(No Model.) 2 Sheets—Sheet 1.

R. M. HUNTER.

TELAUTOGRAPH.

No. 511,081. Patented Dec. 19, 1893.

FIG. 1

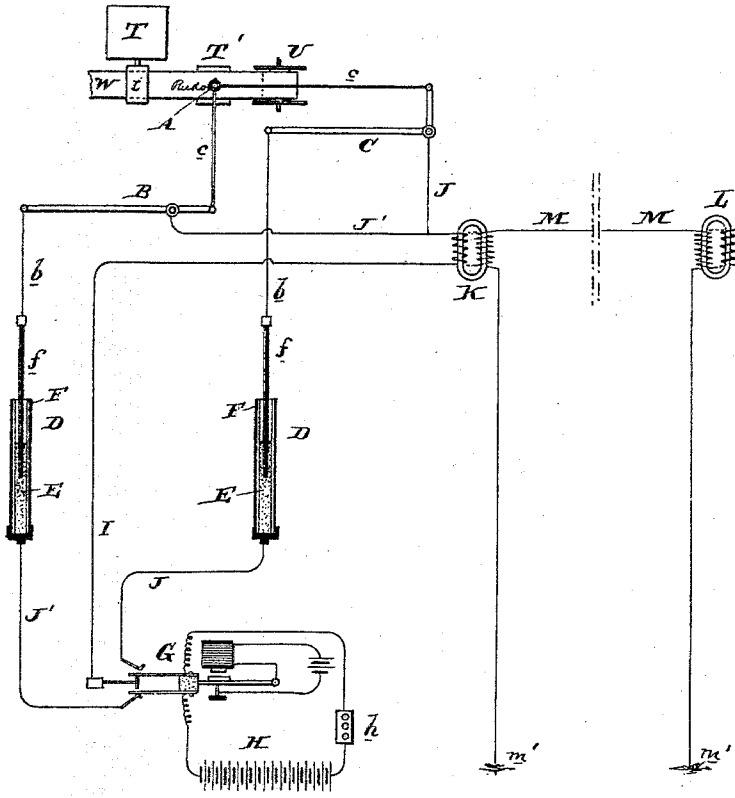


FIG. 2

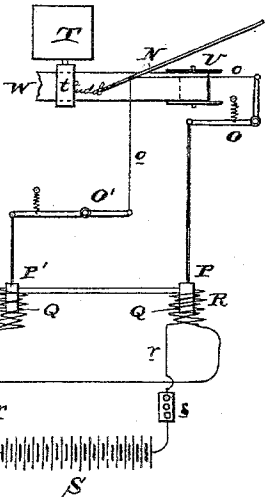


FIG. 3

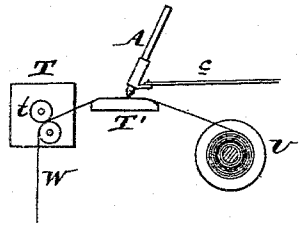


FIG. 4

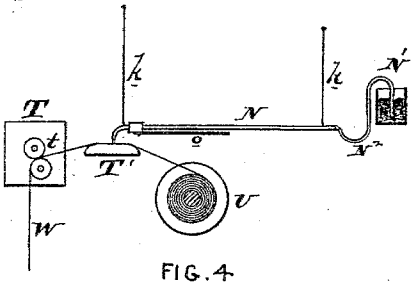


FIG. 6

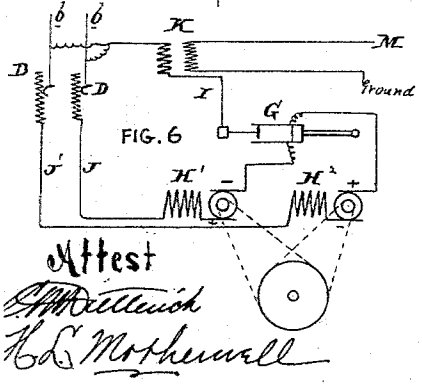


FIG. 5

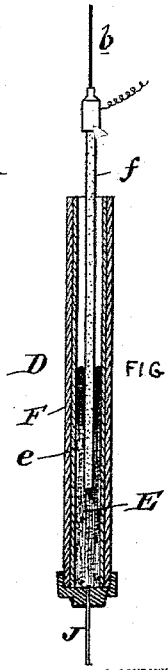
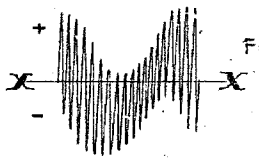


