

(No Model.)

A. MUIRHEAD.

MEANS FOR ADJUSTING SUBMARINE DUPLEX TELEGRAPHS.

No. 329,477.

Patented Nov. 3, 1885.

Fig. 1.

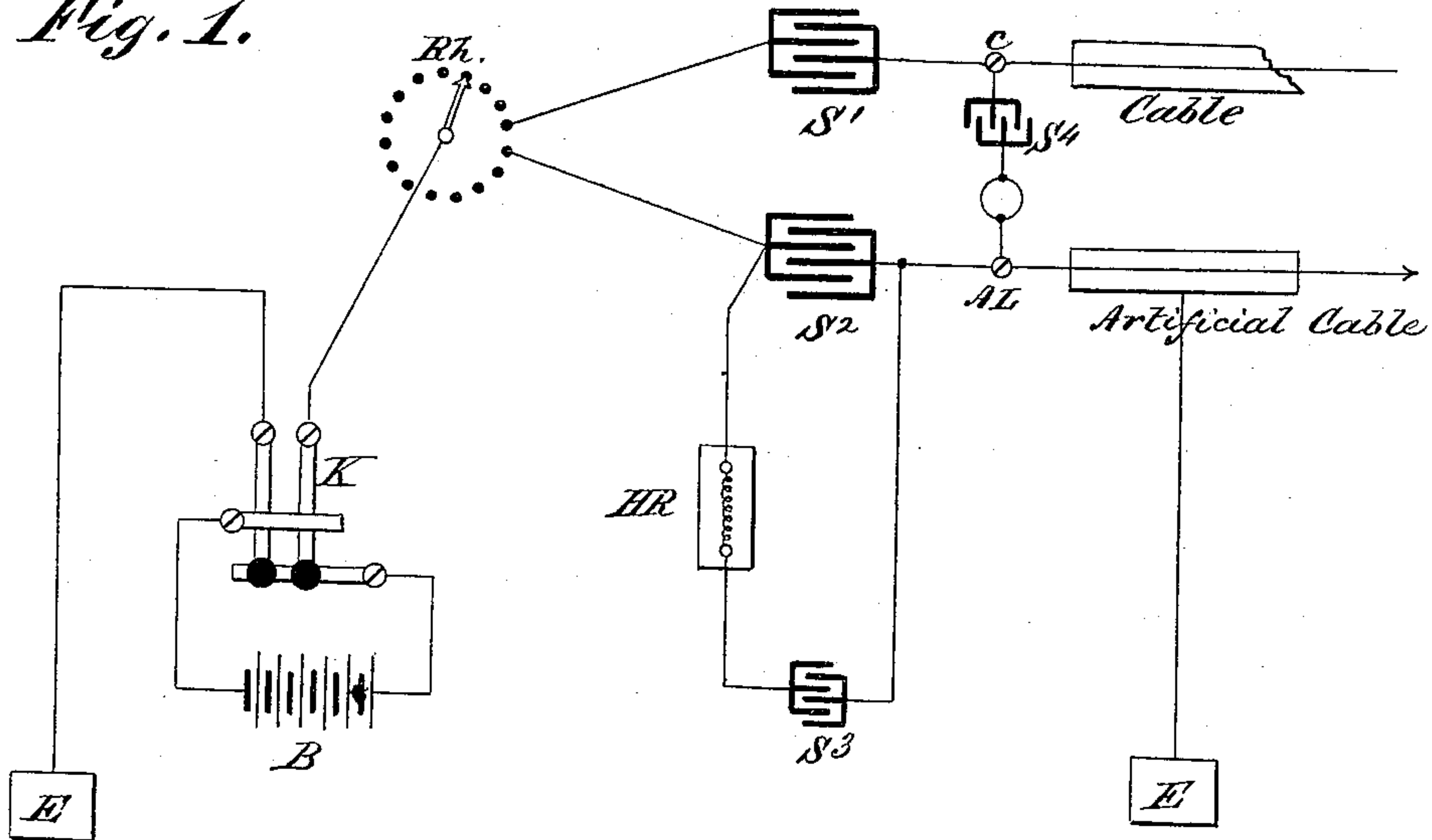
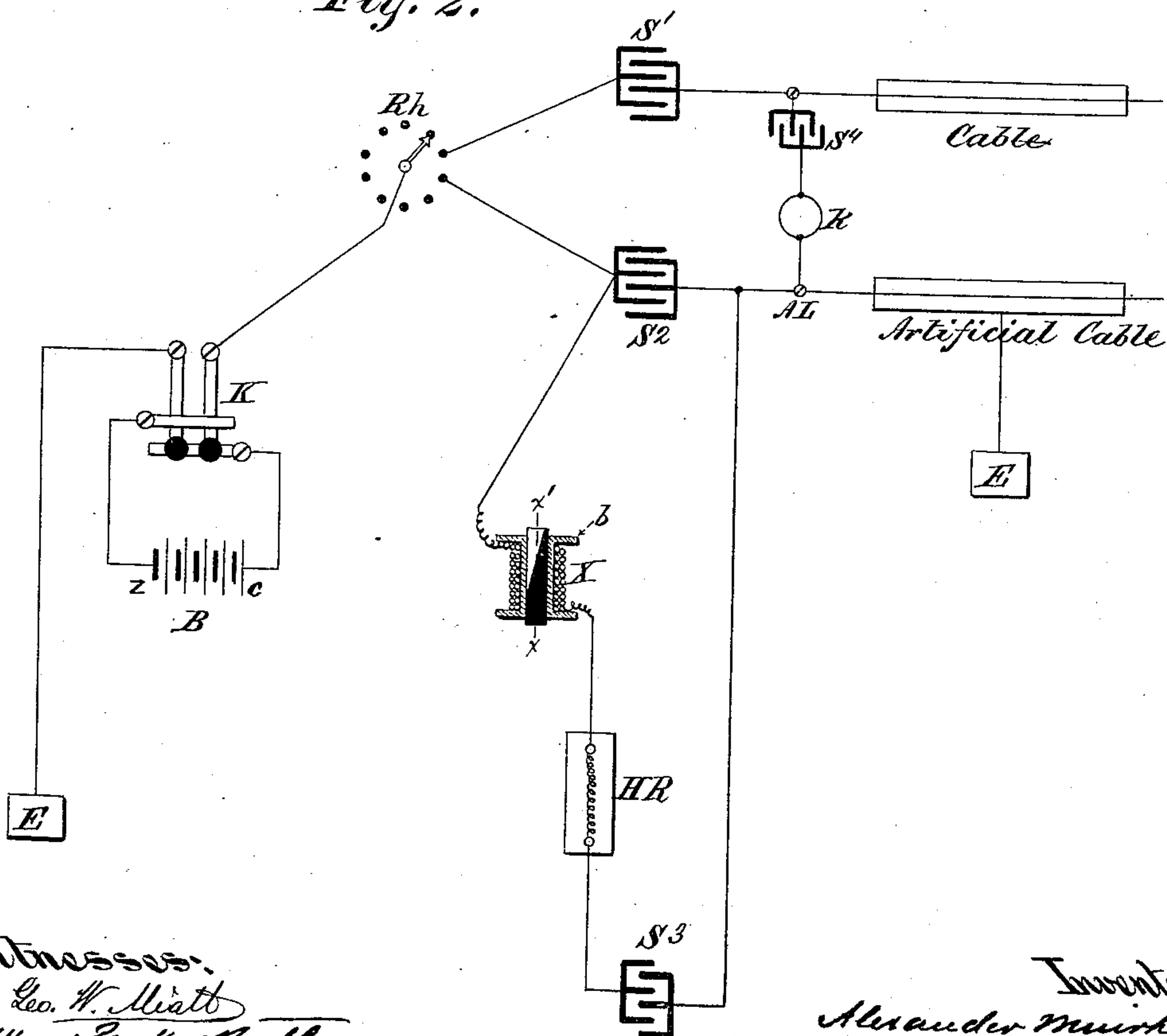


