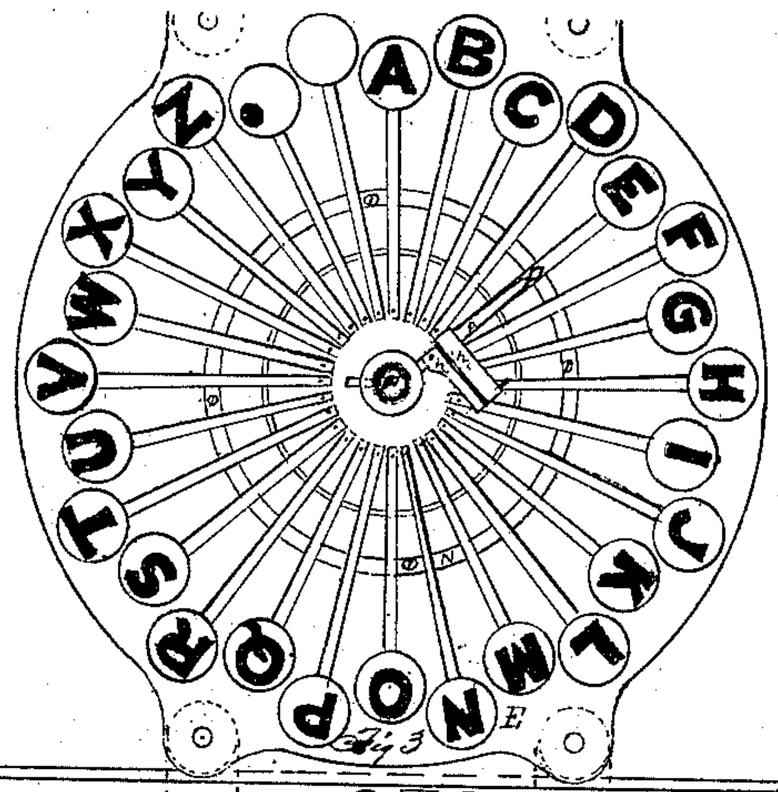
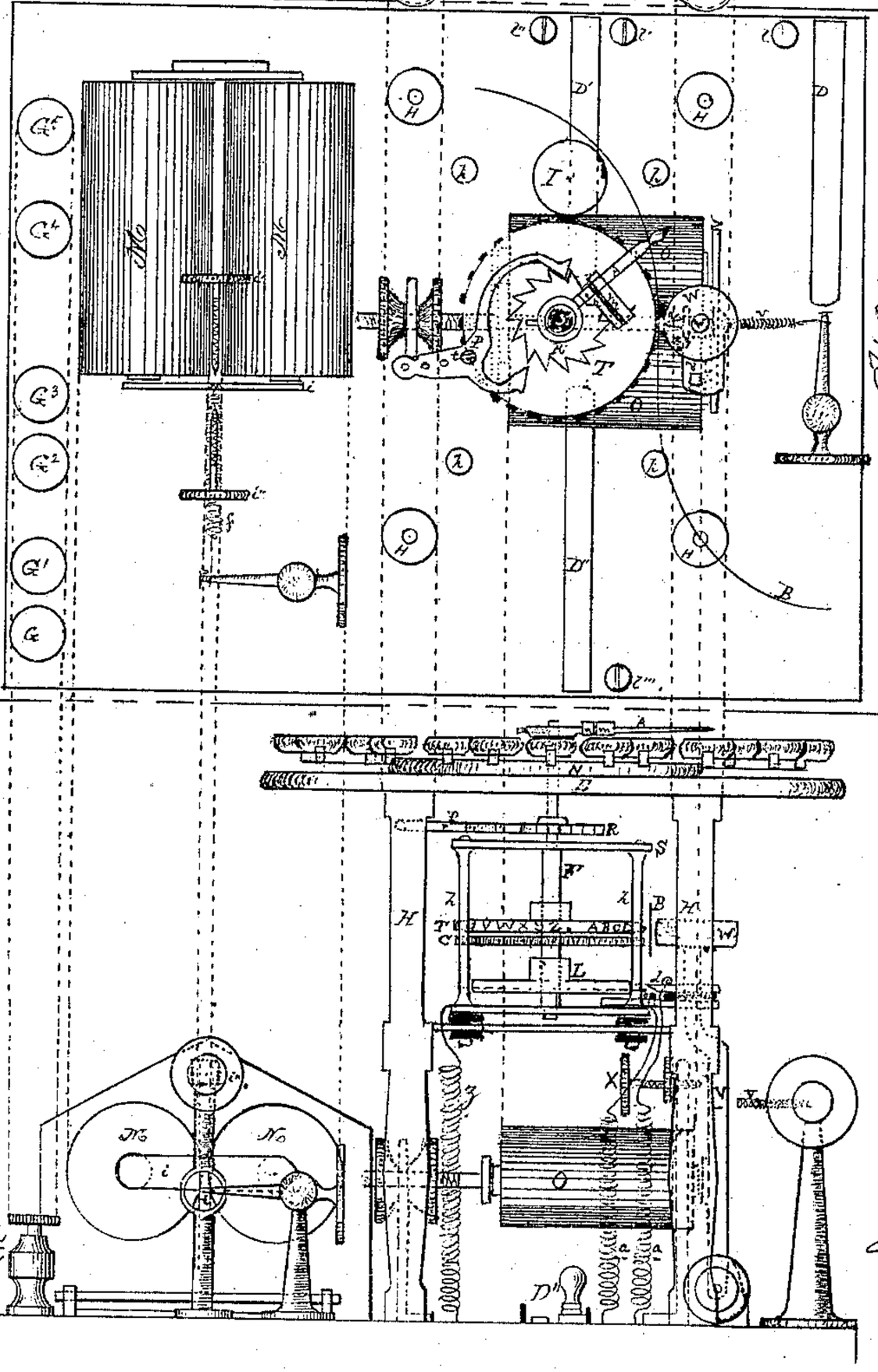
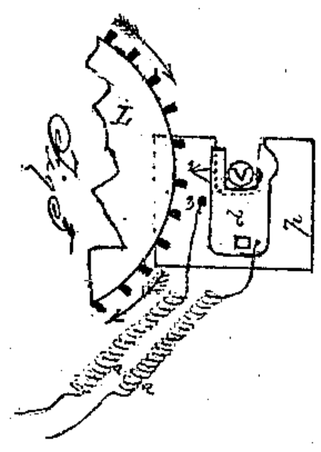
J. T. LINDSEY.