FIG. 7



Attest

S. M. Dellenbaugh

H. L. Mothersill

Inventor

R. M. Hunter

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

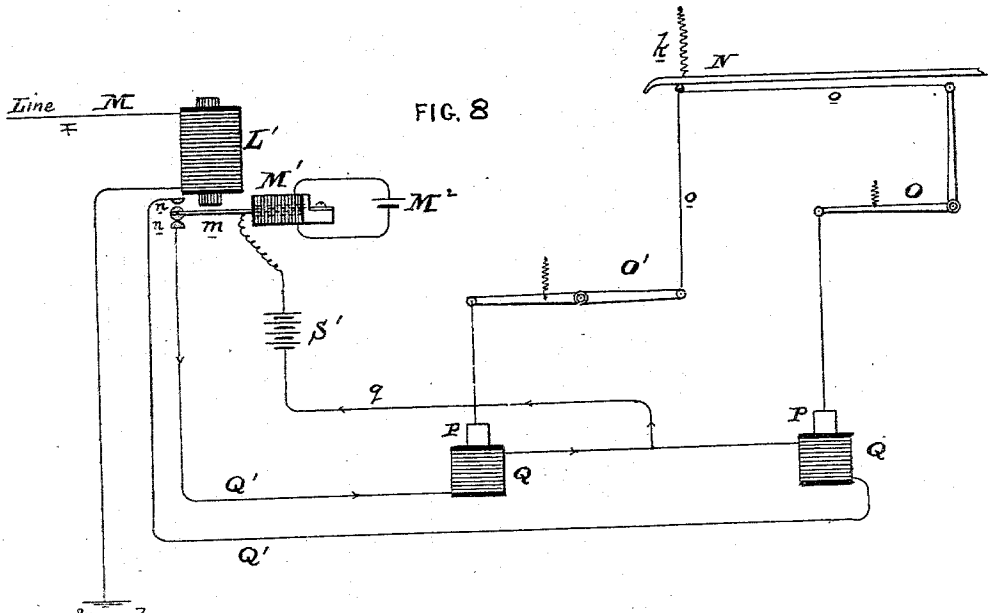
(No Model.) 2 Sheets—Sheet 2.

R. M. HUNTER.

TELAUTOGRAPH.

No. 511,081. Patented Dec. 19, 1893.

FIG. 8



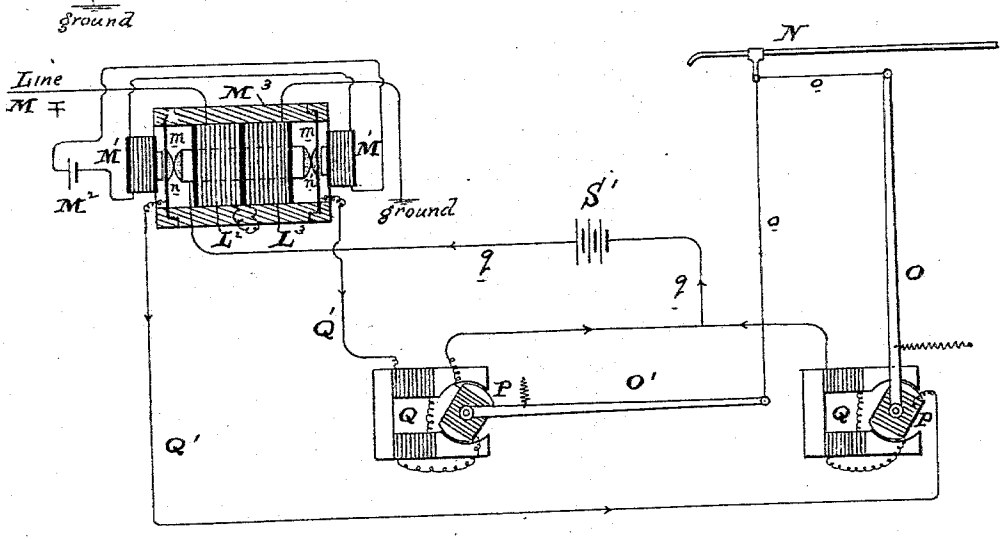


FIG. 9

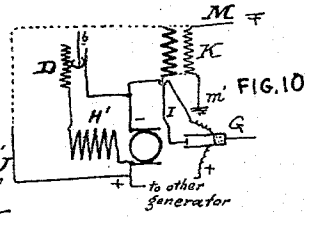


FIG. 10

Attest

E. M. Dillench

H. L. Mothenell

Inventor

R. M. Hunter

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA.

