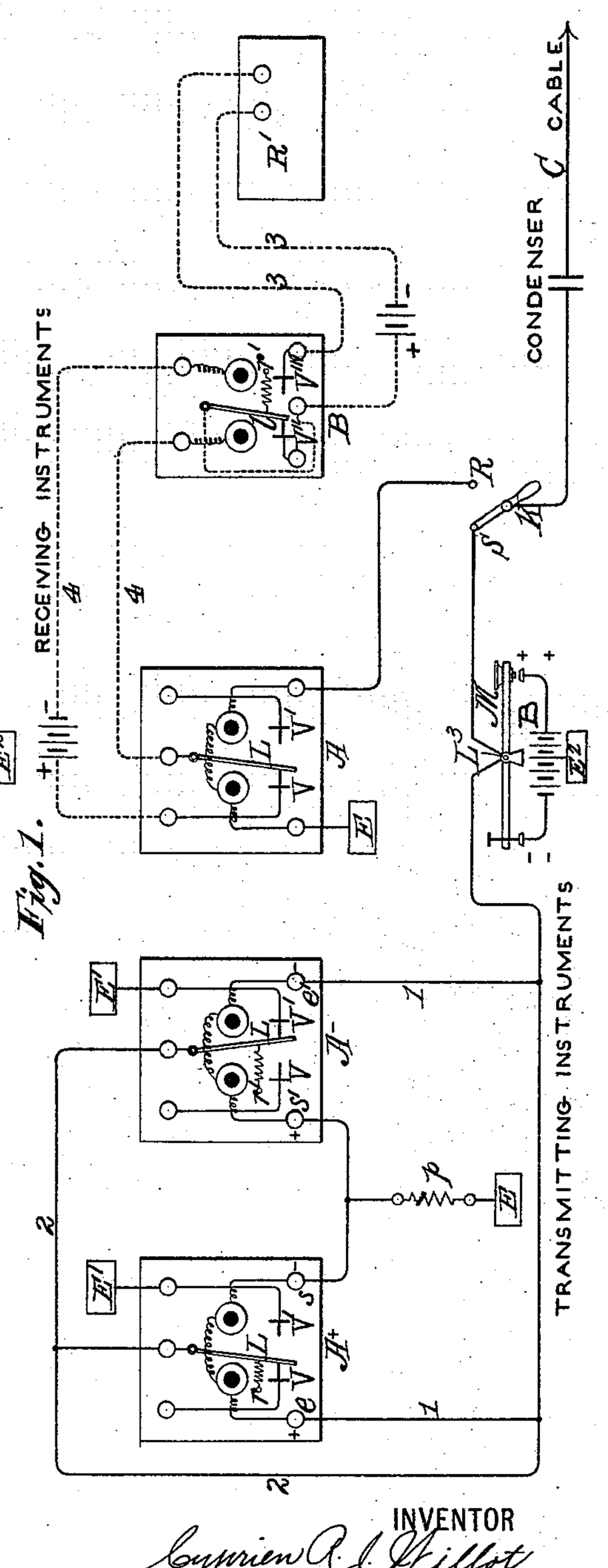

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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TELEGRAPHY.

No. 540,477. Patented June 4. 1895.

