(No Model.)

C. A. RANDALL.

Apparatus for Chemical Telegraphs.

No. 238,713. **Patented March 8, 1881.**

Fig: 1.

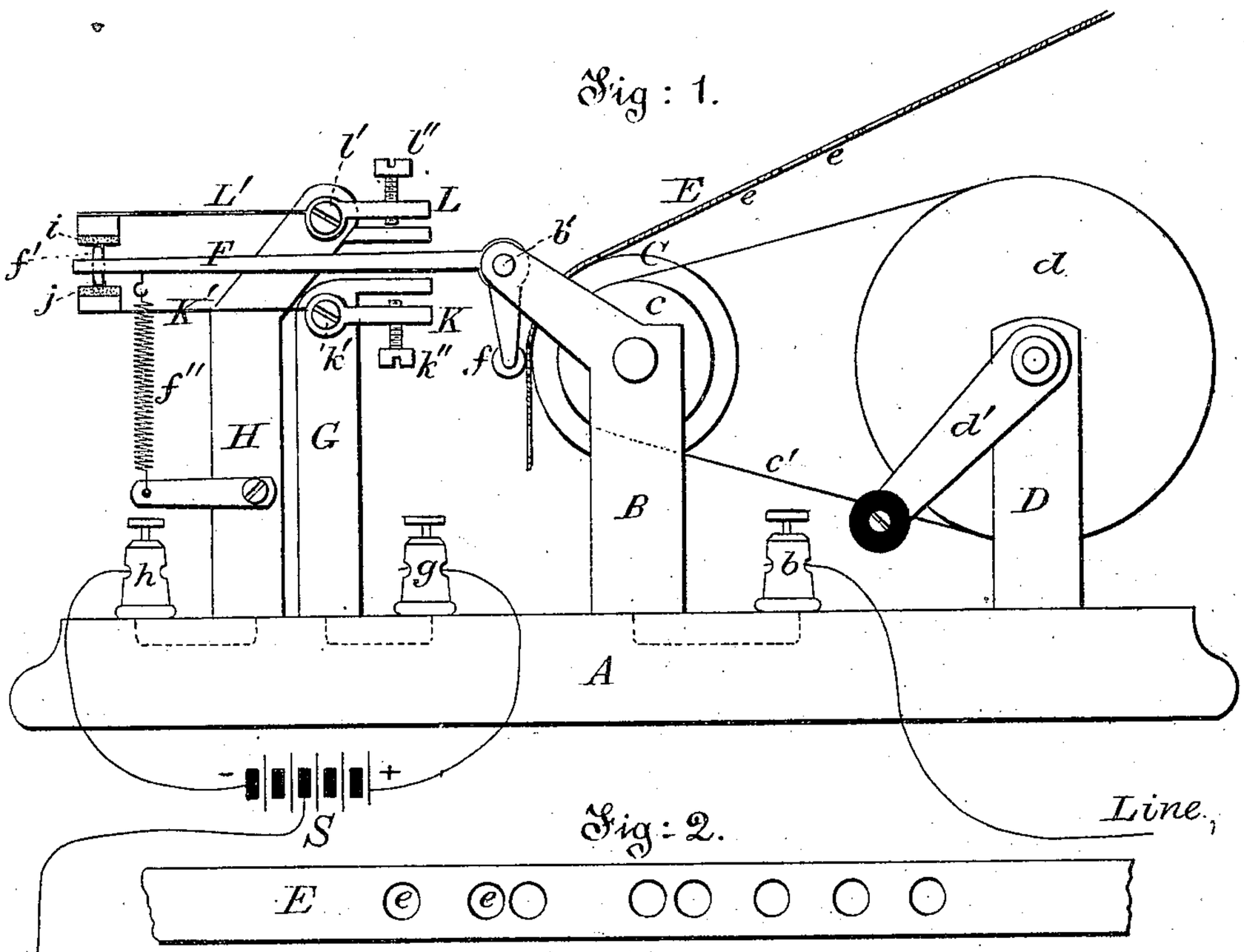


Fig: 2.