TELAUTOGRAPH.

SPECIFICATION forming part of Letters Patent No. 511,081, dated December 19, 1893.

Application filed May 26, 1893. Serial No. 475,590. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Telautographs, of which the following is a specification.

My invention has reference to telautographs, and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form a part thereof.

This application, Case No. 253, has particular reference to electrical apparatus designed to transmit over long distances autographic marks or symbols, such as writing or drawing. Heretofore attempts have been made to accomplish this result, but in all cases the practical application of the invention requiring the use of two electro magnetic devices to operate a single marking device has required the use of two line conductors or circuits extending between the transmitting and receiving stations. This requirement is a very radical objection to the employment of the system on account of the enormous expense and difficulty of maintenance. The danger of derangement to the system is almost double with the employment of two circuits as compared with a system employing but one.

The object of my invention is to provide a suitable apparatus which will permit the transmission of autographic marks or drawings over great distances with practical accuracy, and at the same time employ but a single insulated line circuit. In the practical carrying out of my invention I employ in the line an undulatory current of alternating sign, constituting what may be termed an alternating variable potential circuit. At the transmitting station I produce positive and negative impulses of current intermittent or continuous but variable in character so that the positive currents are constantly varying, as are likewise and simultaneously the negative currents. The said current variations are produced by suitable mechanical devices under the control of the transmitting operator, and preferably in the act of writing upon a suitable paper the words or symbols to be transmitted and reproduced.

It is immaterial to my invention what character of apparatus may be employed to produce the variable positive and variable negative currents which shall be directly or by the intervention of an induction coil transmitted to the line, as I have found in practice that there are several ways this result may be attained and yet embody the same essential method or principle of operation in the apparatus.

The receiving station is provided with a suitable pen or device for tracing upon a moving paper or surface the symbols or marks, and said device is moved by electro magnetic devices which are respectively caused to operate under the positive and negative impulses of the line current. The movements of these electro magnetic devices are in substantial accord with the variations in the potential of the positive and negative impulses transmitted over the line. The electro magnetic devices for operating the marking or tracing device may be worked by means of an induced current produced by suitable transformers or induction coils energized by the line current, or by a battery or other source of electric power at the receiving station under the control of electro magnetic devices energized by the line current and adapted to cause the proper flow of current in the local circuits at the receiving station in connection with the respective electro magnetic devices which operate upon the pen or marking device. I do not confine myself to any particular devices for accomplishing these results, as there are several ways of carrying out my invention in practice, several of which are herein described.

The essential feature of my invention comprehends the employment of a variable potential current of alternating sign in the line circuit, the potential of the positive and negative currents in the line being controlled by suitable hand operated devices at the transmitting station and adapted to energize directly or indirectly electro magnetic devices at the receiving station which by their combined connections shall cause the pen or tracing device to move over a paper or other surface and mark or otherwise form thereon symbols or marks corresponding in character with the movements made at the transmitting station.

My invention not only comprehends the

apparatus for carrying out the invention both broadly and specifically considered, but also includes the method or process by which the results are accomplished.

Referring to the accompanying drawings: Figure 1 is a diagrammatic elevation of a transmitting instrument forming part of my invention. Fig. 2 is a similar view of the receiving instrument thereof. Fig. 3 is an elevation of the tape and connections at the transmitting station. Fig. 4 is a similar view of the moving tape and siphon pen at the receiving station. Fig. 5 is a sectional elevation of one of the resistance chambers at the transmitting station. Fig. 6 is a diagram illustrating a modification of the electric circuits embodying my invention at the transmitting station. Fig. 7 is a diagram illustrating the character of the electric currents in the line during the operation of my invention. Figs. 8 and 9 are diagrammatic elevations illustrating modified forms of receiving instruments which may be used in place of that shown in Fig. 2; and Fig. 10 is a diagram of a modification of the construction shown in Fig. 6.