Printing Telegraph Instrument.

No. 102,561. Patented May 3, 1870.







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UNITED STATES PATENT OFFICE.

LANDY TUNSTALL LINDSEY, OF JACKSON, TENNESSEE.

IMPROVEMENT IN PRINTING-TELEGRAPH INSTRUMENTS.

Specification forming part of Letters Patent No. **102,561**, dated May 3, 1870.

To whom it may concern:

Be it known that I, LANDY TUNSTALL LINDSEY, of Jackson, in the county of Madison and State of Tennessee, have invented a new and Improved Dial and Printing-Telegraph Instrument; and I do declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

Where the same letters or figures appear in the different drawings they represent the same parts, whether such parts be there represented in a vertical or horizontal position.

In the accompanying drawings, Figure 1 is a vertical projection of the instrument. Fig. 2 represents the plan, which is divested of such parts as are not necessary to show the manner and means by which the instrument is controlled and operated. Fig. 3 is a metal plate, with levers arranged in circular form thereon, each representing a letter or character of the type-wheel. These constitute a part of the transmitting device, and the plate, when in its proper position, rests upon the posts H, Fig. 2, completely covering all that portion of the instrument inclosed within the square formed by the position of these posts. Fig. 4 is a section of the plan, removed therefrom to show more clearly the position, shape, and manner of adjusting and working the ratchet-wheel R by means of the pawls P. Fig. 5 is another section of the plan, intended to represent the design and connection for keeping a local circuit closed beyond the time allowed by the vibration of the armature-lever of a relay-magnet which had previously closed it.

The letters and figures of reference may be thus traced:

M is a relay-magnet, such as is used in the Morse system. *i* is the armature thereof, fixed on a lever, and supported in adjustable pivot-screws in the ordinary way. *i'* is an adjusting-screw, supported in a frame or post above the magnet, against which the lever of the armature *i* strikes when attracted by the influence of the magnet M. *i''* is a similar adjusting-screw, supported likewise, but entirely isolated from the former, and receives the stroke of the armature-lever when it is released by the magnet M and drawn back by the spring *f*.

G G^1 G^2 G^3 G^4 G^5 are binding-screws and stands, wherein are secured the wires leading from the main line and local batteries to the instrument. E is a metal plate, having a rim, N, thereon, in which is arranged in circular form a number of levers, equal and corresponding to the letters, figures, and other characters of a type-wheel. H are the posts which support the plate E in its position over the type-wheel.

F is a shaft, supported in suitable bearings, and passing centrally through the circle formed by the levers on the plate E. It contains thereon the type-wheel T and a ratchet-wheel, R, from which latter it receives its motion, and also a right-angle arm, A. The two first named are secured in a permanent manner upon the shaft, below the plate E, and the latter fixed likewise above and overlapping the inner converging ends of the levers.

P represents two pawls extended from an arm, shaped from a solid piece of metal, and working on a pin at *t*. When a vibratory motion is communicated to the arm of the pawls they will impart rotation to the shaft F by alternately striking upon the teeth of the ratchet-wheel R thereon.

I is an inking-roller, which supplies the type-wheel with ink. This roller has a small cistern cut into it, into which a supply of ink can be poured, and a series of perforations through to its circumference, to admit the ink seeping through and saturating a woolen wrapper thereon, and sits in a movable frame.

O is an electro-magnet included in the metallic circuit of a local battery, the office of which is to attract the lever V to its poles when the circuit of which it forms a part is closed.

V is a vertical lever in front of the poles of the magnet O, with an armature properly placed thereon to face the poles of this magnet, by which means the lever can be attracted to it. When the magnet loses its attractive power the lever is drawn back and so held by a spiral spring, *v*. This lever also has an impression-roller, W, fitting loosely thereon at its top and immediately in front of the type-wheel. This roller is made broad enough on its circumference to cover the breadth of the type-wheel and a corrugated wheel, C, just below the type-wheel. When magnet O attracts lever V to its poles it brings therewith

the impression-roller W. This roller will then press an interposed strip of paper (represented by the curved line B, Fig. 2) to the surfaces of the type and corrugated wheels, and the friction created by the contact of these wheels will, when the instrument is in motion, carry the paper forward so long as it lasts. As this lever and magnet bear the same relation in all respects to the relay-magnet as the lever and magnet of a "sounder" or "repeater," they may be so used when desired, and the roller W lifted off, if necessary.

L is a wheel fixed on the shaft F, the office of which is to interrupt the flow of the current through the coils of the magnet O, and thereby destroy the friction between the corrugated wheel and impression-roller after they have revolved together sufficiently to move the strip of paper interposed as far as desired. This is effected by filling the circumference of this wheel with a number of metal projecting pins, equidistant the space it is desired the paper shall move. These will intercept the flow of the current through the magnet at the proper instant for the purpose above designated, as will be below explained.

a a, Fig. 1, represent two wires, in spiral form, leading from the armature-lever *i* and screw-point *i'* of the relay-magnet M to and connecting with a fixed platina point, 3, and movable metal plate *d* opposite to the printing-lever and below the type-wheel.

