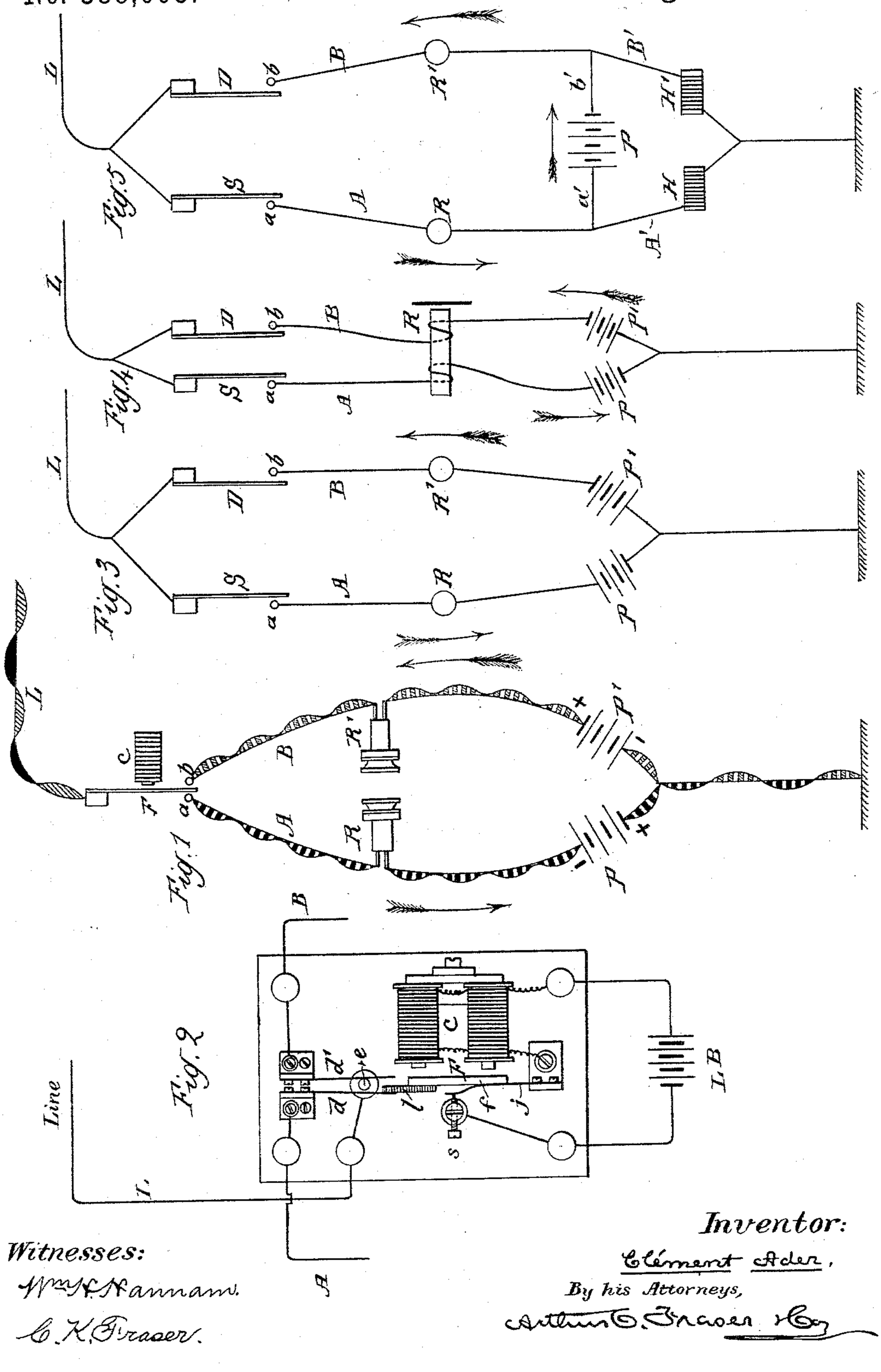
(No Model.) 3 Sheets—Sheet 1.

C. ADER.

ELECTRIC SIGNALING.

No. 388,008. Patented Aug. 21, 1888.



Witnesses:

Wm. F. Hamann.

