THE ELECTRO-CHEMICAL TELEGRAPH.

CHAPTER XXVII.

Bain's Electro-Chemical Telegraph—Apparatus and Manipulation—Smith and Bain's Patented Invention—Bain's Description and Claims—Morse's Electro-Chemical Telegraph—Westbrook and Rogers' Electro-Chemical Telegraph.

BAIN'S ELECTRO-CHEMICAL TELEGRAPH.

THE most prominent chemical telegraph is that of Mr. Alexander Bain, of England. There are none others in practical operation at the present time. In England, this telegraph is worked by the old Electric Telegraph Company to a limited extent. In the United States, through the wonderful energy of Mr. Henry O'Reilly, the chemical telegraph invented by Mr. Bain was used on an extensive range of lines about 1850. The Morse companies instituted suits, and obtained injunctions against the chemical telegraph lines, which produced a very great change in the use of that apparatus in America. The Federal Court for the District of Pennsylvania held a very thorough hearing on an application for an injunction, and a decree was awarded, declaring the patent which had been granted to Mr. Bain an infringement upon the original patent of 1840, granted to Mr. Morse.

After this injunction, the other chemical telegraph lines consolidated with the Morse companies. At the present time, there is but one electro-chemical telegraph line in America, and that one extends from Boston to Montreal, with branches; the whole making about 800 miles, and works in co-operation with the Morse lines.

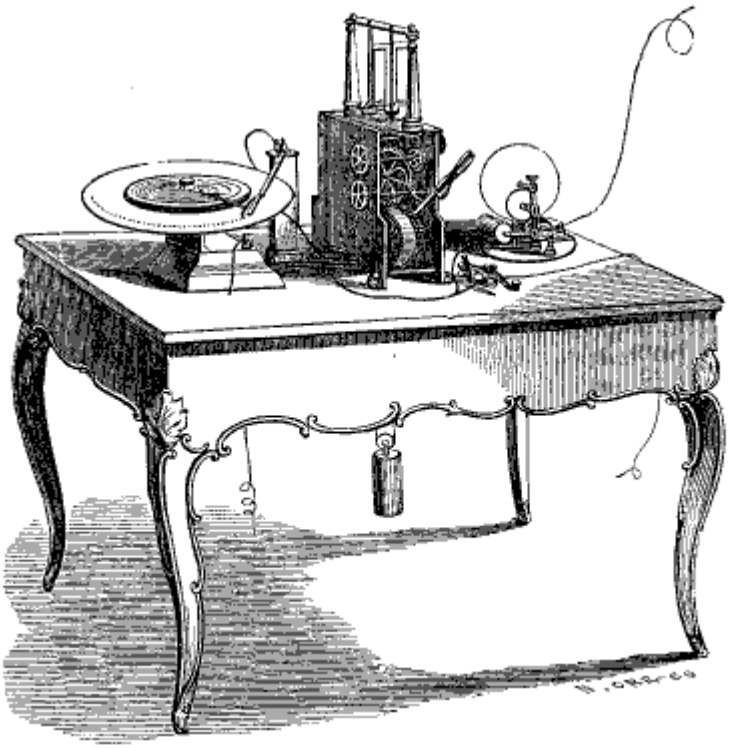
THE APPARATUS AND MANIPULATION.

Having thus briefly referred to the present state of the chemical telegraph lines on both continents, I will, in the next

place, give a few explanations in regard to the practical manipulation of the apparatus.

Fig. 1 represents the apparatus placed upon a table ready for operation. The table is about four feet high and six feet long. The line wire enters the station upon the right, traverses

Fig. 1.



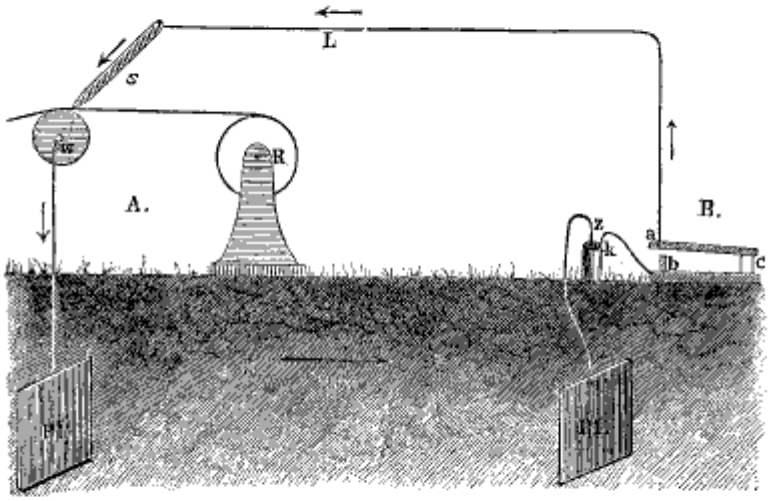
a small relay magnet, sitting on the right of the table; it then passes through the key, and thence to the stylus, which rests upon the disk; from beneath the disk, the wire is conducted to the earth.