The contact of the points *i* and *i'* in the relay-magnet, it has been shown, closes the circuit of a local battery. The magnet O, being included therein, immediately attracts the lever V to its poles, and this lever, in responding thereto, carries forward the metal plate *d* onto the platina point 3, re-establishing at this place a repetition of the connection formed at *i* and *i'*. As the flow of the current through the coils of the magnet O will now be continued by this latter contact after the points *i* and *i'* are disunited, the circuit would remain closed indefinitely if means were not devised to interrupt its flow through the coils of the magnet momentarily, and thus break the circuit. For this purpose the break-wheel L, with the metal pins thereon, is employed, and its operation thus explained: Upon the metal plate *d* is a small projection. (Shown at 2.) When this plate is carried forward upon the platina point this projection is likewise moved in between the pins on the wheel L. When this wheel has revolved the distance between pins one of the pins will strike and lift the plate *d* above and off of the platina point 3, thereby breaking the circuit of the local battery there closed and destroying the influence of the magnet. The spring *v* will then withdraw the lever V, and with it plate *d*, beyond its connection with the point 3. The lever V, on being withdrawn, will bring with it the impression-roller W. This will destroy the frictional contact existing between this roller and the corrugated wheel which moved the paper.

X is an adjusting-screw, to regulate the pressure of the impression-roller W against the type-wheel T when the lever V is attracted by magnet O. *h* are small posts, which support two plates which furnish the bearings for the shaft F. S is the upper of these two plates. D is an ordinary metal switch-bar, movable to and on the button *l*, for opening and closing the circuit of the main line. This may be substituted by an ordinary key, having a circuit-closer attached thereto. D' is a similar metal bar, movable back and forth on the buttons *l l''*, and having a position of rest between them. Its use is in conjunction with that of my electro-magnetic motor, and is to make its vibration unintermitting or annul it, as desired. D'' is another such metal bar, movable to and upon the button *l'''*. Its office is to annul the power of the magnet O, by breaking the circuit at this point, if desired.

K, Fig. 4, is a small plate, having a slot, *e*, therein, and the arm of the pawls P secured movably thereon by the pin *t*. By the use of this plate, on which to place the arm of the pawls and of the slot therein, through which to pass a screw into a second plate beneath, the position and proper adjustment of the pawls can be obtained with perfect accuracy, and permanently secured by screwing down the head of the screw over the slot. *m* is a movable anvil, attached to the arm A by means of a small parallel bar, *n*, to which it is fastened in a manner similar to a hinge. The bar *n* is fixed permanently on the arm A. This arm revolves with the shaft F, and carries the anvil *m* with it.

z, Fig. 1, represents a spiral-wire connection, extending from the main line, through the relay-magnet M, posts *h*, and frame S, to shaft F, having revolving anvil *m* thereon. For the easier adjustment of the wheels and arm A on the shaft F, they are secured thereon by the use of set-screws.

My invention consists, first, in an improved method of constructing the transmitting or signal-key, such as used in the Morse and other like systems, which employ arbitrary characters to represent the letters of an alphabet. This key, as heretofore and at present constructed, consists of a single brass lever four or five inches long, suspended upon an arbor in a metal frame between adjustable set-screws, in such a manner as to allow it to move freely in a vertical direction, its movement in one direction being stopped by striking upon a permanently-located anvil, and in the other by means of an adjustable set-screw. One wire of the main-line circuit is connected to the metallic frame of the key, and the other to the anvil, upon which it strikes, the latter being insulated from the former.

My improvement consists in dispensing with such a frame as that above alluded to, which contains but a single key, and replacing in its stead a larger one, having a number of keys or levers therein, by which means it may be made equally as applicable as a transmitter

for a printing as for a Morse telegraph instrument.

To make it answer the purpose of a transmitter for a printing-telegraph instrument, it will be necessary to have this frame large enough to contain a separate lever for and representing each letter, figure, or other character on the type-wheel of such an instrument. As the relative position of the anvil is the same to all of these keys as to one, the levers being all connected together metallically by means of the frame in which they are supported, it is only necessary to connect one wire of the main-line circuit with this frame to bring it into metallic communication with all the levers. But as the size of the anvil is not changed, and no larger than that required for a single key, it becomes necessary to devise means whereby it can be brought around to make a contact with any lever with which it is desired to close the circuit.

The same connections of the main line are observed in this instance as represented above for an ordinary key—that is, one wire connects with the frame, which contains all the levers therein, and the other connects with the anvil, which must be in such a position as to be made accessible to any one of the levers with which it is desired to cause it to form a contact.

To accomplish this, it will be seen by reference to Fig. 3 that I arrange the levers in their frame in circular order. I then pass through the center of the circle formed by them, and at a right angle thereto, a shaft, F, best shown in Fig. 1, upon which I place a type-wheel, T, and an anvil, *m*, the former below and the latter above the levers.

The anvil is supported upon a metal arm, A, projecting at a right angle from this shaft, overlapping and lying parallel with the inner converging ends of these levers. This shaft is supported in suitable bearings, so that it can be revolved by the communication of any power for this purpose, other arrangements and conditions necessary to enable it to receive a rotary motion therefrom having been complied with. Therefore, any means employed to impart revolution to the shaft F will move, also, the right-angle metal projection A thereon, which supports the anvil *m*, and this anvil, by being secured in a position just over the inner converging ends of the levers, will revolve above and describe such a circle as is formed by them. During each revolution it will pass directly across the inner ends of all these levers, and a contact may be made between it and any one of them by depressing the lever so desired and holding it so until the revolution of the shaft brings the anvil around and against it.

