A. G. BELL.

Transmitter and Receiver for Electric-Telegraphs.

No. 161,739. Patented April 6, 1875.

Fig. 1.

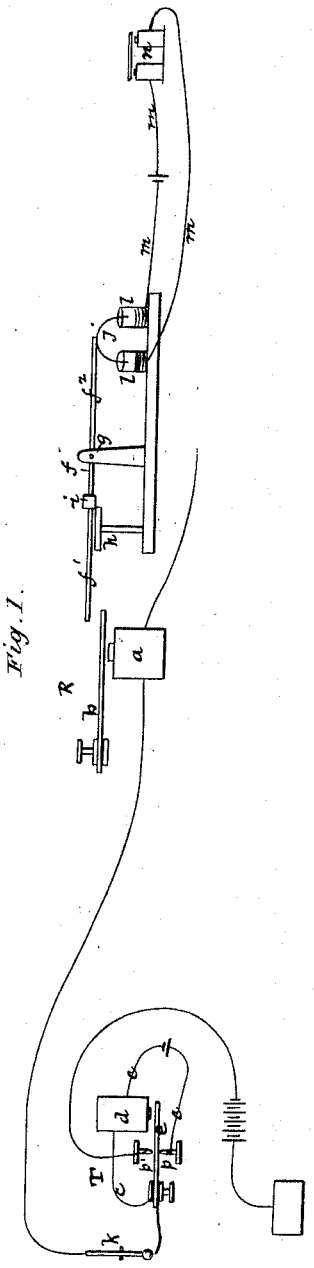
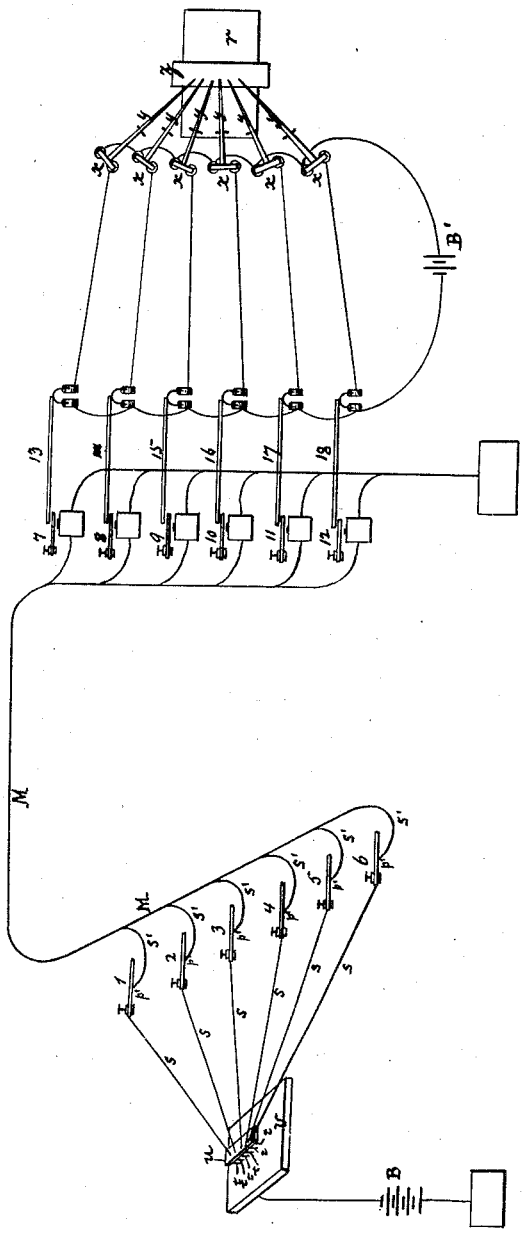


Fig. 2.



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ALEXANDER GRAHAM BELL, OF SALEM, ASSIGNOR TO HIMSELF AND THOMAS SANDERS, OF HAVERHILL, AND GARDINER G. HUBBARD, OF CAMBRIDGE, MASSACHUSETTS.

IMPROVEMENT IN TRANSMITTERS AND RECEIVERS FOR ELECTRIC TELEGRAPHS.

Specification forming part of Letters Patent No. **161,739**, dated April 6, 1875; application filed March 6, 1875.

To all whom it may concern:

Be it known that I, ALEXANDER GRAHAM BELL, of Salem, Massachusetts, have invented certain new and useful Improvements in Apparatus for Transmitting and Receiving Telegraphic Signals or Messages, of which the following is a specification:

In another application for Letters Patent I have described a method of and apparatus for transmitting two or more telegraphic messages or signals simultaneously along a single wire by the employment of transmitting-instruments, each of which transmits, per second, impulses differing in number from the others, and receiving-instruments, each tuned to a pitch at which it will be put in vibration to produce its fundamental tone by one only of the transmitting-instruments.