The relay magnet upon the right has attached to it a circular piece of glass, which serves as a bell, when struck by a rod attached to the armature. With this, the call is made and the operator is thus notified when and by whom wanted. The clockwork on the centre of the table is to put in motion the disk, as seen upon the left. Upon the disk is laid the chemically prepared paper, which is kept damp. It lies on, or connects with the metallic disk. The stylus lies upon the moist paper,

and the revolving of the disk, when communication is being made, conducts the paper from under the stylus, so as to leave a clear space for the marks produced by the current of electricity. The line of dots on the disk illustrates the peculiar action of the marking by the stylus.

This form of apparatus was not universal. The clockwork seen in the table is about eighteen inches high, and is quite weighty. Some of the instruments are constructed as small as the Morse apparatus, using a ribbon paper, passing over rollers plated with a metal that will not be acted upon by the acids used to moisten the paper. The ribbon paper was drawn between two sponge rollers, which moistened it with the chemical solution, and thence it was drawn under the stylus. The operator was compelled to handle the paper, and in doing so, it was liable to break, the paper being very wet. To avoid this, the disk form was adopted. A dozen layers or sheets of paper are laid upon the disk, and kept moistened. The stylus is graduated to move from the exterior to the interior, so that the whole of the sheet lying upon the disk can be written upon before it has to be removed, and then it is merely torn off, leaving the next sheet clean and clear, ready for the

Fig. 2.



stylus to form the connection and trace the marks as before. The mark produced by the electric current does not extend farther than on the top sheet. The current passes through the other sheets leaving no mark. The coloring is confined to the place of contact between the stylus and the paper.

In order that the beauty and simplicity of this apparatus may be the better understood, I present a diagram of the electric current, which will be seen in fig. 2. A B are the respective stations. At station B, I introduce only the sending apparatus, and at station A, I leave off the sending mechanism, and insert only the receiving apparatus, reduced to the most simple and comprehensive form. I will first describe the sending station B. P I is the earth plate of zinc or copper, to which is attached a wire leading to the battery Z; the wire *k* connects with the anvil *b* of the key *a b c;* to *c* is attached the lever *a;* *c* is a non-conductor, and insulates the brass pieces *a* from *b;* to *a* is attached the line wire L, which connects with the stylus S; W is a metallic roller, over which runs the chemically moistened ribbon paper from the reel R; from W the wire extends to the earth plate P I (station B).

The clockwork, as seen in fig. 1, is attached to the roller W, which puts in motion the paper, and causes it to move forward under the point of the stylus S.

In order to communicate, it is only necessary to press upon the lever *a*, which forms a contact with the anvil *b*. This then will complete the circuit from the earth plate of station B to the earth plate of station A, and the earth completes the circuit between the two plates. When the circuit is thus closed at *a b*, the electric current flows over the line wire, as indicated by the arrows, descends with the stylus, traverses the chemically moistened paper, passes through the roller W, and thence to the earth. In the passage of the electric current through the moistened paper, a beautiful dark color is left upon it, either in the form of a dot or a dash, as may be determined by the length of time that *a b* may be in contact. The manipulation with the key is the same as with the Morse system.

The color produced upon the moistened paper remains for an indefinite time. I have a strip of the paper that I got in London five years ago, and on reference to it on the present occasion, I find that the marks are as clear as they were when I got it.

It will be seen that, according to the arrangement of the circuit in fig. 2, there is no electric current on the line, unless a station is communicating, or, in other words, every station transmits a message with a current generated by the battery at that station. There will be, of necessity, a battery at every station. This arrangement, however, is not indispensable; for there might be a continuous current on the line, if desired. With a sounder at each station, there can be no impropriety

in the continuation of the voltaic current on the wire, as is the practice with the Morse apparatus in America. Some of the Bain chemical telegraph lines did not use the sounder for fear of an infringement on the Morse patents. Each station had an allotted time, and the batteries were so organized, that each station brought into service the battery of that station, communicating with that and none other.

With these explanations, I will now proceed to give Mr. Bain's descriptions and claims, in relation to his electro-chemical telegraph.

SMITH AND BAIN'S PATENTED INVENTION.