A is a pencil or part to be moved by the hand and is connected to two levers B and C by links *c*. A horizontal movement of a pencil will operate the lever C and a movement transversely to said horizontal movement will move the lever B.

D, D, are two resistance changers respectively operated by the levers B and C. These resistance changers will be more clearly understood by reference to Fig. 5. They consist of an iron tube F containing a glass case or lining *e* on the inside and are closed at the bottom by an iron cap which receives the electric circuits J or J′.

The cup formed by the parts F, *e* is partly filled with mercury or other good conducting fluid substance E. Conductors *f* of carbon or other suitable substance project into the cups and mercury contained therein and are connected by flexible rods *b* with the levers B and C. It will thus be seen that the movement of the levers B or C, or both, will cause the resistance changers D, D, to vary the resistance in the electric circuit. H is a battery or suitable source of electrical energy of a fixed potential.

G is a current interrupting switch electrically actuated in any suitable manner such as by a rheotome construction, and operates to cause the current to flow alternately over the circuits J, J′, and through their respective resistance changers D. The current after passing through the resistance changer is conveyed by either of the circuits J or J′ through the coarse wire coil of a transformer or induction coil K, and returns to the battery by a circuit I. A resistance *h* may be employed to control the flow of the current. It will now be observed that if the switch G is put into rapid vibration the current will pass alternately into the circuits J and J′ and in all cases return by the circuit I. The positive current will always traverse the circuit J, the negative current will always traverse the circuit J′, and the strength of these currents will be governed by the respective resistance changers D, D, under the control of their levers C, B, which are operated by the hand moving the pencil. An alternating current having a variable potential is thus set up in the coarse wire of the transformer K and produces in the line M, which includes the fine wire coil of the transformer, a high tension alternating variable current adapted to traverse great distances and be conveyed over a small wire. The return line circuit may be the earth by having the line grounded as at *m*′. The current in the line is indicated in Fig. 7 where X—X corresponds to the zero line. The positive impulses of the current are indicated as positive and are above this line X—X, while the negative impulses are below it. These impulses in the line are undulatory in characteristic, but are constantly alternating in sign. The diagram shown in Fig. 7 illustrates the characteristics of the letter O transmitted over the line.

The switch G is preferably so arranged that the current is closed through the circuit J almost simultaneously with the opening of the circuit J′, and vice versa, so as to prevent material distortion in the line current.

It is not essential to my invention that the pencil A shall be employed to write a message, but it is preferable to do so as we then have a record of what was transmitted. To accomplish this, I employ a tape of paper W wound upon a cylinder U and caused to travel over a table T′ by means of a clock work T and feeding rolls *t*. The feeding of this paper tape W is carried on at such a speed that it practically equals that of the writer in forming the letters. By moving the pencil to the right or to the left or transversely thereto the resistance changers D, D, operate to vary the amount of current and potential in the circuits J, J′, and if the switch is made to work very rapidly we have in effect a negative and a positive undulatory current of varying potential transmitted over the line circuit M simultaneously or substantially at the same instant, and as these impulses are very rapid, they may be considered as if composed of two continuous currents of undulatory character, one positive and the other negative.

Referring to Fig. 2, it will be seen that the receiving station is provided with a transformer or induction coil L having its fine wire connected with the line M. The coarse wire coil of this induction coil or transformer is connected to a local circuit *q* which includes in series two independent solenoids Q, Q, adapted to act upon cores P, P′, which are connected to levers O, O′, similar to the levers B and C, and these levers are connected by links *o* with a suitable siphon pen N adapted to trace upon a moving paper tape W the char-

acters or marks to be delineated. The tape W at the receiving station is drawn off a reel U over a table T′ by a clock work T and feeding rolls *t* as in the case at the transmitting station. The siphon pen N is flexibly hung in position with respect to the paper by suitable flexible links *k* of any suitable kind, and the pen receives ink or marking fluid from a vessel N′ through a flexible tube N^2.