In illustration of that method I have shown in the application aforesaid, as one form of receiver, an electro-magnet having a steel-spring armature tuned to the pitch above specified. My present invention primarily is directed to the employment of the vibratory movement of the vibrating part of the receiver, for the purpose of actuating any ordinary or suitable electro-magnetic recording or sounding instrument. This result I have effected by the employment, in a local circuit, (in which is also the recording or sounding instrument,) of a vibratory circuit-breaker acted upon by the receiver, and operating to convert the vibratory motion of the latter into a permanent make or break, as the case may be, of the local circuit, which is continued so long as the receiver continues in a state of vibration.

The arrangement above indicated is applicable to a line where but one receiver is employed, as well as to a line combining a number of receivers. In the latter case each receiver will of course have its own vibratory circuit-breaker arranged in a distinct circuit, which contains only that recorder or sounder which is to be affected by the receiver.

I prefer to use for the vibratory circuit-breaker a light lever of the first order; but I desire here to remark that this form is not arbitrary. Many forms of circuit-breakers for the purpose may be employed—such as membranes, &c., all that is required being that the circuit-breaker shall be capable of vibratory or oscillatory movement, and that its normal rate of movement, when in oscillation or vibration, shall be slower than that of the motor (the vibrating portion of the receiver) by which it is actuated.

To enable others skilled in the art to understand and use my invention, I shall now proceed to describe the manner in which the same is or may be carried into effect, by reference to the accompanying drawing.

In Figure 1, R is the receiver, consisting, in this instance, of an electro-magnet, *a*, and a steel-spring armature, *b*, tuned to a pitch at which it will be put in vibration by the succession of electrical impulses sent through the electro-magnet by the action of the transmitter T. The latter instrument, although constituting, *per se*, no integral part of my present invention, is indicated in diagram, in order to better explain the nature of my improvements. It consists of a local circuit, *c*, and an electro-magnet, *d*, a vibrating steel-spring armature, *e*, tuned to a pitch to accord with the spring *b* of the receiver, two platinum points, *p p'*, between which the spring vibrates, the one, *p'*, communicating with the main line, the other, *p*, with the local, and a key, *k*, by means of which the intermittent impulses due to the action of the vibrating armature can at pleasure be sent along the main line, to affect the vibrating armature *b* at the receiving-station. Adjoining the receiver I place a light lever, *f*, of wood, straw, or other suitable material for the purpose. This lever is mounted to oscillate freely on a pivot or axis, *g*, and one of its ends, f^1, overhangs the free end of the vibratory armature *b*. The normal rate of movement of the lever, when oscillating or vibrating, is considerably less than that of the armature, the consequence of which is that the latter, when in vibration, will, by striking the overhanging end of the lever, elevate that end, and consequently depress the other, which tilted condition of the lever will be maintained so long as the armature continues in vibration. An adjustable stop, *h*, is provided to regulate the distance which shall intervene be-

tween the overhanging end of the lever and the free end of the armature when both are at rest. A weight, *i*, adapted to slide on the overhanging half of the lever, may also be provided to regulate the weight of the one arm of the lever with relation to the other arm. The overhanging arm should slightly exceed the other in weight. The proper excess can be readily ascertained and obtained by means of the sliding weight. To the end f^2 of the lever is attached a platinum bow, *j*, the two ends of which extend down toward two mercury-cups, *l l*. In the present instance the local circuit *m*, in which the mercury-cups are located, is to be closed when the receiver vibrates. To this end the platinum points *l*, when the lever is at rest, are elevated far enough to be out of contact with the mercury; but when, by the action of the vibrating receiver the lever is tilted, the platinum points are depressed far enough to dip well into the mercury, thus completing the local circuit and exciting the electro-magnetic instrument in the circuit, which in this case is an ordinary Morse sounder, *n*.

To prevent oxidation as far as practicable, the mercury-cups are filled above the mercury with glycerine, into which the platinum points at all times are immersed. A condenser may be used in the local circuit to reduce the spark.

The local circuit above shown is normally open; but it is obvious that with slight changes I can work as well with a local circuit normally closed. It will also be understood that other connections beside the mercury-cups can be used. I much prefer, however, the latter. By means of the vibratory circuit-breaker thus actuated, I can operate not only the Morse sounder, but the register or recorder as well. By the same means I can also operate printing mechanisms—such as Hughes's, and type-writers, such as that of Shole & Glydden. The latter will, of course, require one transmitter and one receiver and vibratory circuit-breaker for each key. The same arrangement of circuit-breaker can be adapted to the chemical telegraph, and the various systems of autograph-telegraph.