In the patent granted, in the United States of America, to Messrs. Robert Smith and Alexander Bain of England, under date of October 30, 1849, the inventors declare that their improvement in electro-chemical telegraphing consists of the following, viz.:

1st. In the present mode of arranging the several parts herein described of our marking instruments of Electro-Chemical Telegraphs.

2d. In a mode of constructing a style or point-holder, so as to afford a ready and convenient mode of regulating the pressure of the style or point on the surface of the chemically prepared paper, or other suitable fabric.

3d. In a mode of applying a weight for regulating the pressure of an upper on a lower revolving wheel, or roller, in motion, so as to grasp the strip of chemically prepared paper or other suitable fabric, and insure it being drawn continually forward.

4th. In a mode of arranging the marking instruments, keys, wires, and batteries, in a single circuit, and in branch circuits connected therewith, so that a copy of a message sent from any station may be marked upon the chemically prepared paper or other fabric, at any desired number of stations in communication therewith, and also, if required, at the transmitting station.

I would here state, that the paper, linen, or other suitable fabric, may be prepared by being equally and thoroughly moistened by the following chemical compound, viz.: Ten parts, by measure, of a saturated solution of prussiate of potash, which will be best made in distilled water, and we prefer to use the yellow prussiate for this purpose; two parts by measure of nitric acid, of the strength of about forty by Baumé's scale; two parts by measure of muriatic acid, of the strength of about twenty by Baumé's scale.

To keep the paper or other fabric in a sufficiently moist state, favorable for the action of an electric current, we add about one part by measure of chloride of lime; this mixture is to be kept stirred about with a glass rod, until the chloride of lime is in complete solution. In connection with this compound, it is proper to observe that we have found that prussiate of potash, combined with almost any acids, will give mark under the decomposing action of an electric current, but no other mixtures act so quickly, or give such permanent marks with feeble currents of electricity, as that herein described. The principal use of the chloride of lime is, that it absorbs moisture from the atmosphere, and thereby keeps the prepared fabric in a proper state to be acted upon by an electric current in all states of the weather.

After describing the apparatus for telegraphing, the following are given as the claims of the inventors:

1st. The modes of arranging the several parts of our marking instruments for electro-chemical telegraphs, substantially, as hereinbefore described.

2d. We claim the mode of adjusting a style or point-holder, as hereinbefore described and shown, so as to afford a ready and convenient mode of regulating the pressure of the style or point upon the surface of the chemically prepared fabric.

3d. We claim the mode of applying the weight q, for the purpose of regulating the pressure, as herein described and shown.

4th. We claim the mode of arranging the marking and transmitting instruments, wires, and batteries, in a single circuit, and in branch circuits connected therewith, so that a copy of a message sent from any one station may be marked upon chemically prepared paper, or other fabric, at one or any desired number of stations in communication therewith, and also, if required, at the transmitting station, without requiring the use of any secondary current.

In the application for a patent in the United States, Mr. Bain was opposed by Prof. Morse. The Commissioner of Patents sustained the claims of the latter gentleman. Mr. Bain appealed to the Federal Court for the District of Columbia. On the 13th of March, 1849, the honorable judge reversed the decision of the Commissioner of Patents, and issued the following order, viz.:

"And I do further decide and adjudge, that the said Samuel F. B. Morse is entitled, under the 7th section of the Act of 1836, to a patent for the combination which he has invented, claimed, and described in his specification, drawings, and model; and

that the said Alexander Bain is entitled, under the same section, to a patent for the combination which he has invented, claimed, and described in his specification, drawings, and model; provided the said Morse and Bain shall have respectively complied with all the requisites of the law to entitle them to their respective patents."

The following extracts were embraced in the application of Mr. Bain, which will be sufficient to explain the details of his telegraph.

BAIN'S DESCRIPTION AND CLAIMS OF HIS INVENTION.

Know ye, that I, Alexander Bain, formerly of Edinburgh, now of the city of London, at present in the city of New-York, electric telegraph engineer, a subject of the Queen of Great Britain, have invented and made, and applied to use, certain new and useful improvements in the construction of electric telegraphs, for which original invention a patent was granted to me, by the government of Great Britain and Ireland, dated, in London, the 12th of December, 1846, for which said original invention, including other original and important improvements thereon, I now seek letters patent of the United States: That the said improvements differ with all other precedent modes employed in electric telegraphs; first, by using electricity in a manner independent of any magnetic action; secondly, in composing a message or communication by perforations through paper, in sets of characters, each of which represents a letter of the alphabet, or numeral figure, or other needful sign; which arrangement of perforated signs being arbitrary, may be changed at pleasure, so as to transmit secret or other important communications, by signs not understood by those not having the key or index of the secret arrangement; thirdly, by an arrangement of mechanical means, through which the non-conducting substance of the paper passing through the electrically excited parts of the machinery interrupts the circuit, except when the perforated parts forming the signs pass between the electrically excited parts of the machinery, and place these in contact in a manner that completes the circuit, transmitting a corresponding electric pulsation to the receiving apparatus at the distant station; fourthly, in recording the pulsation so given, by the intermittently passed electric fluid, on chemically prepared paper in such a manner as permanently to record on the chemically prepared substance a succession of signs corresponding to the perforations in the paper used at the transmitting station; and, fifthly, in the arrangement of mechanical means, by which a communication, when composed, can be