C. K. Fraser.

Inventor:

Clément Ader,

By his Attorneys,

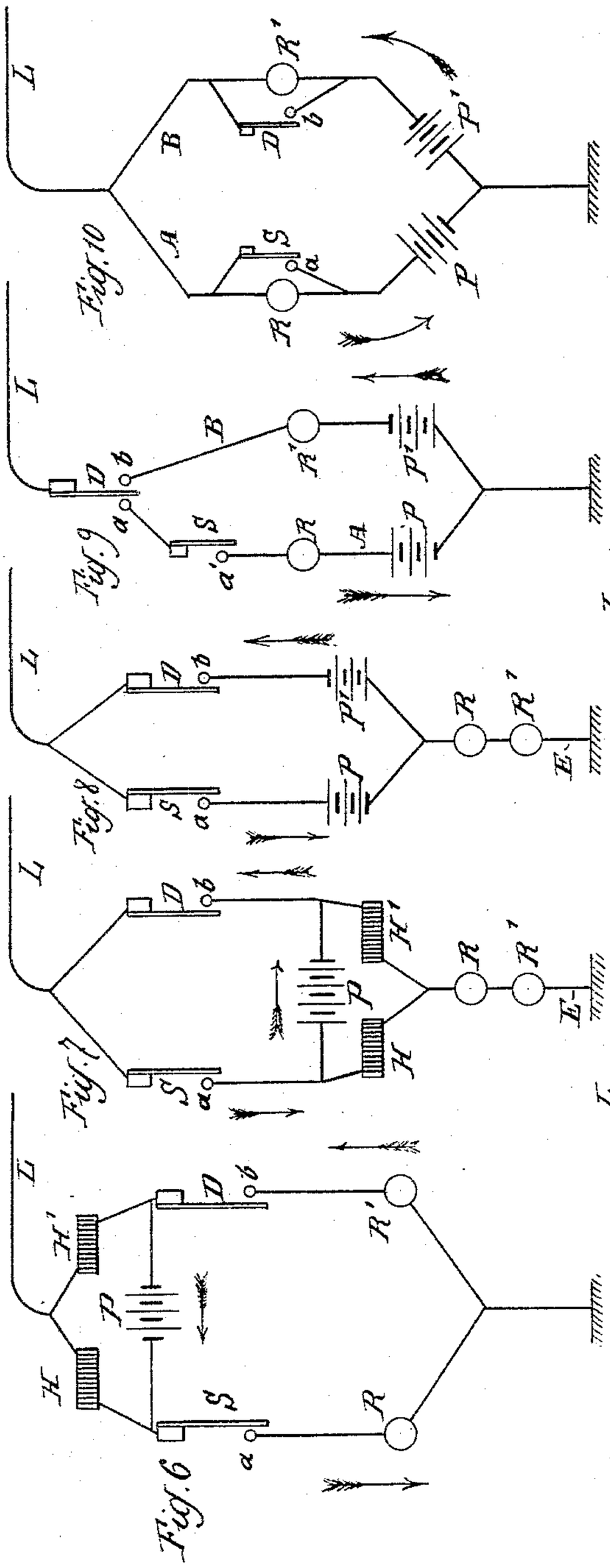
Arthur G. Fraser & Co

(No Model.) 3 Sheets—Sheet 2.

C. ADER.

ELECTRIC SIGNALING.

No. 388,008. Patented Aug. 21, 1888.



Witnesses:

Wm. F. Hamann.

C. K. Fraser.

Inventor:

Clément Ader,

By his Attorneys,

Arthur O. Fraser & Co.

(No Model.) 3 Sheets—Sheet 3.

C. ADER.

ELECTRIC SIGNALING.

No. 388,008. Patented Aug. 21, 1888.

Fig. 14.