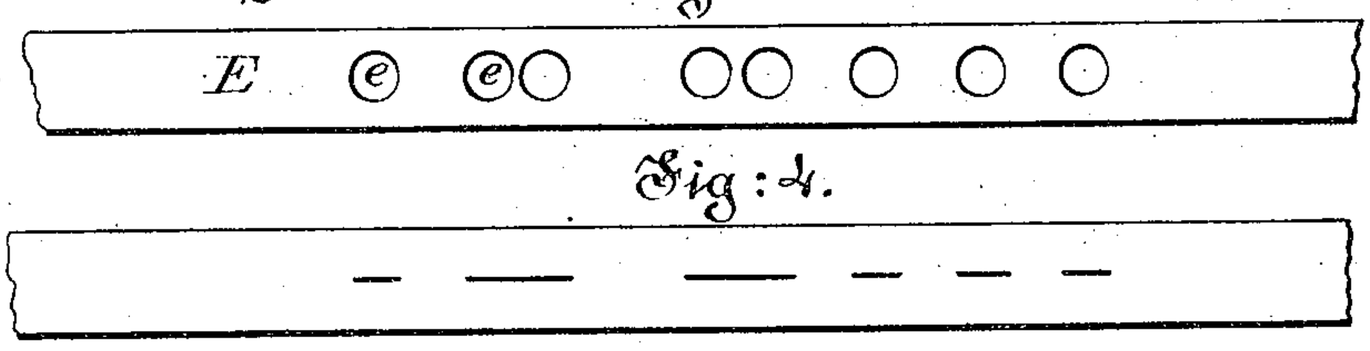
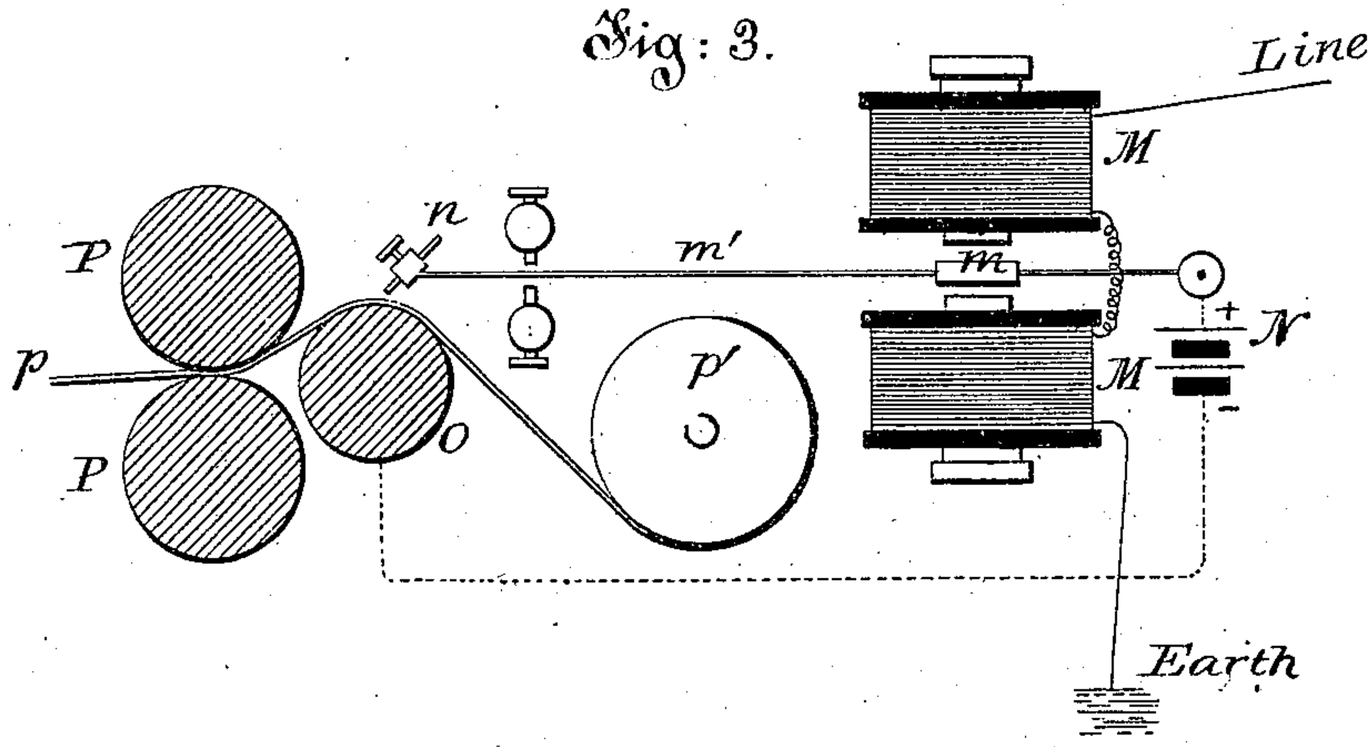