simultaneously transmitted through one machine to any plurality of distant stations, at, or nearly at, the same instant of time; and, as will be shown hereafter, with a rapidity unknown in electro-telegraphic apparatus wherein magnetic influences are admitted.

Before describing the means of making the perforations to form the signs, it may be proper to describe the signs hitherto found most available. By referring to description, it will be seen that the letter A is formed by one small dot and a line, thus, · —; the letter B by a dot, a line and a dot, thus, · — ·; and so on of the rest; but it will be seen that all the letters to N, inclusive, are begun with a dot or dots to the left of the line; L being formed by four dots, I by two dots. and E by one; all following are begun with a line to the left of the dot or dots used; the Y and Z with the abbreviation & being represented by lines only. The numeral signs to 5, inclusive, also commence with a dot or dots, and from 6 to 0, inclusive, these numerals begin with lines; the fractional line is represented by — · — · —, and is to be preceded by the numerator, and followed by the denominator of the given fraction, thus · · · · · — · — · — — — · · ·, will represent $\frac{5}{8}$, and so on of all the other signs. It has been before noticed, that these signs are arbitrary and changeable; but as will be seen hereafter, the means of composing, transmitting, and recording signs are equally effective for any other system of signs that may hereafter be found either better in arrangement, or more especially applicable for any particular object.

The entire alphabet, as adopted by Mr. Bain, and used on the American lines, was the following:

ALPHABET AND NUMERALS.

A · —	N · · — —
B · — ·	O —
C · · ·	P — · —
D · · —	Q — · — ·
E ·	R — — ·
F · — — —	S — · ·
G · — · ·	T — · · ·
H · — —	U — ·
I · ·	V — — — ·
J · · · —	W — — · ·
K · — — ·	X — · · —
L · · · ·	Y — —
M · — · —	Z — — —

& — — — —

NUMERALS.

1 . — — — —	6 — — — — .
2 . . — — —	7 — — — . .
3 . . . — —	8 — — . . .
4 . . . . —	9 — . . . .
5	0 — — . — —

The process of rapid communication contemplated the previous preparation of the ribbon paper, by perforating the alphabet. This arrangement was as follows:

The punch is cylindrical, having a flat end and a sharp edge, and the whole of the parts very accurately fitted and adjusted together, without any lateral shake in the punch, so that it enters the die properly. When so completed, the compositor passes a strip of paper of any required length from beneath through the right-hand slot, and under the guide-block, out and downward through the left-hand slot, when the compositor strikes the head with a small ball of wood, covered with leather or India-rubber, in his right hand, which forces the punch point through the paper into the die, cutting out a small disk that falls through the die and holes below; the expansive spring throws the punch up, while the compositor, by his left finger and thumb, draws the paper on, to strike successively again on the punch head at the required distance, which, for a second or next successive single perforation, should be equal to the diameter of one dot, the space between a dot and the commencement of a line the same; to form a line, the compositor draws the paper on a little less than the diameter of a dot, successively, until he has struck the punch as many times as will form a line equal to three diameters of one dot, leaving a space between the ends and the commencements of lines, in the same manner equal to the diameter of one dot; the space between each two letters, equal to four dots; and the space between each two successive words equal to the diameters of eight dots. This process forms groups of perforations in a continuous line, each of which groups complete a sign, representing a letter or numeral, and the larger spaces show the ends and commencements of words, that so placed are formed and read from left to right along the centre of the paper, in the same manner as common writing or printing. In this manner, a competent compositor, with a thorough knowledge of the signs, will compose a communication nearly as fast as it can be set up in type, and as fast as the same quantity of matter can be marked upon paper, by magnetism operating through mechanical means. When all the perforations are made, the paper strip is to be wound on a

roller, which fits into the transmitting machine, so that the communication is ready to be passed through that machine.