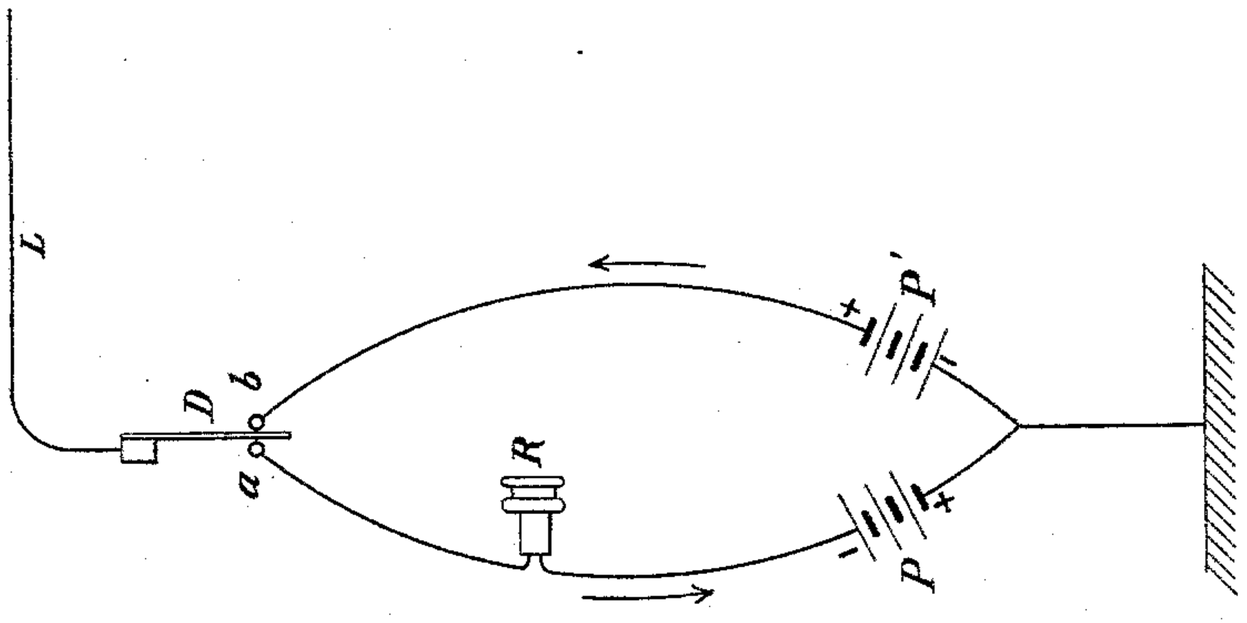
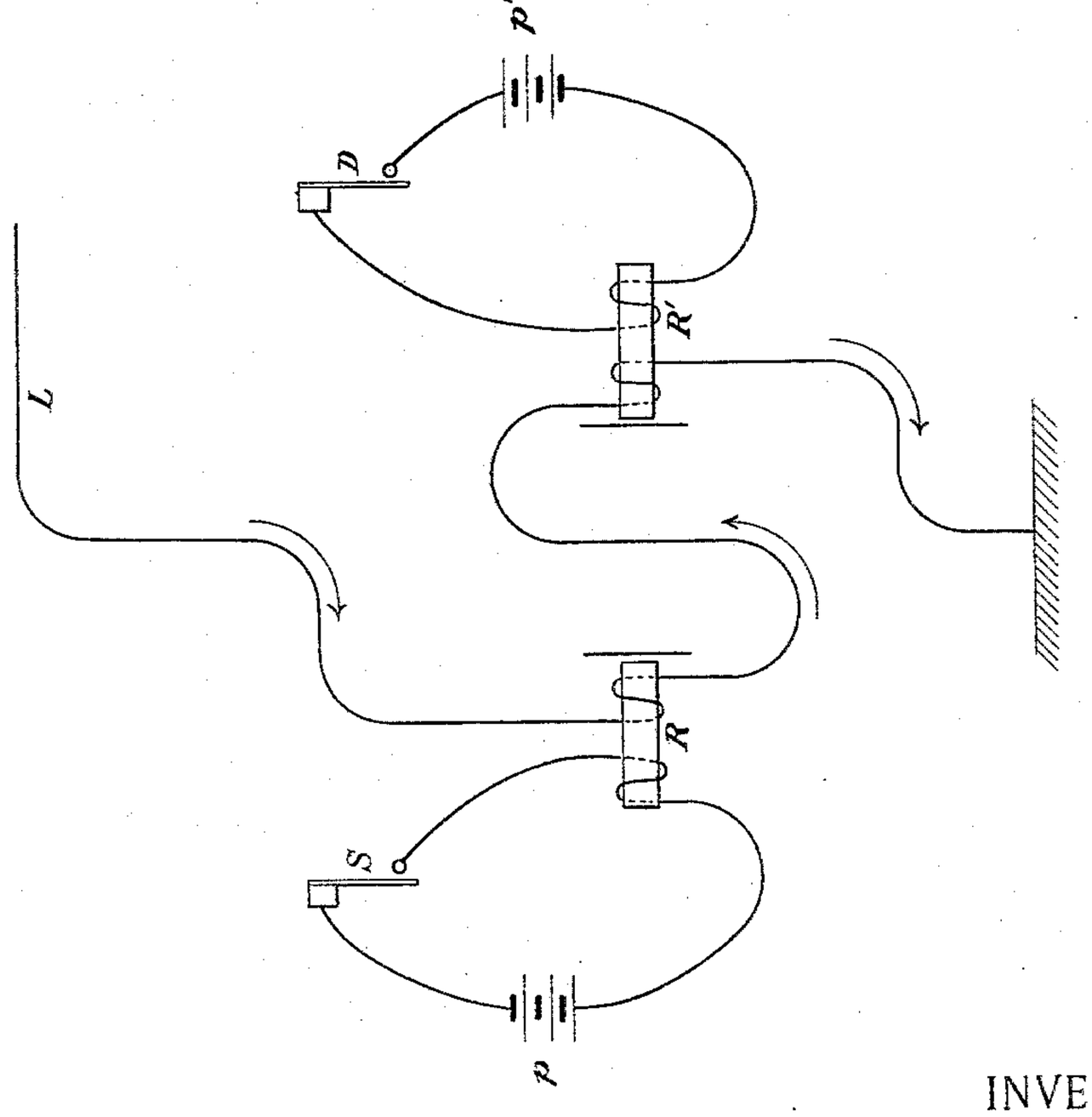