The anvil *m* may be supported in its position on the arm A by means of a hinge-fastening, connecting it with a fixed parallel bar, *n*, so that when it is intercepted by coming in contact with the point of a lever depressed for that purpose, it will yield sufficiently to avoid friction and mount upon, as it glides across, the point of the lever, a slight spring above serving to hold the anvil down to its position on the arm A. This is necessary where the motion of the instrument is unintermitting, and it is desired to prevent this contact impeding the motion of the arm A. It has an additional advantage also, as the anvil can be removed, when necessary, to clean the platina surface thereon.

The type-wheel must always be fixed on the same shaft that has the anvil thereon, and the levers of the transmitting device be arranged in circular form around this shaft. The levers, anvil, and type-wheel must then be so adjusted with reference to each other that when any lever and the anvil come in contact, that letter on the type-wheel which corresponds to the one represented by such lever must be at the same instant immediately before the impression-roller. This roller W, as shown in Figs. 1 and 2, fits loosely upon the lever V, opposite to the type-wheel. This lever has an armature thereon, controlled by a local circuit-magnet, O.

Thus it will be seen that the component parts of the Morse instrument are retained, while the form in which I construct the transmitting apparatus gives it the additional advantage of being applicable as a transmitter for a printing-telegraph instrument, also, for either of which it can be used at pleasure; and the manner in which I employ the lever of the sounder makes it equally as available as a printing-power to produce the impression of a letter as a sounder to produce signals. I claim, therefore, to have utilized the electrical connections of the Morse system by certain changes in, and additions to, its mechanical form, whereby it can be made a combined Morse and printing-telegraph transmitter and receptor, and equally applicable for either.

These changes consist, first, in dispensing with the single lever or key, properly supported in a metal frame and striking upon a stationary anvil insulated therefrom, and substituting instead a frame sufficiently large to hold therein a number of levers or keys equal to that of, and representing, the letters, figures, and other characters upon the type-wheel of the instrument to which they belong; second, by the arrangement of these levers in circular form, so that by placing an anvil on the revolving arm of a shaft so that it will lie just above and parallel to them, it may, by the revolution of this shaft, be made accessible to any one of them, as it passes over in completing each revolution; third, in fitting a suitable roller loosely upon the lever of an instrument similar to a sounder, so that it will be opposite to the type-wheel, and can be made to press a strip of paper interposed thereto whenever actuated by a magnet properly placed to so control it.

Whenever the revolving anvil is in a position of rest over any one of the alphabetical levers, that lever and the anvil, taken together,

represent exactly the single key and stationary anvil of the Morse system; and by removing the impression-roller from the lever which supports it, this lever will represent the sounder of that system also. The connection with the relay-magnet and its mechanical operation and effects remain the same for either system.

To convert the instrument at once into a printing-telegraph, replace the impression-roller upon the lever, and, after having given a rotary motion to the shaft which contains the type-wheel and revolving anvil thereon, depress in regular succession those levers which represent the letters of a word it is desired to print. Each time the revolving arm reaches and makes contact with a lever, it will close the circuit of the main line, and the lever which has the impression-roller thereon, obeying the impulse communicated to the magnet which controls it, through the action of the relay-magnet, will move this roller forward and against the type-wheel, pressing an interposed strip of paper thereto, and imprinting such a letter thereon as is represented by the alphabetical lever above which has made contact with the anvil.

It now remains to describe how the revolving anvil, type-wheel, and alphabetical levers can be so adjusted with reference to each other as to insure a correct production of the same letter on the paper as that represented by that lever which makes contact with the revolving arm. By representing the letters and other characters on the levers in the same order in which they occur on the type-wheel, and revolving the shaft having the anvil thereon so as to bring any particular letter on the type-wheel below to a position immediately in front of the impression-roller, and then fitting the arm above which supports the anvil so that it will be immediately over that lever which has a corresponding letter represented thereon, the adjustment will be complete for them all. The illustration furnished by the drawing will more clearly explain this.

By reference to Fig. 3 it will be seen that the anvil *m* on the arm A is lying immediately over that lever which represents E. Upon referring to the letters indicated on the type-wheel in Fig. 1 it will be seen that E thereon is also just in front of the impression-roller W. If this lever be now depressed so as to close the circuit of the main line by its contact with the anvil, the impression-roller will be immediately thrown forward, and will press the strip of paper to the type-wheel and imprint the letter E thereon. This is the only adjustment necessary for the instrument.

By moving the shaft so as to bring the letter F on the type-wheel before the impression-roller, the anvil, being fixed on and revolving with this shaft above, will advance the same distance and stop immediately over the lever marked F, by depressing which and forming contact with the anvil, the letter F will also be imprinted in the manner as above shown, and so on throughout. As each letter on the type-wheel is advanced to a position immediately in front of the impression-roller, the anvil above advances correspondingly, and assumes a position immediately over the lever so marked above.

While the revolving anvil performs the same office in all respects at each contact with a lever of the transmitting device—that of representing one wire of and assisting to close a main-line circuit—as it does when stationary in conjunction with a single key, it also corresponds in its office here to that of the revolving cylinder which constitutes a part of the composing and transmitting device of other printing-telegraph systems.

Herein I claim an important advantage gained. These cylinders, aside from their cumbersome size, require the greatest accuracy in their construction to insure a like result when in contact with the different keys of the "piano key-board," a similar but separate arrangement having to be made thereon for each key.

In my invention it is only necessary to ascertain the width between the letters on the type-wheel and observe a corresponding width between each lever contained in the circle they form. Then by a single adjustment of the revolving anvil, made as hereinbefore explained, the transmitting device is complete. This anvil, which supplies the place of the cylinder above spoken of, can be made of a piece of metal, with a platina surface thereon, not necessarily weighing over two ounces. The adjustment thereof can be easily, readily, and accurately made, and, the position it occupies on the shaft being above the levers over which it passes during each revolution, its working will be always visible, and, when required, it can be removed without disturbing any other portion of the instrument.