In regard to the preparation of this paper for the application of the apparatus, the following will serve as explanatory :

To receive a communication, the wire brush is to be turned back to the right by means of the pointer, to be out of contact with the transmitting roller; then take a piece of fine, good smooth paper, the width of which should be equal to the length of the cylinder, and long enough to go round the cylinder, with the ends lapping over each other a quarter of an inch; this paper is to be previously prepared as follows: It is to be laid on any clean surface that acids will not act on, the paper is then to be covered on the upper surface with oil, by a very clean sponge; for this good salad oil will answer, but other oils will answer, if they do not evaporate too quickly, because the use of the oil is to lessen the evaporation of the chemicals next noticed, by retaining their moisture; the paper is then to be turned over, and washed with a clean sponge containing a solution of nitric acid, prussiate of potash, and liquid ammonia, in the following proportions—the ammonia is merely added to prevent the other ingredients from rotting the paper: Two parts, by measure, of pure nitric acid, twenty parts, by measure, of a saturated solution of prussiate of potash, in distilled water, and two parts of pure liquid ammonia, mixed together. The paper so prepared is to be laid, with the oiled surface upward, on and around the cylinder, and the lapping edges fastened with a little gum water; the cylinder is then to be put in place, and the steel slide is to be turned on to the paper; the apparatus is then ready to receive a transmitted communication. The machinery is then to be worked by a man at the wheel, at the rate of one revolution of the wheel per minute, the same as in transmitting a communication, and as before stated. The operator at any one distant station transmits the electric current in pulsations, regulated by the perforations in the paper he is using, as already explained, and these pulsations are received by the wire, as before mentioned, they pass by the screw and standards, axle, thence to the stem, and through that to the style, and through the chemically prepared paper to the cylinder, leaving a dark mark on the paper, which, though less in size, will be in number and position an exact transcript of the perforations in the paper used at the transmitting station. It is proper to notice, that steel styles leave a dark mark approaching black or blue black on the paper, but copper styles will leave a brown mark on the paper. It is not intended to discuss the theory of the causes that produce

these effects and facts; nor is it intended to claim the use of any particular chemical solution, either separate or conjoined; because the paper saturated with a solution of nitric acid only will receive a communication that will not become visible, until the paper is washed with a solution of prussiate of potash; therefore any chemical solutions may be used that will produce the best effects: and I have stated the solutions of nitric acid and prussiate of potash as those that I have hitherto found most effective in practical use.

It is believed to be sufficiently plain, without much explanation, that as the perforations composed in the paper successively pass under each comb, the electric circuit will be completed, by the points of the comb coming in contact with the roller through such perforation, and that a corresponding period of rapid electric pulsations will be thus communicated simultaneously to the marking style at each distant station. It is proper to remark, that the battery in connection with each transmitting roller, must be of proportionate strength to the distance the current has to travel; and these arrangements admit of so graduating the strength of each battery, because each separate circuit is totally and entirely independent of any other circuit; and each circuit is completed at the receiving station, independent of any other station, and the communication transmitted is received and recorded at each receiving station, in the same manner, and with the same effect, as if made with the single acting machine first described.

All other electric telegraphs hitherto used are dependent on the motive power of electro-magnetism for their action, and many mechanical means have been sought or tried, whereby to adapt this power for use, the main principle remaining the same in all; the machines are, consequently, all designated "Electro-Magnetic Telegraphs."

But electricity travels with a velocity capable of giving several thousand signals per minute of time; and any apparatus composed more or less of ponderous bodies, having also to give motion to other and similar bodies, cannot act with more than a fraction of the velocity with which electricity travels; and another and greater hinderance is, that, however skilful an operator may be, he can only open and close the electric circuit, in a manner which again reduces the numerical velocity of its pulsations, and no other mode has yet effected the correct transmission of the same communication to a plurality of distant receiving stations.

I have, therefore, in my hereinbefore described invention, rejected magnetism altogether; and caused the pulsations of the

electric current to be transmitted through groups of perforations, forming signs which are recorded at the receiving station by the pulsations of the electric current, acting on chemically prepared paper, in the manner described and shown; so that the circuit is completed and interrupted by the operation of the composed communication itself, without the electric current having to produce any mechanical motion, and without any manipulation of the operator, in forming the intermittent pulsations of the electric current, thereby effecting the transmission of a communication to one or a plurality of distant receiving stations, with far greater rapidity than by any other known mode.

It is not deemed requisite to describe or refer to the voltaic, or other source of electricity, nor is it intended to claim the application of that or any other electric source to these purposes; nor is it intended to claim any of the parts employed herein, irrespective of the uses to which they are severally put, as herein described.

But I do claim as new, and of my own invention, and desire to secure by letters patent of the United States:

1st. The composing of electro-telegraphic communications, by making groups of perforations through paper, corresponding with or representing the signs to be transmitted, irrespective of the general arrangement of the collective or individual signs, and irrespective of the mechanical means employed to make the perforations.

