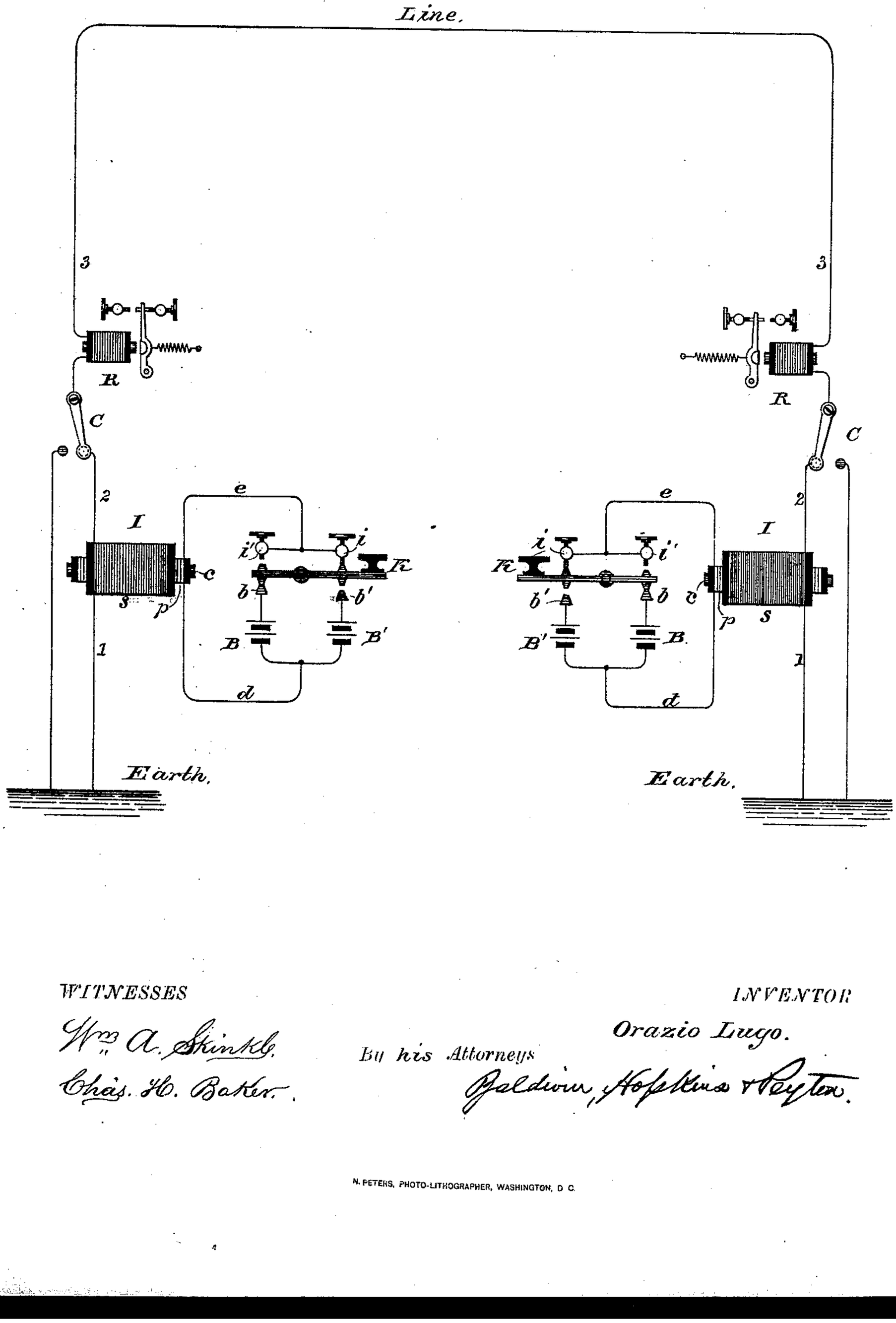
(No Model.)

O. LUGO.

Telegraphing by Induced Currents.

No. 235,160. Patented Dec. 7, 1880.



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TELEGRAPHING BY INDUCED CURRENTS.

SPECIFICATION forming part of Letters Patent No. 235,160, dated December 7, 1880.

Application filed August 23, 1880. (No model.)

To all whom it may concern:

Be it known that I, ORAZIO LUGO, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Telegraphy by Induced Currents, of which the following is a specification.

My invention relates to the transmission of telegraphic signals over long lines by the employment of secondary induced currents or pulsations of high electro-motive force or intensity, which are generated by means of a battery or batteries of comparatively small power through the medium of an induction-coil.

It is well known that an electrical pulsation or current of brief duration is produced in the secondary circuit of an ordinary induction-coil upon the closing of the primary circuit, which induced current is of opposite polarity or direction to the inducing current, and that another similar pulsation is produced at the moment of breaking the primary circuit; but in this case its polarity or direction is the same as that of the primary current. The electro-motive force or intensity of the secondary current may be made greater than that of the primary by increasing the number of convolutions of wire in the secondary wire of the induction-coil in proportion to the number of convolutions of the primary; but whatever this proportion may be it is well known that the electro-motive force or intensity of the secondary pulsation which takes place when the primary circuit is closed is very much less than that of the pulsation which occurs when the primary circuit is broken; hence a difficulty has arisen in the application of this apparatus to telegraphy, especially upon circuits of great length. The signals being made at the sending-station by simply opening and closing the primary circuit of the induction-coil, depending upon the alternate secondary pulsations thus produced to operate the receiving-instrument at the distant station, it has been found in practice that the comparatively feeble pulsations occasioned by the closing of the primary circuit often failed to produce any effect upon the receiving-instrument, while at the same time the pulsations caused by the breaking of the primary circuit were perfectly responded to by the receiving-instrument.