It is immaterial what particular character of marking or tracing device is employed to transcribe or form upon the paper or receiving sheet the marks or characters, and, therefore, when speaking of the pen as the marking device, I employ it with the broadest meaning.

If the coils Q, Q, are unaffected by some additional energy than that which is received from the transformer or induction coil L, their tendency would not be to cause the pen to make a movement corresponding to the pencil A, and consequently I provide a source of electrical energy such as a battery S at the receiving station having approximately a current capacity equal to the normal current in the circuit *q* produced by the battery or source of power H at the transmitting station. This battery S is included in the circuit *r* having in series two helices R, R, relatively differentially wound and superposed upon the coils Q, Q. It will thus be seen that the current from the battery S practically annuls the effect of the positive current in the coil Q of one of the cores, and the negative current in the coil Q acting upon the other core. In this manner the lever O will respond only to the positive impulses over the line and the lever O′ to the negative impulses of the line, and this will be in exact accordance with the operation of the levers C and B at the transmitting station which respectively control the positive and negative currents delivered to the line. The resistance *s* may be employed to vary the current in the circuit *r*.

In place of using batteries as the source of electric energy at the transmitting station, I may employ dynamo electric generators substantially in the manner shown in Fig. 6. Referring to this figure, H′ and H^2 represent two dynamo electric machines driven at a uniform and fixed speed or otherwise operated to produce definite currents which may be of equal potential or of different potentials if desired. These dynamo electric machines are so connected with the circuit switch G and the circuits J and J′ that one of the generators delivers current of one polarity to the circuit J, while the other generator delivers current of another polarity to the circuit J′. Resistance changers or rheostats D are placed in the circuits J and J′ in the manner shown in Fig. 1. In Fig. 6 the resistance changers D are shown as rheostats having resistance coils and are in series with the generators H′ and H^2. It is quite evident that the resistance changer D may be located in the field circuit of these generators and may in fact compose a portion of the coils thereof. It is also evident that in place of using a series generator I may employ a shunt wound machine and have the resistance changer D in series with the field coil and in shunt with the armature so as to vary the output of the machine in accordance with the requirements. This is clearly shown in Fig. 10.

I do not confine myself to any special means for generating and supplying undulatory or alternating currents at the transmitting station, as there are numerous ways of accomplishing this result.

In place of the receiving instrument shown in Fig. 2, I may employ either of the constructions shown in Figs. 8 and 9 to which I will now refer.

In Fig. 8 the alternating current in the line passes through an electro-magnet L′ having a laminated core, and thence to the ground. The electro maguet L′ operates a polarized armature *m* which may consist of a spring plate of iron or steel maintained at a fixed polarity by the magnetizing coil M′ surrounding it at one end and energized by a local battery M^2. The armature *m* carries upon its end carbon buttons which work in connection with two other buttons of carbon as indicated at *n*, *n′*, the circuit being preferably closed through one pair of buttons at one time. The adjustment should be such that but an exceedingly small movement of the armature *m* is required. The parts N *o* O O′, cores P and coils Q are the same in this figure as in Fig. 2. A battery S′ is in circuit between the armature *m* and a connecting circuit between one of the terminals of each of the coils Q, Q, by a circuit *q*. The other terminals of the respective coils Q, Q, are connected by circuits Q′, Q′, respectively with the two carbon buttons *n*, *n′*. It will now be seen that the alternations in the line current will cause the armature *m* to be rapidly vibrated with a greater or less force according to the potential of the current traversing the line and this will cause the battery current S′ to be thrown alternately through the two coils Q, Q, and to vary proportionally to the potential in the line by virtue of the fact that the variable resistance *n*, *n′*, will permit a greater or less current to flow through the circuit Q′ *q* according as to whether the polarized armature *m* is attracted or repelled with a greater or less force.