2d. The application of paper so perforated to open and close an electric current, or several successive currents, thereby transmitting the electric current or currents in successive pulsations, that correspond with the perforations in the paper, substantially in the manner described and shown; but including any merely practical or convenient variations of the mechanical means, or materials, or fabrics employed, that are analogous or equivalent in their operations and effects.

3d. The application of any suitable chemically prepared paper, without regard to the chemical ingredients used for such a purpose, to receive and record signs forming communications, such signs being made by the pulsations of the electric current or currents transmitted from a distant station, said current operating directly, and without the intervention of any secondary current or mechanical contrivance, through a suitable metal marking style, that is in continuous contact with the receiving paper, thereby making marks thereon, which marks correspond with the groups of perforations in the paper, composing the transmitted communication, or may be given by the pulsations from the spring and block, so that, in either

case, these form the received communications, substantially, in the manner and with the effects described and shown, including any merely practical variations in the means employed and the effects produced thereby.

MORSE'S ELECTRO-CHEMICAL TELEGRAPH.

In order that the chemical telegraph invented by Prof. Morse may be understood, I have taken the following extracts from his patent. This chemical telegraph has never been put into operation. The right is held by the companies owning the other Morse patents, and, whether better or worse, there is a disinclination to change the systems.

Whereas, among my earliest conceptions of the telegraph, in October of the year 1832, on board the packet-ship, *Sully*, on her voyage from France to New-York, I conceived the idea of marking the telegraphic signs I had invented (being dots and spaces to signify numerals), by electrical decomposition of certain salts and chemical compounds; and whereas, the application of the proper means for producing a successful result of this thought was soon after superseded in my mind by another method, at the same time conceived, of marking the said signs, to wit, by magnetism, produced by electricity, which is the successful method now in use, and having recently recurred to my original thought of applying decomposition by electricity through a single circuit of conductors, and discovered a means of successfully applying the same, as then conceived, to the marking of the aforesaid signs for numerals and letters, and of any desired characters, I will here describe the nature of my invention, and the method by which I obtain my results.

The nature of my invention consists: 1st. In the application of the decomposing effects of electricity produced from any known generator of electricity, to the marking of the signs for numerals or letters, or words, or sentences, invented and arranged by me, and secured by patent, bearing date June 20th, 1840, reissued January 15th, 1846, and again reissued June 13th, 1848, or their equivalents, through a single circuit of electrical conductors.

2d. In the mode of applying this decomposition, and the machinery for that purpose.

3d. In the application of the bleaching qualities of electricity to the printing of any desired characters.

In applying the decomposing effects of electricity upon any known salts that leave a mark, as the result of the said decomposition, I use

Class A.—A class of salts that produce a colored mark upon cloth, paper, thread, or other material, under the action of electricity.

1st. Iodide of tin in solution.

2d. Extract of nutgalls, and sulphate of iron, in solution, making an ink which colors white cambric cloth of a uniform gray.

3d. Acetate of lead, and nitrate of potash in solution.

4th. Iodide of potassium in solution.

Into either of these I dip a strip of cloth or thread, which is kept properly moistened. All these give a black mark upon the cloth, thread, or other material under the action of electricity.

Class B.—A class of salts which color the cloth, paper, thread, or other material, and are bleached by the action of electricity.

1st. Iodide of tin in solution.

2d. Iodine dissolved in alcohol.

Into either of these I dip a strip of cloth, paper, thread, or other material; and if in solution second, I also dip them into a solution of sulphate of soda, the cloth or other material, in these cases, becomes of a purple color more or less dark. The electricity in these cases, when a metallic point or type is pressed upon, or comes in contact with the moist cloth or other material, bleaches it, and leaves the point or the type impressed in white characters upon the material.

Class C.—A class of salts that produce a mark upon metal, through the intervening cloth or other material, and not upon the material, under the action of electricity.

1st. Sulphate of copper in solution.

2d. Chloride of zinc diluted with water.

3d. Sulphate of iron in solution.

Into either of these solutions I dip the cloth, thread, or other material, and if into the third, I afterward dip it into muriate of lime in solution. The electricity in these cases causes a dark mark upon a bright metal plate beneath the moistened material, but not on the material itself.