Fig. 2.



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UNITED STATES PATENT OFFICE.

ALEXANDER MUIRHEAD, OF UPPER NORWOOD, COUNTY OF SURREY,
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MEANS FOR ADJUSTING SUBMARINE DUPLEX TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 329,477, dated November 3, 1885.

Application filed February 20, 1885. Serial No. 156,555. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER MUIRHEAD, a citizen of Great Britain, and a resident of Upper Norwood, in the county of Surrey and Kingdom of England, have invented certain new and useful Improvements in Duplex Telegraphy, of which the following is a specification.

My invention relates to duplex telegraphs; and the object of the same is to effect greater and better results from the duplex working of long submarine cables on systems such as that known as the "Muirhead double-block system," as described in Letters Patent of the United States, No. 234,490, granted to me on the 16th day of November, 1880, and in certain Letters Patent granted me for subsequent improvements therein, or upon any other analogous system of working.

In the accompanying drawings, Figure 1 is a diagram representing one form of the improved organization of what is known as the "Muirhead double-block system," as the same at present exists for the duplex working of long submarine cables; and Fig. 2 is a diagram showing the arrangement and modification of said improved organization for carrying out the present invention.

It has been found practicable in operating the Muirhead double-block system, and other analogous systems of working, to establish and maintain a balance, without using bridge-wires, by adjusting the capacities of the condensers to each other.

The organization of the system shown in Fig. 1 is as follows: Rh is a rheostat of low resistance, adjustable to varying resistances, which is interposed between the signaling-key K and the condensers S' and S^2 . C represents the cable, and $A L$ the artificial cable, which are connected with these condensers by ordinary wires in the manner shown; and S^4 is a condenser, and R a receiving-instrument of any convenient form, which are inserted in the circuit between the real and the artificial cables. B represents the battery and E the earth. S^3 is the supplementary condenser for effecting the balance, and $H R$ the set of resistance-coils inserted in the resistance-circuit

between one terminal of the main condenser S^2 and one terminal of the supplemental condenser S^3 .

In order to still further facilitate the balancing of the main condensers by means of the supplementary condensers now in use, (shown in Fig. 1 of the drawings as S^3 ,) I introduce into the resistance-circuit, as shown in Fig. 2, between either of the main condensers and the supplementary condenser, either in connection with or without the resistance-coil $H R$, an electro-magnetic inductor, X , made of insulated wire, wholly or partially wound upon a bobbin, b , provided with an iron core, $x x'$, for the purpose of increasing the electro-magnetic capacity of the circuit, when required to do so. The iron core fitting into the bobbin upon which the wire is wound is made adjustable. The core is composed of two sections—one of a soft iron, which is the magnetizable section x , and the other of non-magnetic material, such as brass x' . The two sections are united by a beveled joint, as shown in Fig. 2, which construction permits of a careful adjustment of the amount of magnetizable metal within the coil and bobbin. The extremities of the core are so mounted that the core may be moved through the bobbin in the direction of its length by means of an adjusting-screw or other convenient mechanism. Any convenient or desirable number of such inductors may be used, either with or without the resistance-coil $H R$.

In certain cases it has been found advisable to apply independent resistance-circuits to both of the condensers in both the main and the artificial line, and this is now actually done upon long submarine cables. In such cases the electro-magnetic inductor may be introduced into either one or both of the resistance-circuits in connection with the supplementary condenser, and either with or without the resistance-coil $H R$, as before.

I claim as my invention—

1. In an electrical or telegraphic circuit, the combination, substantially as hereinbefore set forth, of an adjustable condenser with an adjustable resistance-circuit having an electro-magnetic inductor included in said circuit,

and means, substantially as described, for adjusting the energy and duration of the electric discharge from said inductor.

2. In an electrical or telegraphic circuit, the combination, substantially as hereinbefore set forth, of the receiving-instrument, the adjustable rheostat, the separate condensers in the circuit, one connecting with the actual and the other with the artificial or compensating line, the adjustable supplementary condenser, the adjustable resistance-coil, and the adjustable electro-magnetic inductor in connection with the circuit of said supplementary condenser, with the key and battery and the condenser in the circuit between the actual and artificial line.

3. In an electrical or telegraphic circuit, the combination, substantially as hereinbefore set forth, of the receiving-instrument, the adjustable rheostat, the separate condensers in the circuit, one connecting with the actual and the other with the artificial or compensating line, the adjustable supplementary condenser, and the adjustable electro-magnetic inductor in connection with the circuit of said supplementary condenser, with the key and battery and the condenser in the circuit between the actual and artificial line.

4. In an electrical or telegraphic circuit, the combination, substantially as hereinbefore set forth, of the receiving-instrument, the adjust-

able rheostat, the separate condensers in the circuit, one in connection with the actual and the other with the artificial or compensating line, the adjustable supplementary condensers placed in independent circuits surrounding said main condensers, and the adjustable electro-magnetic inductors in connection with said circuits, with the key and battery and condenser in the circuit between the main and the artificial line.

5. In an electrical or telegraphic circuit, the combination, substantially as hereinbefore set forth, of the receiving-instrument, the adjustable rheostat, the separate condensers in the circuit, one in connection with the actual and the other with the artificial or compensating line, the adjustable supplementary condensers placed in independent circuits surrounding said main condensers, and the adjustable electro-magnetic inductors and resistance-coils in connection with said circuits, with the key and battery and condenser in the circuit between the main and the artificial line.

Signed at 3 Elm Court Temple, in the city of London and county of Middlesex, this 3d day of February, A. D. 1885.

ALEXANDER MUIRHEAD.

Witnesses:

J. A. McMULLEN,
A. F. SPOONER.