Referring to Fig. 9, we have the siphon pen N operated by links *o* and levers O, O′, as before. In this case, however, the levers O, O′, are connected to pivoted armatures or cores P directly, and the said armatures or cores P are caused to rotate in the magnets Q in place of being drawn up and down therein. The line current passes over the line M, through the coils L^2, L^3, contained within a case M^3 of diamagnetic metal, and thence to ground. The core of the coil L^2, L^3, is preferably formed of steel as in the case of an ordinary receiving telephone. Arranged at each end of the core and supported in the case M^3 are dia-

phragm armatures m similar to a receiving telephone diaphragm. Interposed between the armature diaphragms m and the cores are various resistances as carbon buttons n, n'. One of the diaphragms m is connected by a circuit Q' with the coils upon the armature and field magnets of one of the electro magnetic devices P Q, and the other diaphragm armature m is connected in a similar manner with the other electro magnetic device P Q. The return circuit q from these electro magnetic devices include a battery S' and connect with the core so that the currents traversing the respective electro magnetic devices must pass through the resistance changing buttons n, n'. M' are electro magnets energized by a battery M^2 and are adapted to maintain the armature diaphragms m m at opposite polarities to the ends of the core of the electro magnets L^2 L^3 so that there is at all times an attraction between the core and the diaphragms, but which attraction may be varied by the alternations of the current traversing the coils L^2 L^3. These coils are so wound that the positive currents in the line will strengthen the attraction at one end of the core and reduce the attraction at the other end of the core, and vice versa with the negative currents in the line. The effect of this is to vary the resistance n for the currents of one potential in the line and the resistance n' for the currents of the other potential in the line. These variations in the resistances n n' cause the electro magnetic devices P Q corresponding to the levers O and O' to be energized with varying force and produce a combined effect upon the pen N which shall cause it to traverse the paper or tape in a manner corresponding to the movement of the pencil A at the transmitting station.

In Fig. 8 the pen is shown as suspended by a delicate spring k in place of the straight links shown in Fig. 4.

It is quite evident that in place of having the line current pass through the coils L', L^2, and L^3 of Figs. 8 and 9 directly, the said coils may be energized by a transformer, as indicated in Fig. 2 in such manner that the current operating the armatures m would be of lower potential, but the general principle would remain the same.

It is quite evident that the electro magnetic devices P Q shown in Fig. 8 may be employed in connection with the modification shown in Fig. 9 in place of the electro magnetic devices P Q of said figure, and vice versa. The same is also true of the electro magnetic devices shown in Fig. 2, as the electro magnets Q with the rotating armatures P shown in Fig. 9 may be employed in connection with the transformer L and local battery and differentially wound coils R of Fig. 2.

It is evident that both of the transformers K and L may be dispensed with and in this case the junction of the wires J and J' would be connected directly with the line M at the receiving station, and the circuit q would be connected with the line at the receiving station. The circuit I at the transmitting station and the other terminal of the circuit q at the receiving station would be grounded as at m'. In this case the potential of the line would also be the potential in the circuits at the receiving and transmitting stations. It is preferable, however, to use the transformers K and L either in part or in whole.

It will be evident from the foregoing description that my invention may be carried out by a variety of modifications all of which depend upon the same general principle of operation, and therefore it is apparent that the apparatus shown may be greatly modified without departing from the principles of the invention.

What I claim as new, and desire to secure by Letters Patent, is—

1. The herein described method for transmission of autographic marks or symbols which consists in generating and transmitting over a line circuit positive and negative currents of variable potential, energizing electro magnetic devices by means of said positive and negative currents of varying potential, and operating by means of said electro magnetic devices common to both of said electro magnetic devices marking or tracing devices.

2. The herein described method for transmission of autographic marks or symbols which consists in generating and transmitting over a line circuit positive and negative currents of variable potential, energizing electro magnetic devices by means of said positive and negative currents of varying potential, operating by means of said electro magnetic devices marking or tracing devices common to both of said electro magnetic devices, and simultaneously therewith moving a surface upon which the marks or symbols are traced under the marking or tracing devices.

3. The herein described method of transmitting autographic marks or symbols which consists in generating positive and negative currents, varying the said currents by the hand in the act of writing or otherwise forming marks or symbols, generating high tension currents by induction from the positive and negative currents, transmitting the said high tension currents to a distance, and operating therewith electro magnetic devices at a distant place for moving marking or tracing devices common to said electro magnetic devices.

4. The herein described method of transmitting autographic marks or symbols which consists in generating positive or negative currents, varying the said currents by the hand in the act of writing or otherwise forming marks or symbols, generating high tension currents by induction from the positive and negative currents, transmitting the said high tension currents to a distance, generating by induction at the distant place low tension currents of alternating sign, and oper-

ating electro magnetic devices at the distant place for moving marking or tracing devices common to said electro magnetic devices by means of said low tension currents.