The mode of applying this decomposition by electricity, is by the use of so much of my machinery previously described in the schedule referred to in the letters patent, granted to me, and bearing date June 13, 1848, being the re-issue of the original patent of April 12th, 1846, as is employed in regulating the motion of the paper, substituting, however, for the common paper therein used, the cloth, thread, metal, or other material, chemically prepared, and which machinery is therein

described in the words following, to wit: "The register consists of a series of wheels and pinions, and its object is to regulate the movement of paper, or other material upon which to imprint telegraphic characters. A, A, &c., sheet I., II., figs. 1 and 3, the platform of wood or other convenient material upon which the machinery is erected. B B, &c., the standards for the reel of paper, and C the reel of paper upon which is to be printed the telegraphic characters. D one form of the arrangement of the wheels and pinions of the register; *a e* rollers for drawing the paper in contact with the pen or marking roller 2, seen also on sheet III., fig. 10. * * * * * * The frame D contains the train of wheels, whose motion is caused by the weight *a*, or its equivalent. * * * * * * The paper roller *d e*, and 2, fig. 10, sheet III., are so connected with the train of wheels, that the paper drawn from the reels by passing between *a* and *e*, is made to be in contact with the cylinder, fig. 2. The roller *e* is kept in contact with *a*, by the forked spring in fig. 10, bearing upon the ends of the journals, and regulated in its strength by the thumb-screws 8 and 9. The bearings or sockets for the ends of the shafts of *e*, are not circular, but are slots to allow of a slight movement in a direction with and against the force of the spring, so that the spring shall act with proper power, tending to keep the cylinder *e* in contact with *d*."

Instead of a magnet, however, and lever and pen, I dispense altogether with both the receiving magnet and the register magnet, of my former patents, and substitute therefor the following arrangement, as exhibited in the accompanying drawing and description:

Description.—In the accompanying drawing, R is so much of the register of my original patent just quoted, as is used in drawing and regulating the motion of the paper, and is similarly used for drawing and regulating the chemically prepared material for marking by electricity.

S S is the wooden platform for mounting the machinery.

a is a metallic cylinder or drum, or piece of metal mounted upon a metal standard *d*, screwed into the platform. *b* is the cloth or prepared material to be marked.

c is a thin-edged wheel, the periphery of which is platinum, held by a metal spring *e*, also mounted on a metal stand and *f*, screwed into the platform.

K is the metal key of my previously patented telegraph machinery. One form of it consists of a short lever of metal, having its fulcrum at or near one end. At the other end is a finger-knob, the better to press it down. Between the fulcrum and the knob may be a protuberance or hammer, as at *i*, above

a small anvil, as at *h*, from which the hammer is separated, when not pressed down, by a spring. P is the battery.

From the standard *d*, a conductor proceeds to one pole of the battery. From the standard *f*, a conductor proceeds connecting with the back of the key at *g*, which is screwed into the platform.

h is the metallic anvil, also screwed into the platform, and insulated from the rest of the key.

i is the hammer attached to the upper part of the key.

From the anvil proceeds a conductor to the other pole of the battery.

Operation.—While the hammer *i* is separated from the anvil *h*, no current can proceed from the battery. But the moment *i* and *h* are in contact, the current of electricity takes the direction of the arrows, and passes through the chemically prepared material at *a*, decomposing the salt with which it is prepared, and making a mark. Thus the characters of my conventional alphabet, and other characters, are at pleasure made upon the prepared material.

I consider the discoloring process better than the bleaching process: and for the discoloring process, I consider the iodide of potassium in solution, as the best of the substances I have mentioned for the preparation of the cloth, paper, or other material. I wish it to be understood, that I do not confine myself to the use of the substances I have mentioned, but mean to comprehend the use of any known substance already proved to be easily decomposed by the electric current.

Claims.—What I claim as of my own invention and improvement, and desire to secure by letters patent:

1st. The use of the single circuit of conductors for the marking of my telegraphic signs already patented, for numerals, letters, words, or sentences, by means of the decomposing, coloring, or bleaching effects of electricity, acting upon any known salts that leave a mark as the result of the said decomposition, upon paper, cloth, metal, or other convenient and known markable material.

2d. I also claim the combination of machinery as herein substantially described, by which any two metallic points or other known conducting substances, broken parts of an electric or galvanic circuit, having the chemically prepared material in contact with and between them, may be used for the purpose of marking my telegraphic characters already patented in letters patent, dated the 20th June, 1840; in the first issue 25th January, 1846; and second re-issue, 13th June, 1848.

WESTBROOK AND ROGERS' ELECTRO-CHEMICAL TELEGRAPH.

Messrs. Charles Westbrook and Henry J. Rogers, of the city of Baltimore, were extensively engaged in the chemical telegraph lines, and in their daily labors, they invented a very important improvement. The stylus, made of asbestus or other substances, is brought into contact with the brass disk, as seen in fig. 1. On passing the current through the stylus, a clear and distinct mark is made upon the brass plate. This mark can be removed by rubbing the face of the disk. They also devised the plan of using a fountain pen and other modes, to avoid the use of the chemically moistened paper.