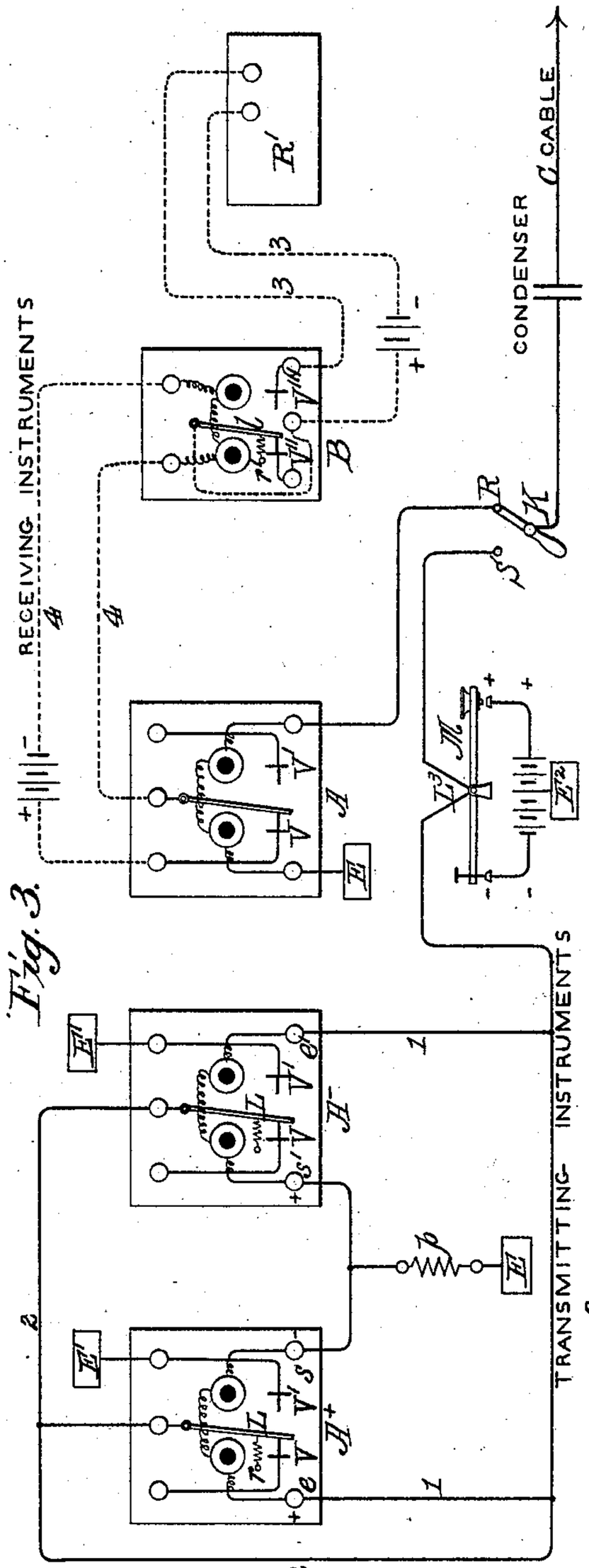

Fig. 3.

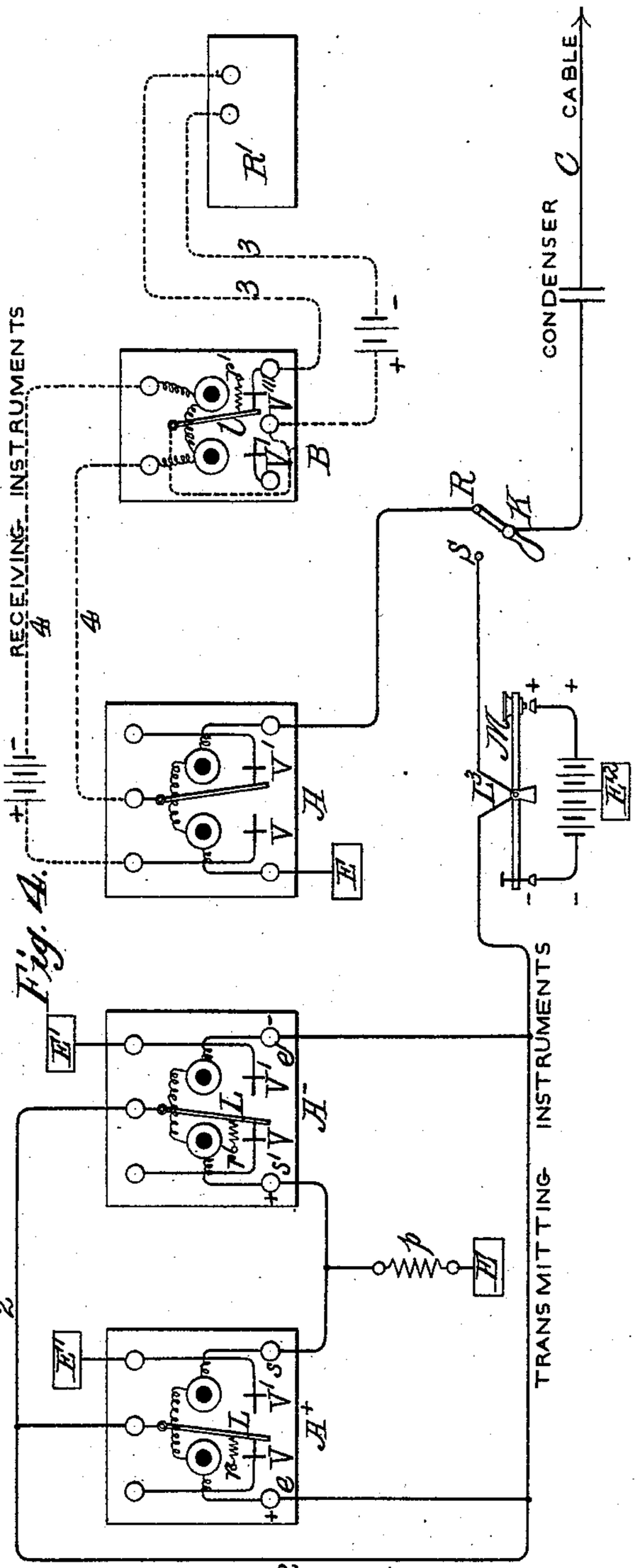

Fig. 4.

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UNITED STATES PATENT OFFICE.

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TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 540,477, dated June 4, 1895.