5. The herein described method for transmission of autographic marks or symbols which consists in alternately passing, positive and negative currents of electricity into a circuit, varying the said current by means of hand operative devices at a transmitting station, producing by induction high tension currents of alternating sign and variable potential, transmitting the said currents to a distant station, and operating electro magnetic devices at said distant station by means of the line current for the purpose of marking or tracing by the joint action of the electro magnetic devices autographic marks or symbols corresponding to the movements of the hand operated devices at the transmitting station.

6. The herein described method for transmission of autographic marks or symbols which consists in alternately passing positive and negative currents of electricity into a circuit, varying the said current by means of hand operative devices at a transmitting station, producing by induction high tension currents of alternating sign and variable potential, transmitting the said currents to a distant station, and operating electro magnetic devices at said distant station by means of induced currents generated from the line current for the purpose of marking or tracing by the joint action of the electro magnetic devices autographic marks or symbols corresponding to the movements of the hand operative devices at the transmitting station.

7. The herein described method of transmission of autographic marks or symbols which consists in producing positive and negative currents, alternately passing the said positive and negative currents into a circuit, varying the positive and negative currents by means of hand operative devices in the act of tracing or marking, transmitting to a distant station the variable potential alternating currents so produced, and operating at the distant station electro magnetic devices for the purpose of jointly operating a single marking or tracing device.

8. The herein described method of transmission of autographic marks or symbols which consists in producing positive and negative currents, alternately passing the said positive and negative currents into a circuit, varying the positive and negative currents by means of hand operative devices in the act of tracing or marking, transmitting to a distant station the variable potential alternating currents so produced, operating at the distant station electro magnetic devices for the purpose of jointly operating a single marking or tracing device, and simultaneously therewith moving a surface upon which the symbols or characters are traced or marked under the marking or tracing devices.

9. The herein described method of transmitting and utilizing electricity at a distance which consists in generating at a transmitting station alternating currents of variable potential, varying the potential of the positive and negative currents independently of each other at will by hand, transmitting the same over a line to a distant circuit and controlling separate electro magnetic translating devices respectively by the positive and negative impulses of the alternating current.

10. The herein described method of generating transmitting and utilizing electricity at a distance which consists in generating positive and negative currents, varying at will by hand the potential of said positive and negative currents, generating by induction high tension alternating currents of a potential relatively corresponding to the potential of the positive and negative currents, transmitting the said alternating currents to a distance, and operating thereby electro magnetic devices.

11. The combination of a source of positive and negative current, local circuits, a switch for rapidly causing the positive and negative currents to circulate the electric circuits, hand operative devices for varying the positive and negative currents under the will of the operator, a transformer having one coil connected with the local circuits and the other coil connected to the line, a line circuit extending to a distance, and electro magnetic devices operated by the current in line circuit at a distant place.

12. The combination of a source of positive and negative current, local circuits, a switch for rapidly causing the positive and negative currents to circulate the electric circuits, hand operative devices for varying the positive and negative currents under the will of the operator, a transformer having one coil connected with the local circuits and the other coil connected to the line, a line circuit extending to a distance, and electro magnetic devices operated by the current in line circuit at a distant place consisting of two independently operated electro magnets, lever devices connected thereto, and a marking or tracing device connected with the said levers so as to be moved in any direction under the influence of the electro magnetic devices.

13. The combination of a source or sources of positive and negative electric current, a local circuit, a switch to cause the positive and negative current to alternately flow over the local circuit, variable resistances for controlling the positive and negative currents, hand operated devices for moving said variable resistances, a line circuit, a transformer interposed between the line circuit and local circuit, electro magnetic devices arranged at a distance and operated by the current in the line circuit, and marking or tracing devices operated by said electro magnetic devices.

14. The combination of a source or sources of positive and negative electric current, a

local circuit, a switch to cause the positive and negative current to alternately flow over the local circuit, variable resistances for controlling the positive and negative currents, hand operated devices for moving said variable resistances, a line circuit, a transformer interposed between the line circuit and local circuit, electro magnetic devices arranged at a distance and operated by the current in the line circuit, marking or tracing devices operated by said electro magnetic devices, a tape or surface upon which the characters or symbols are marked or traced, and means to move the said tape.