Fig. 15.



WITNESSES:

J. A. C. Criswell

C. K. Fraser.

INVENTOR:

Clément Ader,

By his Attorneys,

Arthur G. Fraser & Co.

UNITED STATES PATENT OFFICE.

CLEMENT ADER, OF PARIS, FRANCE.

ELECTRIC SIGNALING.

SPECIFICATION forming part of Letters Patent No. 388,008, dated August 21, 1888.

Application filed January 26, 1888. Serial No. 261,979. (No model.) Patented in England December 20, 1887, No. 17,528.

To all whom it may concern:

Be it known that I, CLEMENT ADER, a citizen of the French Republic, residing in Paris, France, have invented certain new and useful Improvements in the Art of and Means for Electric Signaling, of which the following is a specification.

This invention has been patented in Great Britain by No. 17,528, dated December 20, 1887.

My present invention relates in the main to an improvement on or modification of the system of electric signaling, called "The Phono-Signal," disclosed in my application for United States patent, filed July 1, 1887, Serial No. 243,124.

The object of my present invention is to render my phono-signaling system applicable to lines transmitting currents of alternating polarity.

In telegraphic transmission through submarine-cables a great advantage has always been found in representing the signals of the Morse alphabet by electric impulses or currents of both positive and negative polarity, the positive currents, for example, representing dots and the negative currents representing dashes. In reversing the direction of currents between a dot and a dash, or vice versa, the cable is discharged, which is an important advantage. According to my present improvement, I apply this means of transmission in connection with my phono signaling system for the reception of the electric signals in such manner as to reproduce distinctly in receiving-instruments the respective negative and positive signals in such manner that the respective signals are easily distinguishable the one from the other by the ear of the operator. The two receiving-telephones of the phono-signal being placed the one at the left ear and the other at the right, the positive signals corresponding to the dots are heard by the left ear and the negative signals corresponding to the dashes are heard by the right ear. To further distinguish the signals, I provide means for imparting to the sounds heard in the receiving-telephones a different pitch, that placed at the left ear, for example, giving a high and that at the right ear a low note.

In my above-mentioned application for patent I have explained that the undulatory current arriving over the line, being subdivided, is directed into two receivers and thence to earth, these two receivers being thus enabled to be utilized by putting them to the ears of the operator. The same principle is utilized with my present invention, with the additional provision that means are provided for influencing the two receivers in different manner, according as the currents are positive or negative.