My invention is intended to overcome this difficulty; and it consists in producing all the secondary pulsations which are employed in the formation of signals by the breaking or interruption of the primary circuit, and utilizing the feebler pulsations caused by the closing of the primary circuit for the purpose of clearing the line from static electricity between the signals, which is important in the operation of long lines when the signals are required to be sent in rapid succession.

The accompanying drawing is a diagram illustrating my invention, and represents two terminal stations connected by a line in the ordinary manner. The apparatus at the two stations is the same, and therefore a description of one will suffice for both.

In the figure, I is an induction apparatus of well-known construction, consisting of an iron core, *c*, upon which is wound a primary coil, *p*, of a comparatively small number of convolutions of coarse wire, and outside of this a secondary coil, *s*, having a much larger number of convolutions of finer wire. The proportion between these coils will be determined in practice by the length of line through which it is designed to transmit the signals.

R is the receiving-instrument, which may be of the ordinary construction, consisting of an electro-magnet having an armature arranged to vibrate between adjustable stops, and a retracting-spring, all of which are well known, and therefore need no detailed description. One terminal of the secondary coil *s* of the induction apparatus is connected with the earth, and the other, by the wire 2, with the receiving-instrument, whence the wire 3 goes to the line and distant station. By means of a switch, C, the line may be connected directly from the receiving-instrument to the earth in receiving communications, thereby removing the resistance of the secondary coil *s* from the circuit, if desired.

The transmitting-key K oscillates between four stops or contacts, *b b' i i'*. The stops *b* and *b'* are, respectively, connected with the

like poles of two local batteries, B and B′, which may have from one to, say, five cells each. The remaining poles of these batteries are joined by a common wire, *d*, to one terminal of the primary coïl *c* of the induction apparatus I, and the other terminal of the latter is connected by a common wire, *e*, with the contacts *i* and *i′* of the key K. When the key is at rest, as shown in the figure, it forms a connection between the contacts *b* and *i*, and thus closes the circuit of the battery B through the primary coil *p* of the induction apparatus, and causing the core *c* to become magnetic. If, now, the key K be depressed, the primary circuit is momentarily broken, which demagnetizes the core *c* and induces a pulsation of great intensity in the secondary coil *s*, which traverses the line and causes the receiving-instrument R to momentarily attract its armature and produce a signal. The key then closes the circuit of battery B′ between the points *b′* and *i′*, which transmits a feebler pulsation of reverse polarity. This serves to discharge the line of any static electricity remaining after the transmission of the signal. When the key is raised the primary circuit is again broken between *b′* and *i′*, and another pulsation is transmitted having the same polarity as the one which was transmitted by depressing the key, and this is again followed by a weak pulsation of opposite polarity, as before. Thus a pulsation of the same polarity is produced by breaking the primary circuit at each elevation as well as each depression of the key.

If the key is manipulated in the ordinary manner, as in the Morse telegraph, the signals upon the receiving-instrument will consist of a series of "dots," as they are technically termed, and the different letters or characters may be distinguished by means of the varying intervals of time between them, if read by sound, or by varying intervals of space when recorded on paper in the ordinary manner. By making the local battery B′ somewhat more powerful than the battery B a corresponding difference will be manifested in the respective signals upon the receiving-instrument, and they can then be read as from a common Morse sounder.

The receiving-instrument may be constructed as a direct sounder or recorder, or as a relay to work other instruments through the agency of a local battery.

Way-stations may be inserted at any point between the terminal stations in a manner well understood.

By the use of my invention intelligible telegraphic signals may be transmitted through several hundred miles of line by means of power derived from a battery of two or three ordinary cells, and the annoyance and expense inseparable from the use of powerful batteries of two or three hundred cells is entirely avoided.

I do not desire to confine myself to the particular construction and arrangement of the transmitting-key which I have described, as it is obvious that this may be arranged in various ways to produce substantially the same result.

I claim as my invention—

1. The hereinbefore-described art, method, or system of transmitting telegraphic signals by secondary or induced currents, which consists in producing the pulsations constituting the signals by the breaking of the primary current, and in employing the weaker pulsations caused by closing the primary circuit to clear the line from static electricity between the signals.

2. The combination, substantially as hereinbefore set forth, of an inductor consisting of an iron core, a primary and a secondary coil, a key or transmitting-instrument which momentarily interrupts the circuit of the primary coil, both when it is depressed and when it is elevated, and a receiving-instrument included in the circuit of the secondary coil.

Signed by me this 21st day of August, A. D. 1880.

ORAZIO LUGO.

Witnesses:
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