Application filed April 24, 1894. Serial No. 508,863. (No model.) Patented in France August 13, 1892, No. 223,657, and in England December 17, 1892, No. 15,689.

To all whom it may concern:

Be it known that I, CYPRIEN RENELDE JOSEPH WILLOT, a citizen of the Republic of France, residing in Paris, France, have invented an Improved Telegraphic System, (for which I have obtained a French patent, No. 223,657, dated August 13, 1892, and a British patent, No. 15,689, dated December 17, 1892,) of which the following is a specification.

My invention relates to a telegraphic system, whereby the dashes or strokes employed in the Morse code may be transmitted at the same speed as the dots, the said system being applicable more particularly to submarine cables. With this object I employ two polarized relays of special construction, one of which operates under the influence of positive currents and the other under the influence of negative currents of electricity, the said relays being adjustable in such a manner that they are only actuated by emissions of current having a duration greater than those necessary to produce dots of the Morse code, so that the first relay acting after the formation of the first third of a dash puts the cable in connection with the earth, or a resistance during the formation of the last two thirds of the said dash, the other relay acting in a similar manner after the emission of a reverse current through the cable which determines the length of the blank space separating the signals forming the code.

In principle in order to obtain with a submarine cable of a given length the maximum of regular and consequently undistorted signals, it is desirable that the cable should be brought after each signal, or element of a signal, to a neutral state, or into a determined but constant electrical condition. Experience has proved that this determined electrical condition is more rapidly obtained by the employment of reversed currents, and the cable is blocked between two series of condensers of determined capacity. On the other hand with the Morse code comprising dots and dashes, produced by short and long emissions of current, the charge corresponding to the dash will necessarily be longer than that occasioned by the transmission of a dot since the charge is dependent on the duration of the emission. The determined electrical condition hereinbefore mentioned after the transmission of a dash will not be so quickly reached as after the transmission of a dot, and the speed of transmission under these conditions is necessarily limited to that of the successive transmission of dashes. The present invention has for its object to obviate this cause of retardation and to produce the dashes of the Morse code with the same speed and with the same regularity as the dots.

In the accompanying drawings, Figure 1 is a diagram of a station arrangement at one end of a cable with the transmitting-instruments to the line and with the armatures of the relays in the positions they occupy when a negative current is being sent through the cable. Fig. 2 is a similar diagram with the armatures of the relays in the positions they occupy when a positive current is being sent through the cable. Fig. 3 is a diagram similar to Fig. 1, but arranged for receiving—that is, with the transmitting-instrument out of circuit and the receiving-instrument to line—and showing the armatures of the relays in the positions they occupy when a negative current is received over the cable from the transmitting-station, such as in Fig. 1; and Fig. 4 is a similar diagram showing the armatures of the receiving-relays in positions when a positive current is received over the cable.

In the diagrams, C represents the cable; E, E′, &c., the connections to earth; R′, any suitable receiver of the Morse or Wheatstone types; A^+, A^-, and A, special polarized relays; B, an ordinary relay; K, a switch capable of being moved from the transmitting position S to the receiving position R, that is adapted to throw either the transmitting or the receiving instruments to line.

The transmitting installation comprises a suitable transmitting instrument, which I have shown by way of example, as an ordinary reversing key M; two relays A^+ and A^- called "consuming" relays (and preferably of the kind described by me in the specification of Letters Patent No. 536,559, granted to me March 26, 1895), and a rheostat p_-. The two relays A^+ and A^- are provided to establish a novel compensating system, in order, as hereinbefore stated, to produce the dashes in the Morse code with the same length of emission

of current as for dots. For this purpose the key of the transmitter M communicates with the incoming binding posts *e* and *e'* of the two relays A^+ A^- arranged in opposite directions. The outgoing binding posts *s*, *s'* of the bobbins of each of the two relays A^+ and A^- are connected together and are finally connected to earth as at E through a rheostat p_-, having a resistance equal to or greater than that of the cable itself. The armatures of the two relays A^+ A^- are connected together and to the terminal L^3 of the transmitting key through the conductors 2, 1. The contact screws V' of the consuming relays are each in connection with the earth, as at E'. The back stops V are insulated.

By the general arrangement hereinbefore described, it will be seen that all currents from the generator sent through the cable are divided at L^3, that is, find two paths, one through the cable and the other through the two "consuming" relays A^+ and A^-, and the resistance p_- to the earth at E.