A system of autograph-telegraph devised by me and based upon the above-described method of operating the vibratory circuit-breaker by the vibrations of the receiver, is represented in Fig. 2. 1 2 3 4 5 6 are transmitting-instruments, such as represented in Fig. 1. The local circuit or circuits for these transmitters I have omitted, to avoid confusion. Each vibrating armature connects by a wire, *s*, with a metallic or conducting bristle, *t*, mounted in a non-conducting base, *u*, placed over the metallic plate *v*, with which the bristles are in contact. The plate is in communication with the main battery B. The bristles are insulated from one another and are placed as near together as possible. From the platinum point p' of each transmitter (with which point the vibrating armature of the transmitter makes and breaks contact during its vibration) leads a wire, s', to the main line M. For each transmitter there is, at the receiving end of the line, a corresponding receiver—such, for instance, as indicated in Fig. 1, whose armature responds in vibration to one only of the transmitters. The receivers are indicated at 7 8 9 10 11 12. The main line, by branches, passes through each electro-magnet of each receiver, and thence to earth. With each receiver is combined a vibratory circuit-breaker, in the manner hereinbefore described. These circuit-breakers are indicated at 13 14 15 16 17 18. The mercury-cups of the circuit-breakers are in a circuit worked by battery B'. The local-circuit connections are plainly indicated in the diagram. In the local circuit are electro-magnets *x*, one for each receiver, and above each electro-magnet is one arm of a vibratory lever, *y*, constituting the armature of the magnet. The other arm of the lever terminates in a stylus, which normally rests upon an ink-ribbon, *z*, just above the plate or bed *r*. The stylus-armed ends of the levers converge, so as to be about as near, and in the same relative position to one another, as the metallic bristles at the transmitting end of the line.

To operate the apparatus the message or object to be copied at the receiving end is written or impressed in non-metallic ink on a sheet of metallic foil, and this sheet is placed on the metal plate under the bristles at the transmitting end. The sheet of paper, or other material on which the message is to be delivered, is placed on the receiving-table *r*, under the stylus-armed levers. Both sheets are dragged or drawn along (not necessarily, however, at the same rate of speed) over their respective tables. So long as the bristles have metallic contact, intermittent electrical impulses from their respective transmitters pass along the line-wire, and operate all the receivers, the consequence of which is the vibratory circuit-breakers are operated to close all the connections of the local circuit, all the electro-magnets in that circuit are excited, and all the recording-levers are attracted by the magnets and lifted from the ink-ribbon. When, however, the message comes under the bristles, each of said bristles, according to the position of the non-metallic line or surface under it, will be brought in contact with a non-conductor, which will have the effect of interrupting the series of intermittent impulses from the transmitter connected with that bristle, and consequently the corresponding receiver at the other end will cease to vibrate, the circuit-breaker of that receiver will be removed from contact with its mercury-cups, thus breaking the circuit between those cups and the electro-magnet connected therewith, and the magnet, losing its power, will release the recording-lever, whose stylus end will consequently drop and impress a mark, through the medium of the ink-ribbon, on the paper or other sheet passing between the ink-ribbon and the recording-table. In this way an exact copy of any message, picture, or other object impressed or

written upon the metallic foil can be transmitted to and obtained at the receiving end.

The recording-levers can be provided, if need be, with light springs, to draw them quickly down onto the ink-ribbon when released by their electro-magnets.

Having described my invention, what I claim, and desire to secure by Letters Patent, is as follows:

1. In a system of telegraphy in which the receiver is put in vibration by electrical impulses sent along the line-wire from the transmitting-station, as described, the combination at the receiving end of a local circuit independent of the receiver and a vibratory circuit-breaker in said local circuit, acted upon by said receiver to effect a permanent make or break, as the case may be, of the local circuit, which is continued so long as the receiver continues to vibrate, and ceases with the cessation of the receiver's vibration, substantially as herein set forth.

2. The combination, substantially as herein described, with the vibratory portion of the receiver, of a vibratory circuit-breaking lever which will vibrate or oscillate at a slower rate than that at which the former moves when in vibration, as and for the purposes set forth.

3. The autograph-telegraph, comprising the combination of a series of transmitters and transmitting bristles or wires, a single main wire, receivers corresponding in number to the transmitters, tuned to a pitch to vibrate in unison with the succession of electric impulses transmitted from their respective transmitters, vibratory circuit-breakers, one for each receiver, and a local circuit, electro-magnet, and recording-lever for each circuit-breaker, the whole for operation substantially as shown and described.

In testimony whereof I have hereunto signed my name this 2d day of March, A. D. 1875.

A. GRAHAM BELL.

Witnesses:

EWELL A. DICK,

HENRY R. ELLIOTT.