Fig: 4.

Fig: 3.



WITNESSES:

Walter C. Earl.

J. Lockwood French.

INVENTOR,

Charles A. Randall,

by Frank L. Dyer.

ATTORNEY

UNITED STATES PATENT OFFICE.

CHARLES A. RANDALL, OF NEW YORK, N. Y.

APPARATUS FOR CHEMICAL TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 238,713, dated March 8, 1881.

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

To all whom it may concern:

Be it known that I, CHARLES A. RANDALL, of the city, county, and State of New York, have invented certain new and useful Improvements in Systems of Chemical Telegraphy and Apparatus therefor, of which the following is a specification.

My invention relates to that class of chemical telegraphs in which the transmission of signals is effected by means of an automatically-operating transmitter, the movements of which are controlled by a previously-prepared pattern, usually consisting of a perforated or embossed strip, band, or sheet, the perforations or embossments upon which are so grouped as to produce the required duration and succession of signals upon the line.

In the chemical telegraphs heretofore in use, two principal modes of transmission have been made use of, one of which may be termed the "single-current" and the other the "double-current" system. In the first-mentioned system the signals are formed by electrical currents or pulsations, all of which are of the same polarity, but of varying duration or length, the spaces separating the signals from each other being formed by breaking or intermitting the current. In the second system the signals are formed by a succession of currents or impulses alternately of positive and negative polarity. The latter system is much the most effective, especially for very rapid transmission and on lines of considerable length, as the retarding and otherwise troublesome effects of static induction are greatly diminished by the well-known action of the alternating currents.

In order to transmit the required succession of alternating currents by means of a strip of perforated paper, which is the most usual and convenient device for the purpose, it has heretofore been necessary to arrange the perforations in two rows or lines, one row of perforations transmitting currents or impulses of one polarity, and the other row those of the opposite polarity. When this method is made use of there is necessarily a break of the circuit at the transmitting contact-points at each change of polarity. This interruption of the circuit produces a spark at the end of each signal, which has proved to be a very serious objection in practice, inasmuch as it frequently fuses the metallic contact-points, and sometimes burns and destroys the edges of the perforations. The interruption of the circuit, also, has the effect of lessening or shortening the actual time during which the line is closed for each signal, and this frequently causes single short impulses, or "dots," as they are technically termed, to disappear or fail to be recorded at the receiving-station.