The relays A^+ and A^- can be so adjusted that the short emissions representing dots in the code have no effective action upon the armatures. This adjustment is obtained by means of a retracting spring *r*, or *r'*, the tension of which upon the armature is regulated once for all at the commencement of the tests. This spring is stretched slightly when the two relays are actuated by emissions corresponding to a dot on the code, but the armatures do not move over. If, however, the emission is prolonged, the strength of the current increasing with the period of duration of the emission until the stationary state is attained, the relays will come into action, the one A^+ under the action of the positive current and the other A^- under the influence of the negative current. The armature of the relay A^+ will thus make contact with the screw V', as shown in Fig. 2, as soon as the emission of the current has attained the limit hereinbefore referred to; that is to say, after sending through the cable the third of an emission corresponding to a stroke. The screws V', being connected to earth, and the armature lever being in communication with the line, no current from the transmitter M at the home station, will pass through the cable when the armatures of the relays are in contact with the said screws V', but such current will flow directly to earth at E', Fig. 2. The charge produced in the cable for the formation of a dash or stroke in the code will not therefore exceed that for the transmission of a dot.

To produce the blank spaces separating the signals, which are obtained as is well known in the Wheatstone system, by means of a negative or reverse current, the relay A^- is actuated by a negative emission in the same conditions that and at the same moment as the relay A^+ is actuated by the positive current. The screw V' of the relay A^-, will, as shown in Fig. 1, put the transmitter M in direct communication with the earth at E', such contact remaining in force during the intervals of the signals.

With this arrangement the transmission of Morse signals consists, therefore, in sending through the cable a series of dots unequally spaced. The signals of the Morse code thus transmitted are collected upon their arrival in the special relay for submarine cables described in my Patent No. 536,559, granted to me March 26, 1895, and are converted into dots and dashes in the receiving instrument. With this purpose the lever L of the receiving relay A in its normal state in contact with the screw V, closes a local circuit 4 through an ordinary polarized relay B, the said local circuit acting in opposition to a spring *r'*, and maintaining the armature in contact with the screw V''. As soon as the working current emitted through the cable arrives in the relay A, when the switch K has thrown the receiving instruments to line, as in Figs. 3 and 4, the lever L leaves the screw V (Fig. 3), and breaks the local circuit of the relay B, as shown in Fig. 4. The lever of the armature of this latter actuated by the mechanical force of the spring *r'* makes contact with the screw V''' and causes the transmission of a local current in the circuit 3 containing any ordinary receiver R'. The marking signal in the receiving instrument will continue so long as the lever of the armature of the polarized relay B remains in contact with the screw V''' or during the whole period of interruption of the circuit between the lever L of the special submarine relay, the screw V, and the relay B.

The special relay A, as regards the cable C, has only to act as circuit breaker and it is not essential that the lever L of this relay should leave the screw V entirely in order to cause the working of the relay B, a mere change of the contact pressure between the screw V and the lever L being sufficient, since the resistance of this point of contact helps to increase the total resistance in which the electro-magnet of the relay B is placed. The coils of this magnet are provided with wire of very slight resistance (ten to fifteen ohms at the most) so that the diminution of resistance at the point of contact of the lever L and screw V of the special relay A will cause the action of the relay B, the spring being sufficiently powerful to overcome the local electromotive force.

The special relay A for the submarine cables, operates somewhat in the manner of a microphone, and the armature of the relay B will only return into contact with the screw V'' (Fig. 3), when the contact between the lever L and the screw V of the relay A is complete, that is to say, when the inverse emission of current which terminates any signal or element of a signal has been transmitted through the cable and has reached the relay A. The residual magnetism which affects the electromagnet of the relay B tends also to prolong the action of the external current. As a consequence of this arrangement the current for

producing the signs of the relay B is maintained in the receiver R′ until the inverse current coming from the cable has reached the relay A, that is to say, until the resistance of the points of contact V and L of the relay A is brought back to its normal state, and thus the unequal spaces in the transmission are converted into dots and dashes in the receiver. The formation of the dashes and blank spaces is therefore obtained by the transmission of a series of dots unequally spaced and the speed of transmission of the dashes is identical with that of dots since the charge corresponding to the emission of a dash is identical with that which corresponds to the transmission of a dot.

I claim as my invention—

1. A telegraphic transmission system operated by Morse or Wheatstone apparatus, provided with two polarized relays, of which A^+ only operates under the influence of positive emissions of current and the other A^- under the influence of negative emissions, the relays so adjusted that they are only operated by emissions having a duration greater than that corresponding to a dot of the code, whereby the relay A^+, acting after the formation of say the first third of the dash, will connect the cable to earth during the formation of say the last two thirds of the dash, and the relay A^- will operate similarly after the sending of the first reverse current through the cable, which determines the blank space separating the signals, all substantially as described.

2. In a telegraphic transmission system operated by the Morse code, the combination of a transmitting key M connected to the cable with two polarized relays A^+ and A^-, connected to the key and cable and to the ground, substantially as described whereby the cable may be grounded at the sending station, to limit the duration of the emissions of negative or positive currents.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CYPRIEN RENELDE JOSEPH WILLOT.

Witnesses:
AUGUSTUS PESTEL,
CHARLES DOUY.