Figure 1 of the accompanying drawings is a diagrammatic view illustrating the installation of the line-circuit and its subdivisions at the receiving-station. This view corresponds to the right-hand portion of Fig. 5 of my said original application. Fig. 2 is an elevation of the rheotome or commutator for effecting the subdivision of the current arriving over the line. Fig. 3 is a diagram corresponding to Fig. 1 and illustrating a further development of my invention. Figs. 4 to 15, inclusive, are diagrams of the same character as Fig. 3, which illustrate various modifications of which my invention is susceptible.

Referring to Fig. 1, the line-wire is divided at the receiving-station into two branches, A and B, which are reunited and connected with the earth, (or equivalently with any other return-circuit conductor.) In the branches A and B, respectively, are installed the telephonic receiving-instruments R and R′. The branches terminate, respectively, in contacts *a* and *b*, which are alternately put into communication with the line-wire L through the medium of the subdividing commutator or rheotome F. This commutator may consist of a vibrating plate or tongue vibrated by a magnet, *c*, receiving alternate currents from a local battery. As thus far described the installation is the same as in my said original application.

Let us suppose that the line L is traversed by both positive and negative currents—such, for example, as I have indicated in Fig. 1—by means of undulatory lines curving to opposite sides of a neutral line, the blackened undulations designating positive currents and the tinted undulations designating negative currents. On their arrival at the commutator or rheotome F these currents are divided between the two branches A B with a rapidity corresponding to the vibrations of an audible musical note, as described in my said original application, the currents passing half into one

branch and half into the other. According to my present invention, I intercalate in the respective branches A and B two batteries, P and P′, which are so polarized that in branch A the negative pole is turned toward the receiving-telephone and the commutator, while in branch B, on the contrary, the positive pole is turned toward them, as shown. It necessarily results from this arrangement that a local current (indicated by the two arrows) is caused to flow through the two branches—the receiving-telephones and the commutator. When no current is arriving over the line, the commutator or rheotome, by interrupting the local current from the batteries P P′, causes a continuous and regular sound to be produced in the two receivers R R′. This local current will be regulated by means of a rheostat or shunt for each battery, or in any other manner known to electricians for determining the current to be generated by a battery, in such manner that it shall have as nearly as possible the same volume and intensity as the current which ordinarily arrives over the line. Consequently when a positive current passes over the line it will always be divided by the commutator and pass off into each branch; but in the left-hand branch it will find itself re enforced by an equal current therein flowing in the same direction, while in the right-hand branch it will be opposed by a contrary current of the same intensity, and will therefore be neutralized, or approximately so. It follows that the receiver on the left will alone reproduce the sound and the receiver on the right will become mute. The arrival of a negative current will produce precisely the same effect except reversed. In this manner all positive signals, representing dots of the Morse alphabet, will be received at the left ear, and all negative signals, representing dashes, will be heard by the right ear of the operator. It will be understood that any suitable construction of the commutator may be employed—such, for example, as the several modifications thereof described in my said previous application.

Fig. 2 shows a rheotomic commutator which I prefer to use with my present invention. The electro-magnet *c* has its coils installed in a local circuit fed by a local battery, L B, and in front of its poles its armature *f* is arranged, being mounted on a flexible spring, *j*, the free end of which comes in contact with a screw, *s*. The spring *j* and screw *s* form part of the local circuit, so that when the magnet attracts its armature the spring is drawn away from the screw and the circuit is broken, whereupon the spring retracts the armature and re-establishes the circuit, thereby causing the incessant vibration of the armature in the manner well known in electro-magnetic rheotomes. The free end of the armature carries a finger, *l*, of insulating material, which vibrates between the ends of two very light metal springs, *d d′*, which constitute the terminals of the branches A and B of the circuit. Between the springs *d d′* is a metal contact-boss, *e*, which constitutes the terminal of the line. When the finger *l* is at mid-stroke, both springs *d d′* are in contact with the boss *e;* but at either extremity of the stroke of the finger one of these springs is pressed out of contact with this boss, thereby breaking the connection of the corresponding branch with the other branch.