As a practical telegraph, there can be no doubt but what the invention of Messrs. Westbrook and Rogers would prove eminently useful, and subserve completely the purposes intended. The dot and dash alphabet was employed.

In order that the reader may have a fuller description of this important improvement in telegraphing, I extract the following from the letters patent granted by the government of the United States to Messrs. Westbrook and Rogers:

The nature of our invention consists in recording telegraphic signs on a metallic surface, connected with the earth by a wire conductor at one end, and to a galvanic battery and the earth at the other end of the circuit, by the use of the acidulated water or other fluid interposed between the point of the usual wire conductor, leading from the operating apparatus, connected with a galvanic battery of the ordinary construction and the metallic surface, by which the use of paper is dispensed with; time also being saved in not having to moisten the chemically prepared paper, when it becomes too dry for use, and in having the telegraphic signs more clear and distinct on the metallic surface than on the paper, and in avoiding the inconvenience arising from the fumes from the chemicals employed in preparing the paper, and evils arising from the corrosion of instruments, and annoyance to the operators in preparing and using chemical paper, and other inconveniences.

The metallic recording surface, after being filled and transferred, is simply cleaned, by the application of a sponge, or other soft substance, saturated with acidulated water.

Description.—A is the pen, made tubular, of some non-conducting substance, such as glass or ivory, open at both ends, and made tapering at its lower end, for containing a piece of sponge or other porous substance, through which the acidulated water, or other fluid passes to the metallic surface, on which the telegraphic signs are to be made—the bore of the pen being

sufficiently large to contain the requisite quantity of acidulated fluid. By reducing the outlet at the tapered end of the pen, the sponge or porous valve may be dispensed with. A very small barrel valve might be used to regulate the flow of the fluid, instead of the porous substance.

b is a short conducting wire, connected with the metallic stand *c*, or pen-holder *d*, and leading into the barrel of the pen *a*, and brought into immediate contact with the acidulated fluid in the pen—thus continuing the conducting line to the surface of the metallic cylinder or plate, so that the current from the galvanic battery can be made to pass from the metallic conductor through the acidulated fluid or saline solution, to the metallic surface of the plate or cylinder upon which the signs or marks are to be made. *e* is the binding screw for securing the main wire; *f* is the main wire connecting the receiving and transmitting stations; *g* is the fulcrum of the manipulator; *h* is the manipulator; *i* is the anvil of the manipulator;—*k* platina pole of a galvanic battery;—*l* is the zinc pole of the battery, connected by a wire with the ground plate *m* at the transmitting station;—*n* is also a ground plate, connected with the binding screw *e*, at the receiving station.

g is a horizontal stationary screw-shaft, upon which the cylinder moves to the right, by means of a chaser (*s*), fixed to the end of the cylinder, and revolving with the cylinder in contact with the spiral thread of said screw. The cylinder may be made to move to the right and to the left, over the shaft, simultaneously with its rotary motion, by forming a female screw through its centre, corresponding with the screw shaft. The rotary motion of the cylinder may be produced by ordinary clock machinery, or by a coiled spring, pulley, cord, and weight, or by any convenient means. The cylinder having the combined rotary and longitudinal movement, as aforesaid, will cause the telegraphic signs to be recorded on the surface of the cylinder or plate, in a continuous spiral line, in the same manner that we have practised for some time past.

Operation.—Bear down the long arm of the key, lever, or manipulator *h*, so that the point comes in contact with the anvil *i*, the current will instantly pass from the platina pole *k* of the battery, through the conducting wire and acidulated solution contained in the pen, to the surface of the cylinder (*c*) or plate (*p*), thence to the ground plates *m* and *n*, the earth being part of the circuit, and by the wire to *l*, the zinc pole of the battery, leaving a black mark or stain on the cylinder or plate, according to the length of time the circuit is closed,

indicating the sign, mark, word, or sentence required to be recorded.

Having thus . . . . . described the nature of our invention and improvement in telegraphs,

What we claim and desire to have secured to us by letters patent is, recording telegraphic signs on the surface of a revolving metallic cylinder plate, or other equivalent surface, by means of an acidulated liquid, or saline solution, of water held between the point of the wire conductor and the metallic recording surface, by means of a non-conducting porous substance contained in a glass, or other non-conducting reservoir, in which the recording fluid is contained, to which the electric current from a battery is applied, by means of any of the known forms of manipulators, and anvils used for making and breaking the circuit—the recording fluid being applied to the metallic recording surface, substantially in the manner herein fully set forth, by which the use of every description of paper is dispensed with, thereby saving great expense in telegraphing.