The usual method of recording which has been employed in connection with the double-current system hereinbefore referred to has been that of causing a strip of chemically-prepared paper to pass beneath two metallic recording-styluses placed side by side, these being so connected with the circuit of the main line that one stylus is made to record only the positive currents from the transmitting-station, and the other stylus in like manner only the negative currents or impulses. Thus the successive signals were recorded alternately in two parallel lines upon the strip of chemical paper. The unequal consumption of the points of the styluses or pens, when of iron, and the frequent adjustment of them necessitated thereby, has always been a great and hitherto insurmountable objection to this method of recording.

It may also be remarked that the necessity of preparing the transmitting-strip by perforating it with two rows of perforations adds greatly to the complication of the perforating machinery which it is necessary to make use of in the preparation of the strips, thereby rendering it much more expensive to construct and difficult to operate.

By the use of my improved method and apparatus I am enabled to make use of the double-current system of transmission, and at the same time to avoid in a great measure the difficulties and objections hereinbefore referred to.

To this end my invention consists, first, in the combination of one or more electro-magnets at the receiving-station, arranged to act upon a polarized armature, and a chemical recording apparatus in a secondary circuit, which is opened and closed by the movement of said armature, with a pole-changing continuity-preserving key or transmitter at the sending-station, the movements of which are

controlled by a suitable pattern strip, band, or sheet; second, in the combination of a pattern strip, band, or sheet, having predetermined characters formed thereon by perforating or embossing, with a pole-changing continuity-preserving key or transmitter having contact-surfaces of graphite or carbon, whereby the adjustment of the transmitter is more easily effected and the short-circuiting of the battery is prevented.

In the accompanying drawings, Figure 1 is a side elevation of my improved transmitter, and Fig. 2 represents a portion of a perforated strip or band which is intended to be employed in connection therewith. Fig. 3 is a diagram of the receiving-instrument, and Fig. 4 is a portion of the record produced by the receiving-instrument, corresponding to the perforations in Fig. 2.

Referring to Fig. 1, A is the base, upon which the different parts of the transmitting apparatus are mounted. The standard B, attached to said base, carries a roller or drum, C, upon the axis of which is a pulley, *c*, by which the drum may be put in rotation by a band, *c'*, attached to any convenient uniform source of power. In the drawings I have shown a driving-pulley, *d*, and crank *d'*, mounted upon a suitable standard, D, affixed to the base A. A strip of paper or other suitable material, E, which has previously been prepared, by means of perforations or otherwise, so as to form a prearranged pattern, is drawn over the drum C as it revolves.

An L-shaped lever, F, is mounted upon an axis, *b'*, upon the standard G, and carries at the extremity of its shorter arm a roller, *f*, which rests upon the pattern-strip E in the line of its perforations as it passes beneath it. A spring, *f''*, attached to the longer arm, keeps the roller *f* at all times pressed firmly against the pattern-strip. The effect of this arrangement is, that when the successive perforations in the pattern-strip E (which are arranged in a straight line, as seen in Fig. 2) pass beneath the roller *f*, a vibratory motion is communicated to the lever F as the roller drops into the perforations, and is raised again a distance determined by the thickness of the band during the passage of the spaces between the perforations. Thus the vibration of the lever F corresponds to the arrangement of the perforations in the pattern-strip E.

The long arm of the lever F carries a pair of contact-points, *f'*, preferably of platinum, which play between the contact-surfaces *i* and *j*. The latter are mounted upon spring-arms L' and K', these being attached to rigid arms L and K, pivoted at *l'* and *k'* upon separate standards H and G. The contacts *i* and *j* are to be carefully adjusted by means of the screws *l''* and *k''*, provided for that purpose, so that when the long arm of the lever F is at the middle point of its vibration the contact-points *f'* will be pressed lightly by both contact-surfaces *i* and *j*, but the slightest movement in either direction of the lever F will interrupt the contact upon the opposite side. The lever F is electrically connected with the line-wire through the standard B and binding-screw *b*. The contact *j* is connected, through the spring-arm K', standard G, and binding-screw *g*, with the positive pole of the main battery S. The contact *i* is in like manner connected with the negative pole of the battery through L', H, and *h*. A wire running to the earth is attached to the battery S at a point about midway between its two poles, as shown in Fig. 1. Thus it will be understood that when the apparatus is in the position shown in Fig. 1, the roller *f* resting upon the pattern-strip E, the lever F will make contact with the contact-surface *i* and a negative current will flow to the line; but as the pattern-strip moves forward, the roller will drop into each of the perforations *e e* as they successively pass beneath it, when the lever F will make contact with *j* at the same time or before it breaks contact with *i*. By this arrangement the circuit is never absolutely broken, but the current going to the line is changed from positive to negative, or vice versa, at each movement of the contact-lever F.