I will now describe the construction shown in Fig. 3, which involves the complete development of my invention. In this arrangement two commutators or rheotomes are employed, lettered, respectively, S and D. Only the vibrating contact springs or arms of these rheotomes are shown, the electro-magnet or other means for vibrating them being omitted. The rheotome S is arranged in branch A and the rheotome D in branch B. The two rheotomes are adjusted to vibrate with different velocities, the left-hand one, S, having a velocity corresponding to the vibrations of a high note and the right-hand one, D, having a velocity corresponding to a low note. For example, the vibrations of S may be such as to produce the musical note *sol*, and those of D to produce the musical note *do*. The result of this arrangement is that the note *sol* will be heard in the left-hand telephone, R, and the note *do* in the right-hand telephone, R′. The arrangement and adjustment of the batteries P and P′ being precisely the same as in Fig. 1, it follows that the positive currents arriving over the line will cause an intensified *sol* note to be heard by the left ear, and the negative currents will cause an intensified *do* to be heard by the right ear, so that the operator can readily distinguish the dots of the Morse alphabet from the dashes, the former being heard with the pitch of *sol* and the latter with the pitch of *do*.

Fig. 4 shows a modified arrangement wherein only one telephone is employed, its core being wound with two coils, the one in branch A and the other in branch B, so that when no current is passing both notes *sol* and *do* are heard simultaneously; but when a positive current arrives the sound of *sol* is intensified and the *do* is extinguished, and on the arrival of a negative current the sound *do* becomes louder and the *sol* becomes mute. The principle of my invention, which I have thus described, may be carried into practice by a great variety of means, a few examples of which I have illustrated in the several diagrams in the accompanying drawings.

Fig. 5 shows an arrangement wherein a single local battery, P, is employed, having its one pole connected by a wire, *a′*, to the branch A, and its other pole connected by a wire, *b′*, to the branch B, so that the current circulates in the manner denoted by the arrows, its short-circuiting through the portions A′ and B′ of the branches being prevented by the intercallation therein of rheostats H and H′. Fig. 6 shows the same arrangement, with the exception that the battery P and rheostats H and H′ are arranged between the commutators S D and the line.

In Figs. 7 and 8 the receiving-instruments R R′ are connected serially in the earth-wire E, the *sol* and *do* being received simultaneously in both.

In the arrangement shown in Fig. 9 the commutator D subdivides the line-current between the two branches A and B, and the commutator S is arranged in one of the branches alone. The result is that a single note is heard in one receiver, and the two notes combined are heard in the other.

Fig. 10 shows an arrangement wherein the commutators S and D are arranged in short circuits or shunts in the respective branches A and B around the receivers R and R′.

In Fig. 11 the receivers R R′ have their cores wound with two coils, one of which is in the branch A or B and the other of which is in a distinct local circuit fed by a local battery, *p* or *p′*. The branches A and B are interrupted by the commutators or rheotomes S and D, as before; but there are no batteries connected with these branches directly. The local circuits, in which the batteries *p* and *p′* are connected, are interrupted by secondary commutators or rheotomes, S′ and D′, respectively, which vibrate synchronously with those of the branches A and B. The local currents serve to maintain the sounds of *sol* and *do* in the receivers until a current passes over the line, when, if it be a positive current, it will, according to the relative polarization of the batteries, either intensify or extinguish the *sol* in one telephone, and if it be a negative current it will in like manner intensify or extinguish the *do* in the other telephone.

Fig. 12 shows the same arrangement as that illustrated in Fig. 3, with the addition of a condenser, X, connected in the earth-wire E; and Fig. 13 shows the same arrangement as Fig. 5, with the addition of two condensers, C and C′, intercallated in the branches A and B.

In order to adjust the batteries their currents may be shunted through resistances in the manner well known to electricians.

It should be understood that it is not essential to my invention to employ two receiving-telephones, or even a single telephone having two coils traversed by the currents flowing over the two branches, since one of the telephones may be omitted from the arrangements shown in Figs. 1 and 3, as shown in Fig. 14, or, what amounts to the same thing, one of the telephone-coils from the arrangement shown in Fig. 4. Furthermore, the particular arrangement or position of the commutator or rheotome or interrupter in the circuits is not essential, provided it be so connected that by its interruption of the current, or a local current influencing the telephone, it shall produce an audible sound or note in the latter, which sound will be varied by the currents arriving over the line according as they are of positive or negative polarity. Nor is my invention confined in its application to use with currents of reversed polarities, as it may be utilized for the phonic translation of currents either entirely positive or entirely negative. In such case the passage of the current might, by the proper relative polar arrangements of the connections, be made to intensify or establish a *sol* note in one receiver and simultaneously diminish or extinguish a *do* note in the other. Fig. 15 shows such an arrangement. It differs from Fig. 11 only in that the line-circuit is not divided, but extends serially through the main coils of the two telephones R R′, which normally give the notes of *sol* and *do*, respectively, because of the rheotomes S and D in the local circuits. Such modifications as these are quite within the province of any practical electrician, who can put them in practice by the utilization of expedients well known in the art.