Another important advantage I claim, arising from the position in which I place the levers of the transmitting device, is my ability to convert the instrument into a dial as well as a printing or Morse telegraph. The two latter have been already explained; the former I will now explain.

The circular form in which I arrange the alphabetical levers which constitute that portion of the transmitting device as shown in Fig. 3 renders the instrument favorable to this latter consummation. By employing a ratchet or other equally suitable motion to communicate revolution to the shaft which has the type-wheel and revolving anvil thereon, and by extending the length of the arm A, which supports this anvil, so as to terminate it in the shape of a pointer or index, similar to the hand of a clock, a step-by-step motion can be imparted to the shaft by such means, and the arm point to each letter represented on the different levers as it advances to a position over them. The motion so employed would carry the type-wheel and arm forward one letter at each stroke of the pawls on the

teeth of the ratchet-wheel. Suitable provision will have to be made in this case for momentarily arresting the motion at any lever the letter on which it is desired to indicate, that it may pause long enough over such lever to so indicate it. This I claim also to have accomplished by the use of a ratchet-motion in conjunction with my electro-magnetic motor already patented, and in the manner I shall hereinafter describe.

The novelty of this invention cannot be presented more comprehensively than by claiming my ability to adapt it as a Morse printing or dial telegraph, possessing in one, as has been above explained, all the essential requisites necessary for each, and so constructed that these qualities are combined without requiring any readjustment or change in the instrument, either system above referred to being readily available at the option of the manipulator.

The connections necessary to connect the instrument with the main line correspond with those made use of for this purpose in the Morse system, their originality forming no part of my claim. One end of the main-line wire passes through the relay-magnet M to and connects with the frame N, which contains the alphabetical levers therein. The other end of this wire proceeds to and connects with the revolving anvil *m* through the shaft F. Therefore, when the revolving anvil and any one of the levers of the transmitting device unite, their contact closes the circuit of the main line. The local circuit, having the magnet O therein, which controls the movement of the printing-lever V and impression-roller thereon, is simultaneously closed by the action of the relay or main-line magnet, and the letter thus imprinted.

I have introduced a switch-bar, D″, and button *l‴*, Fig. 2, into the metallic circuit of the local battery of the magnet O, by which means I can permanently break the circuit by removing the bar from the button. This would be necessary at any station while transmitting; for were it otherwise, each time the main-line circuit closed the local circuit would do likewise, and the lever V, responding to the pulsation thus given to the magnet O, would advance the impression-roller to the type-wheel and imprint the letter. The use of this bar, however, can be avoided by removing the impression-roller from the lever which supports it, as is done when employing this lever as a sounder. There would then be no contact between this roller and the type-wheel at each vibration of the lever in response to the closing of the main-line circut, and if this circuit be elsewhere interrupted the lever ceasing to vibrate would so indicate it.

The Morse system forms an indispensable co-operative part in conjunction with the use of my instrument as either a dial or printing telegraph, for it is necessary to employ it for signaling stations, which is required to be done in an audible manner, and otherwise indicating what the movement of the printing mechanism would fail to do. Its use may also be claimed as a valuable auxiliary to my instrument by enabling the introduction of repeaters. Where a telegraph-circuit exceeds a certain length, or, by reason of defective insulation or otherwise, the current of the main line becomes so enfeebled that signals are transmitted to distant stations with difficulty, it frequently becomes necessary to divide or cut up the line into one or more shorter circuits, each complete in itself, but through all of which signals may be transmitted simultaneously throughout their original extent by the aid of repeaters, an instrument the operation of which is familiar to those practically versed in the art of telegraphing.

The principle of repeaters, it may not be amiss here to say, consists in causing the lever of a sounder of one circuit to open and close another circuit by an action similar to that of a relay-magnet, reproducing in effect upon a second circuit a repetition of the pulsations of electricity transmitted from a station included in the first circuit, and so on throughout a succession of circuits so connected. Repeaters are also often used for connecting one or more branch lines with a main line, for the purpose of transmitting simultaneously the same dispatch over them all.

By making the proper connections of the line-wire with the lever V and a screw-point, X, against which it strikes, (see Fig. 1,) all the benefits to be derived from the use of repeaters may be secured without the addition or introduction of any additional mechanism for this purpose.

As a printing-instrument would not be complete in all its parts without a proper arrangement in some shape for a feeder to insure the movement of the strip of paper after the impression of a letter had been made thereon, so as to make place for the next, I have devised suitable means for this purpose, the originality and utility of which are here claimed. These refer to a reclosing of the local circuit of the magnet O after it shall have been previously closed by the contact of the points *i* and *i′* of the relay-magnet, (see Fig. 2,) and so continuing it a sufficient time to allow the frictional contact of the type-wheel and impression-roller, while thus held and revolved together, to carry forward the paper simultaneously with the impression of the letter thereon. This is done by the movement of the printing-lever V as it advances to the poles of the magnet O, the magnetism of which has just been acquired by the contact of the points *i* and *i′* of the relay-magnet, and which, by being retained by the movement of the lever V, will now be perpetuated so long as this lever is held to its poles, for the movement of the lever has reclosed, and is keeping closed, the local circuit of the magnet O, and this magnet, thereby retaining its power, is holding the lever to its poles, and preserving the connection it has made by advancing to them. We have, there-

fore, the result that the connection so formed preserves the influence in the magnet, and the magnet by its influence preserves the connection unbroken. The magnet cannot lose its power until the lever is withdrawn, so as to break the local circuit, and the lever cannot be withdrawn by the spring for this purpose so long as the magnet retains its power. The local circuit of the magnet O would, by the above arrangement, remain closed perpetually were not means devised to momentarily interrupt the flow of the current through the coils of the magnet O, and cause it to lose its attractive influence over the armature on the lever V. This being done, a spiral spring, *v*, will immediately withdraw the lever V, doing which will disunite the connection formed by it and break the circuit of the local battery.