15. A source or sources of positive and negative electric energy, a local circuit, a switch for alternately causing the positive and negative currents to flow over the local circuit, independent means for controlling the positive and negative electric currents, hand operative devices for operating the said controlling devices, and electro magnetic devices controlled by the current in the local circuit for operating the moving pen or tracing device under the action of the variable potential alternating current set up in the local circuit.

16. The combination of means for producing in a line circuit alternating currents of variable potential, hand operative devices for controlling the potential of the positive and negative impulses in the line, electro magnetic devices operated by the alternating variable potential current of the line, and common marking or tracing devices operated by said electro magnetic devices.

17. The combination of means for producing in a line circuit alternating currents of variable potential, hand operative devices for controlling the potential of the positive and negative impulses in the line, electro magnetic devices operated by the alternating variable potential current of the line consisting of independent coils and moving armatures or cores one of the armatures or cores being movable under the action of the positive currents and the other armature or core being movable under the action of the negative currents, and common marking or tracing devices operated by said electro magnetic devices.

18. The combination of a line circuit, a source or sources of positive and negative electricity, hand controlled devices between the source or sources of electric energy and the line for causing an alternating variable potential current to flow over the line circuit, electro magnetic devices at a distant place operated by the positive and negative impulses in the line, and common marking or tracing devices moved by the electro magnetic devices.

19. The combination of a line circuit over which an alternating and variable potential current is flowing, electro magnetic devices part of which are operated by the positive impulses of the line current and the remainder by the negative impulses of the line circuit, and marking or tracing devices operated by the joint action of the electro magnetic devices.

20. The combination of a line circuit over which an alternating and variable potential current is flowing, electro magnetic devices part of which are operated by the positive impulses of the line current and the remainder by the negative impulses of the line circuit, marking or tracing devices operated by the joint action of the electro magnetic devices, a tape or surface upon which the marks are formed, and feeding devices for feeding the tape or surface relatively to the marking or tracing devices.

21. The combination of a line circuit over which an alternating and variable potential current is flowing, electro magnetic devices part of which are operated by the positive impulses of the line current and the remainder by the negative impulses of the line circuit and consisting of two electro magnets having movable cores or armatures and differentially wound whereby one set of coils is energized by the current in the line circuit and the other set of coils is energized by a local source of electric energy, a local source of electric energy, and marking or tracing devices operated by the electro magnetic devices.

22. The combination of a line circuit over which an alternating and variable potential current is flowing, electro magnetic devices part of which are operated by the positive impulses of the line current and the remainder by the negative impulses of the line circuit and consisting of a vibrating armature operated under the varying currents in the line, two independent electro magnets having movable armatures or coils, a local battery, local circuits including the battery and the respective electro magnets, variable resistance contacts controlled by the vibrating armature for causing the current from the local battery to flow alternately over the local circuits and the two electro magnets and energize the said magnets with greater or less force corresponding to the variable potentials in the line, and marking or tracing devices operated by the electro magnetic devices.

23. The combination of a line circuit over which an alternating and variable potential current is flowing, electro magnetic devices part of which are operated by the positive impulses of the line current and the remainder by the negative impulses of the line circuit, an electro magnet in circuit with the line, two polarized diaphragms vibrating under the action of the electro magnets, variable resistances controlled by the diaphragms, two independent electro magnets having movable armatures or cores, a local battery, independent circuits for the said electro magnets and moving armatures respectively including the two variable resistances whereby the

current passing over the respective electro magnets and moving armatures is in accordance with the variations in the line, and marking or tracing devices operated by the electro magnetic devices.

24. A transmitting device for a telautograph consisting of two electric generators, electric circuits uniting and connecting respectively with the positive and negative poles of the respective generators, a switch to connect the generators alternately in operative circuit, and hand operative devices for varying the potential of the two generators simultaneously whereby an alternating current of varying potential is generated and transmitted.

In testimony of which invention I have hereunto set my hand.

R. M. HUNTER.

Witnesses:
ERNEST HOWARD HUNTER,
C. M. DIETTERICH.