I claim as my invention the following defined improvements in means for electric signaling or telegraphing, substantially as hereinabove specified, namely:

1. The combination, with an electric signaling circuit, of a telephonic receiver in said circuit, a local battery in circuit with said receiver, and a rheotome arranged to interrupt the current from said local battery with a rapidity corresponding to the vibrations of an audible note, whereby a sound is produced in said receiver which remains uniform as long as no current arrives over the line and is varied audibly upon the passage of a line-current.

2. The combination, with an electric signaling circuit divided at the receiving-station into two branches, of a telephonic receiver in one of said branches, a local battery in circuit with said receiver and supplying a current thereto, and a rheotome arranged to interrupt the current from said battery with a rapidity corresponding to the vibrations of an audible note.

3. The combination, with an electric signaling circuit divided into two branches, of a telephonic receiver in one of said branches, a rheotome adapted to direct the current into said branches alternately with a frequency corresponding to the rapidity of vibration of an audible note, and a local battery in circuit with said branches and supplying a uniform current thereto, whereby the current from said battery is interrupted by said rheotome and produces a continuous sound in said receiver, which sound is varied audibly upon the passage of a line-current.

4. The combination, with an electric signaling circuit, of two telephonic receivers connected therewith, a local battery in circuit with one of said receivers and supplying a current thereto in one direction relatively to the line, a local battery in circuit with the other of said receivers and supplying a current thereto in the contrary direction, and two rheotomes constructed to vibrate at different velocities and arranged to interrupt the local currents traversing said receivers, respectively, whereby two different sounds are produced in

said receivers, which remain uniform as long as no current arrives over the line and are varied inversely to one another upon the passage of a line-current, the sound in the one being increased and the other diminished by a positive current, and the sound in the other increased by a negative current.

5. The combination, with an electric signaling circuit, of a telephonic receiver connected therewith, a local battery in circuit with said receiver and supplying a uniform current thereto, two rheotomes constructed to vibrate at different velocities, corresponding to audible notes of different pitch, and arranged to interrupt the current traversing said receiver, and electrical circuit connections between said local battery, receiver, and rheotomes and the line, so arranged that the polarities of the currents interrupted by the rheotomes are relatively reversed, whereby a positive current arriving over the line will cause a note of one pitch to be heard in said receiver and a negative current will cause a note of the other pitch to be heard.

6. The combination, with an electric signaling circuit divided into two branches, of a telephonic receiver in one of said branches, a local battery in circuit with said branches and regulated to supply a current thereto of equal intensity with the currents normally arriving over the line, and a rheotome arranged to interrupt the current from said battery with a rapidity corresponding to the vibrations of an audible note.

7. The combination, with an electric signaling circuit divided into two branches, of two telephonic receivers, one in each of said branches, a local battery in circuit with said branches and regulated to supply a current thereto of equal intensity with the currents normally arriving over the line, and a rheotome arranged to interrupt the current from said battery with a rapidity corresponding to the vibrations of an audible note, whereby a continuous sound is produced in both receivers so long as no current arrives over the line, and is extinguished in one receiver upon the passage of a positive current and in the other upon the passage of a negative current.

8. The combination, with an electric signaling circuit divided into two branches, of two telephonic receivers, one in each branch, two local batteries intercalated in said branches with their poles reversed relatively to the line, and a rheotome arranged to interrupt the currents from said batteries with a rapidity corresponding to the vibrations of an audible note.

9. The combination, with an electric signaling circuit divided into two branches, two telephonic receivers, one in each branch, a rheotome adapted to direct the current into said branches alternately with a frequency corresponding to the rapidity of vibration of an audible note, and two local batteries intercalated in said branches with their poles reversed relatively to the line.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CLEMENT ADER.

Witnesses:
J. B. BOURNE,
AMAND RITTER.