Since the movement of the printing-lever V has reclosed the local circuit in the first instance, as above shown, it remains for the driving or driven motion of the instrument to interrupt the flow of the current through the coils of the magnet O at the proper instant to admit the lever V being withdrawn by the spring *v*, and so cut it off entirely by breaking the circuit. The latter effect, which may be caused by any suitable device for breaking the circuit ultimately, may be in the shape of a wheel, revolving on the same shaft with the type-wheel, or a metal slide having the proper battery-connections attached thereto, so as to break and make the circuit at each vibration of the propelling-lever of my electro-magnetic motor, when this power is employed to impart motion to the instrument.

It is immaterial in what position and shape this arrangement is made for extending and continuing the connection formed in the first place by the contact of the points *i* and *i'* in the relay-magnet, so that the movement of the printing mechanism, when actuated to imprint a letter, recloses it, or how broken afterward, so that the driving or driven motion of the instrument subsequently breaks it.

As the most available position in which to represent my idea, I have extended the wire-connection which closes the local circuit by the contact of the points *i* and *i'* in the relay-magnet M, Fig. 2, from these points to a place immediately in front of the lever V, and just below the type-wheel.

One of the wires thereof I have terminated in a permanently-located platina point, 3, the other in a small movable metal plate, *d*. (Best shown in Fig. 5.) The latter is secured loosely on a pin, and has a slotted opening therein, through which the lever V passes. When this lever is attracted to the poles of the magnet O by the contact of the points *i* and *i'* in the relay-magnet, it carries the metal plate forward upon the platina point, reuniting the connection represented at *i* and *i'*, and in the same manner reclosing the circuit in which the magnet O is included. This completes the arrangement for reclosing the local circuit by the movement of the lever V. It now remains to provide the means by which this circuit can be broken after the type-wheel and impression-roller have revolved together far enough to propel the paper ahead by their friction.

The friction requisite to move the paper may be more surely made by having a wheel, C, Fig. 1, with a corrugated circumference, secured to and just below the type-wheel. The shape in which I have represented the circuit-breaker is by placing immediately below the type-wheel T and corrugated steel wheel C another wheel, L, having on its circumference twenty-eight metal pins, placed equidistant, there being this number of letters represented on the type-wheel. (See Fig. 1.)

When the impression-roller and type-wheel have revolved together the one-twenty-eighth part of the circumference of this wheel—the space occupied by one letter—one of these pins will strike and slide under the metal plate *d*, lifting it above and off of the platina point 3, and breaking the circuit there closed, the lever V being simultaneously withdrawn by the spring *v*.

A more comprehensive explanation of this arrangement may be had by reference to the sectional drawing, Fig. 5, which fully elucidates the idea. In this drawing only the parts necessary in securing these results are shown.

L is a broken section of the break-wheel, having the metal pins thereon. V is the top of the lever as it appears through the slot of the metal plate *d*.

The plate *d* represents one wire of the connection, and the platina point 3 the other, extended thereto from the points *i* and *i'* in the relay-magnet. *p* is an under plate, which supports the plate *d* and point 3, which are properly insulated from each other. The plate *d* is secured movably on a pin at 4, and is represented as when withdrawn from contact with the platina point 3.

When the magnet O attracts the lever V to its poles, it carries the slotted side of the plate *d*, through which it passes, forward also, and upon the platina point 3, reuniting at this place the connection formed at *i* and *i'*, as above explained. There can also be seen a small projection, 2, upon the plate *d*, which is carried forward also, and to a position between the pins on the wheel L. Therefore when the wheel L has revolved the distance between pins thereon, one of them will strike and lift the point 2, and with it plate *d* as it passes under. This will break the connection of the local circuit there formed, and, the magnet O losing its power, the lever V will be immediately withdrawn by the spring *v*, carrying with it the plate *d* beyond any contact with the platina point 3, in which latter position the drawing, Fig. 5, now represents it.

If there should be any objection found to the method as above described for moving forward the paper, it may be done by a ratchet motion, communicated by the lever V at each stroke, or by the use of clock-work, moved by

a weight or spring, and the motion of the lever V employed to arrest and release an escapement of the same at each stroke.

I further claim the ready adaptability of my instrument, with all the advantages hereinbefore claimed for it, to any of the printing-telegraphs heretofore invented, where such instruments can be made to move synchronously, whether moved by manual or electrical power, and without reference to the agencies employed to give it motion, the revolving anvil being always placed on, and the alphabetical levers of the transmitting device around, that shaft in such instrument which has the the type-wheel thereon, the manner of adjusting the instrument being the same as hereinbefore explained.

Having described the nature of my invention, and shown in what manner its application can be utilized, I will now describe the manner in which I can communicate a rotary motion to the type-wheel by the employment for this purpose of my vibrating electro-magnetic motor granted by Letters Patent No. 92,066, dated June 29, 1869.

For this purpose it is necessary to have but a single shaft in the instrument upon which to place the arm A, which holds the revolving anvil thereon, type-wheel T, corrugated wheel C, and break-wheel L. (See Fig. 1.) They are placed thereon in the order of allusion, the revolving anvil being just above and over the alphabetical levers of the transmitting device, and the others below them. Any of the known methods may be applied to this shaft for imparting to it rotary from rectilinear motion. That which I have represented is by the use of a ratchet-wheel, R, secured on the shaft above spoken of. The employment of this or any similar motion best enables the use of the dial system, when so desired, as each vibration of the propelling-lever of the electro-magnetic motor will communicate a corresponding motion to an arm having two pawls thereon, and one of these pawls, striking upon a tooth of the ratchet-wheel at each vibration, will urge it and the shaft also forward.