I prefer in all cases to make the contact-surfaces *i* and *j* of graphite, carbon, or some similar semi-conducting material, thus availing myself of the well-known property of these substances, by virtue of which their surface conductivity varies enormously under pressure. By the movement of the lever F this pressure decreases upon one side as it increases upon the other, the resistance being at a maximum upon both sides when the lever is in its middle position and in contact with both sides, at which time the battery would be short-circuited were it not for the great resistance offered by the carbon contacts.

The receiving-instrument is very simple in its construction, and will be understood by reference to the diagram, Fig. 3. A polarized armature, *m*, is mounted upon a pivoted lever, *m'*, preferably between the poles of two electro-magnets, M M. The lever *m'* carries at its free end an adjustable metallic stylus, *n*, which is suspended thereby above a strip of chemically-prepared paper, *p*. This strip of paper unwinds from a roll, *p'*, and is drawn along between rollers P P, (moved by clock-work or otherwise,) passing over a metallic roller, O, beneath the stylus. The positive pole of a local battery, N, is attached to the lever *m'*, carrying the stylus *n*, and the other pole is connected to the roller O. A positive current traversing the line from the sending-station, and passing through the electro-magnets M M, will cause the polarized armature *m* to be deflected in a direction to bring the stylus *n* into contact with the moving strip of chemical paper *p*, and a mark will be produced thereby upon the paper, which will continue as long as the positive current flows over the line. The negative or spacing current will act in the opposite direction upon the polarized armature

m, withdrawing the stylus from the paper. The marks thus correspond in length to the groups of perforations in the pattern-strip, as will be observed by comparing Figs. 2 and 4. The dashes or long marks in the record are produced by means of two perforations in a group placed close together one after the other. In this case the space between the perforations is of such short duration that the reversal of the current produced thereby is not perceptible upon the record at the receiving-station. Two circular perforations are employed in lieu of a single elongated one, for reasons connected with the mechanical construction of the perforating machinery, and which need not be further enlarged upon in this description.

I do not desire to restrict myself to the use of a pattern strip or band having the characters perforated therein as described, although I prefer that arrangement on account of its convenience and economy. A sheet may be used adapted to be placed upon a cylinder with the characters arranged thereon in a spiral. These characters may be embossed upon the strip or sheet instead of being perforated.

I would also remark that a chemical recording-instrument of the ordinary description, known under the general name of a "Bain" recorder, may be placed directly in the main circuit at the receiving-station, and the electro-magnets, armature, and secondary battery dispensed with, although I consider this arrangement much less advantageous for general purposes than that which I have described.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of one or more electro-magnets at the receiving-station, acting upon a polarized armature, and a chemical recording apparatus in a secondary circuit, which is opened and closed by the movements of said armature, with a pole-changing continuity-preserving transmitter, the movements of which are controlled by a prearranged pattern.

2. The combination, substantially as hereinbefore set forth, of a pattern strip, band, or sheet, having predetermined characters formed thereon by perforating or embossing, with a pole-changing continuity-preserving key or transmitter having contact-surfaces of graphite or carbon.

Signed by me this 19th day of June, A. D. 1880.

CHARLES A. RANDALL.

Witnesses:

NELSON ZABRISKIE,

FRANK L. POPE.