The connecting medium between the vibrating lever of the electro-magnetic motor and the arm of the pawls, which receives its motion therefrom, is a rod of an insulating substance, or having an insulated section therein, which is so made to prevent any liability of a ground-connection being formed with the main line through the propelling-lever of the motor, which is connected with the circuit of a local battery. The position in which I place this lever is vertical, with an armature properly supported thereon to face the poles of two horizontally-placed magnets, one on either side of it, which is one form in which I place the magnets and levers of my motor. These magnets will, as they become alternately charged, in like manner attract the armature, and with it the lever to their poles.

The printing instrument having been already adjusted, as hereinbefore described, upon revolving the shaft from right to left, or left to right, as the position and movement of the ratchet-wheel and pawls will determine, each vibration of the propelling-lever of the motor, communicated to the ratchet-wheel, as before described, will carry forward a letter on the type-wheel to a position in front of the impression-roller, the revolving arm with anvil thereon above also advancing simultaneously therewith to and over that lever in the transmitting device lettered correspondingly.

In order to place the motion of my electro-magnetic motor under the control of a relay or main-line magnet, that it may be stopped and started by the armature-lever of this magnet, similar to the manner of actuating the vibration of the lever of a sounder, I have introduced such a connection, leading from the relay-magnet to the motor, as is necessary to effect this purpose, and its course and result may be thus traced: One of the wires leading from the electro-magnetic motor to a battery is disunited, one of the dissevered ends thereof being connected with the armature *i*, and the other with the screw-point *i''* in the relay-magnet M. (See Fig. 2.) That dissevered end which leads to and connects with screw-point *i''* is first connected with a metal bar, D′, and from thence it is continued to this point by a wire-connection leading from the button *l''*, on which this bar rests. This bar and button are introduced into the route of this connection, to enable the wire united by them to be divided by sliding the bar off of the button when it is desired to permanently interrupt the motion of the motor.

When the bar D′ is resting on the button *l''* the connection is complete in this quarter; and when the circuit of the main line is opened the relay-magnet M will lose its power over the armature on the lever *i*, and this lever will be drawn back by a spring, *f*, against the screw-point *i''*, and their contact close and complete the broken circuit of the motor, causing its motion to immediately begin; but when the circuit of the main line is closed the relay-magnet M will regain its power, and at once attract the armature, and with it the lever *i* to its poles. This will break the contact between this lever and the screw-point *i''*, and, by so disuniting the wire leading to the battery above alluded to, arrest the motion of the motor. Upon the use of this connection depends the successful working of the dial-system when this power is applied to impart motion to the instrument. To start the motion of the electro-magnetic motor, then, it will only be necessary to open the circuit of the main line, and thus form the requisite connection for so doing by uniting the points *i* and *i''*, as above explained. This is an important advantage, as any number of instruments placed at different distant stations can thus be simultaneously started and stopped by opening and closing the main-line circuit. If, however, an intermitting motion is desired, it can be obtained by extending that wire which

makes a connection with the armature-lever *i* in the relay-magnet beyond this position to a button, *l'*, which is accessible to the switch-bar D'. The bar D' is already in connection with one end of the dissevered wire of the local battery of the motor which leads to the screw-point *i''*.

By thus placing the button *l'* in communication with the other end thereof, which connects with the lever *i'*, and moving this bar to and on the button *l'*, the connection of the battery-wire, which is made each time the points *i* and *i''* unite, will be permanently established at this place, and the motion continue without intermission, regardless of the contact at *i* and *i''*.

The bar D', when moved onto button *l'*, makes the motion of the instrument uninterrmitting. When moved on the button *l''* it causes the instrument to start and stop each time the circuit of the main line is opened and closed by obeying the vibration of the armature-lever of a relay-magnet; and when in a position of rest between these buttons it keeps the battery-wire of the motor permanently disunited, and stops its motion entirely.

In the use of the dial system the step-by-step motion, which the use of a ratchet-wheel gives, has been shown as the most practicable, as this motion moves forward one letter on the type-wheel and advances the revolving arm, with anvil thereon, to another lever in the transmitting device at each movement of the same.

There are, however, disadvantages in the use of the ordinarily-arranged ratchet-wheel movement. These disadvantages arise from the arms and pawls which operate on and move the wheel being more or less jointed, and depending upon springs or their own gravity to insure their falling between and catching upon the teeth at the proper instant.

There is also engendered, to some extent, a friction on the surface of the teeth of the ratchet-wheel requiring additional force to overcome, caused by one pawl having to be dragged over their surface, while the other is acting and driving this wheel forward. This is greatest where the pawls require the pressure of a spring to insure their clicking in between the teeth of the wheel just after being dragged over those preceding.

Another and vital danger, inasmuch as it affects the synchronous movement of the instruments, upon which their success depends, is the liability of the revolving shaft to run ahead of the regular motion of the propelling power, on account of the momentum imparted to it by the rapid vibration of the latter, which would readily overcome the slight resistance which the spring-pressure or gravity of the pawls would offer to retard this weight in rapid motion after the pawls had completed a stroke and made a temporary pause. If there were no pause in the vibration of the propelling power this would not be so liable to occur; but the electro-magnetic motor having two vibrating levers, one of which is always at rest while the other is completing its stroke, the disadvantage pointed out becomes apparent.

I claim to have invented an improved manner of constructing the arm and pawls which impel a ratchet-wheel forward, by the use of which all difficulties in this respect are obviated. It depends on neither springs nor gravity to insure the proper action of the pawls which impel a ratchet-wheel forward, and the arm and pawls are made of a solid piece of metal without a joint or break therein.

Only one pawl can be in contact with or touching the wheel at one time, the other always receding correspondingly from the wheel. When the stroke is completed the pawl which has driven the wheel forward remains closely fitted between the teeth thereof, where it is held firmly by the propelling-lever until the other lever has made its stroke, thereby preventing any possibility of the ratchet-wheel gliding ahead, however rapid the motion the lever is making at each vibration.

Fig. 4 is a correct illustration of the mode of constructing the arm and pawls to insure these advantages. They are shaped, as there shown, from a solid piece of metal, which is the prominent novel feature in their construction; and, as they are inflexible, when one of the pawls is approaching a tooth of the ratchet-wheel, the other is receding correspondingly. They are so adjusted that when one pawl reaches the tooth to which it is moving, the other has receded just beyond the tip of that tooth upon which it has just been resting, releasing it, and leaving the wheel free to move forward under the pressure of that pawl which is driving it.

In the drawing, Fig. 4, I have represented by dotted outline the position occupied by the longer pawl before the movement began in the opposite direction. It will be seen that it had pressed the wheel forward until it had moved into and compactly filled the space between teeth, and in this position it held the wheel firmly and securely until the other lever had completed its stroke and the motion of the arm of the pawls commenced in the contrary direction. The position occupied by this longer pawl, as shown by dotted outline in Fig. 4, is also clearly shown in full outline in the plan, Fig. 2. The pawls are so shaped as to fit and fill completely the space between teeth, as there shown, thereby preventing the wheel moving in either direction when the pawls are in the position there represented.

The position in which I have indicated the pawls to be in Fig. 4 is when the stroke is about half completed. The short pawl is shown to have just reached that tooth to which it is being moved, while the longer pawl is seen to have receded sufficiently far to be clear of any contact whatever with and above the tips of the teeth of the wheel, leaving them free to move forward under it. This clearly illustrates the idea, showing the infal-

libility and accuracy of the movement, the impossibility of any motion whatever of the ratchet-wheel after the movement of the pawls has ceased, caused by the momentum imparted by the rapidity and force of each vibration of the propelling-lever, and also that but one pawl is ever in contact with or against the ratchet-wheel at one and the same time. It is just the reverse of the action of the pallets which control an escapement, which merely arrest and release the teeth of a wheel driven by an independent power. This arrangement engages the teeth of the wheel and propels it also.

The manner as above described of either pawl fitting in between the teeth of and holding the ratchet-wheel immovable at the completion of each stroke thereon, insures the practicability of the dial system; for if it is desired to suddenly arrest the motion of the instrument to point out and indicate a letter, that pawl which has just completed its stroke may, by the closing of the main-line circuit and breaking of the contact between the points *i* and *i''* in the relay-magnet, as hereinbefore shown, be held firmly against the wheel, and so stop the revolution of the shaft.

As it requires a very exact adjustment of the pawls to insure a reliable movement of the ratchet-wheel, I fit the arm thereof movably on a pin, *t*, on a small metal plate, *k*. (See Fig. 4.) Into this plate I cut an oblong slot, through which to pass a screw, *e*, to fasten it permanently to a fixed base, S, beneath, after it shall have been properly adjusted. The use of this plate *k* admits the shifting of the pawls secured thereon into various positions, by means of its slotted opening and the use of the screw *e* therein, until a correct adjustment shall have been acquired, after obtaining which the plate can be penmanently secured by closing down the head of the screw over the slot.

The synchronous movement of two or more of these instruments by the attachment of my electro-magnetic motor can be obtained with the most perfect accuracy, and in the following manner:

Let it be supposed that the dial system is being used, and it is desired to make the instrument at the receiving-station move synchronously with that at the transmitting-station. The operator at the latter station will depress one of the alphabetical levers of the transmitting device, which shall have been previously understood by both. The operator at the former station will then continue the adjustment of his governor until his instrument will indicate the same letter also at each revolution. Thus, if it were previously understood that A should always be the letter to adjust to, each time the anvil on the revolving arm came in contact with the lever correspondingly marked at the transmitting-station, the instrument at the receiving-station would also indicate a letter, but a different one. The space it would fall short of reaching the lever lettered A, however, could be noted, and the governor manipulated so as to perceive with what rapidity it neared its proximity thereto at each revolution, until finally it could be made to stop immediately over it. The distant station can then be signaled to this effect by simply opening the main-line circuit, which will destroy the power of the relay-magnet to stop and start the motion of the motor, since it will then be broken in two places, and consequently cannot be closed by the contact of the anvil with a lever at the transmitting-station, as before this latter opening had occurred. The failure thereupon to close the main-line circuit would also be the cause of the relay-magnet M failing to attract the armature-lever *i*, and so draw it from its contact with the point *i''*. This contact being preserved, as above explained, the motion of the motor will continue without intermission, and not stop to point out a letter, which, being observed at the transmitting-station, will demonstrate that the proper adjustment has been obtained.

Having described my invention, I claim—

1. The combination of the series of levers A B C D, &c., arranged in a circle and properly supported in a frame, with the arm *a*, anvil *m*, and rotating shaft F, in the manner and for the purpose set forth.

2. Extending the wires connecting with the points *i* and *i'* in the relay-magnet M to plate *d* and platina point 3, for the purpose of keeping the circuit through the magnet O closed after the contact of the points *i* and *i'*, substantially as described.

3. The break-wheel L, so arranged as to break the circuit through the magnet O after the contact of the type-wheel and impression-roller has been maintained long enough to move the strip of paper for a distance sufficient to form a space between the letters, in the manner substantially as set forth.

4. The combination of the printing-telegraph instrument with the electro-magnetic motor, in the manner and for the purpose described.

5. The combination of the slotted plate *k*, or its equivalent, with the arm and pawls operating the ratchet-wheel, as described.

L. T. LINDSEY.

Witnesses:

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D. M. STEPHENS.