3 Sheets—Sheet 1.

T. M. FOOTE & C. A. RANDALL.

PRINTING TELEGRAPH APPARATUS.

No. 114,791. Patented May 16, 1871.

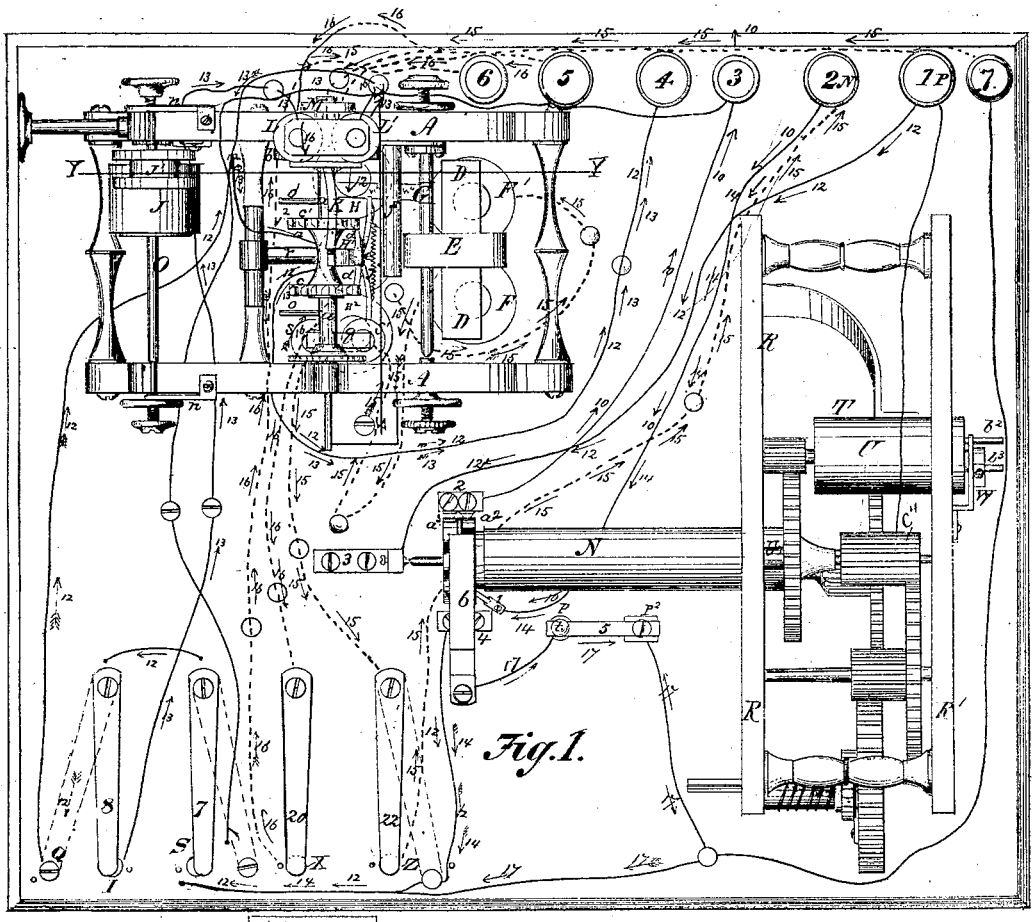


Fig. 1.

Fig. 6.

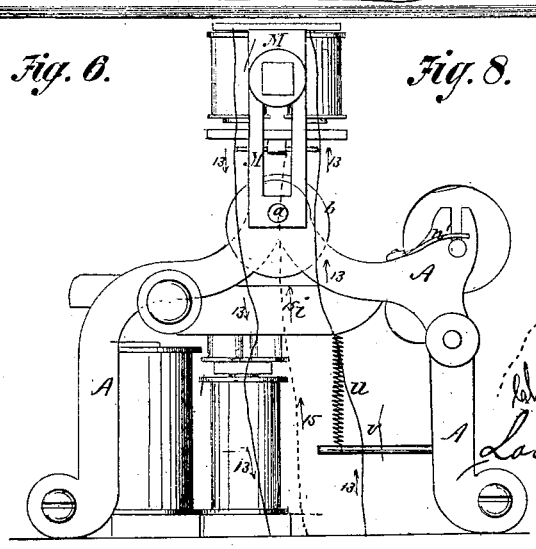
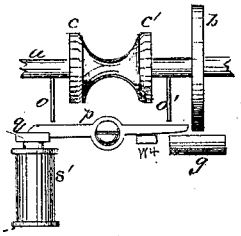


Fig. 8.



Witnesses.

Charles E. Doe

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Inventors

Thos. M. Foote

Charles A. Randall

3 Sheets—Sheet 2.

T. M. FOOTE & C. A. RANDALL.

PRINTING TELEGRAPH APPARATUS.

No. 114,791. Patented May 16, 1871.

Fig. 2.

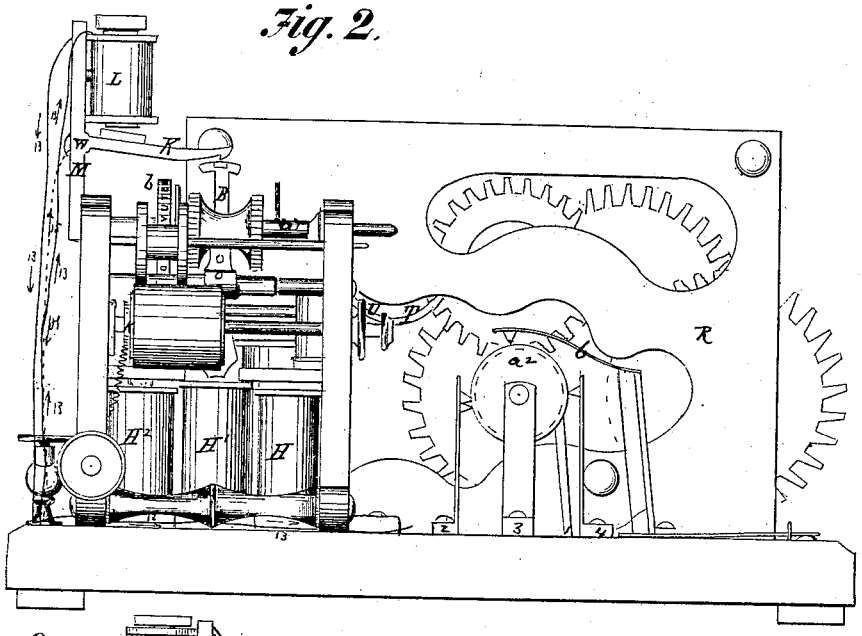


Fig. 3.

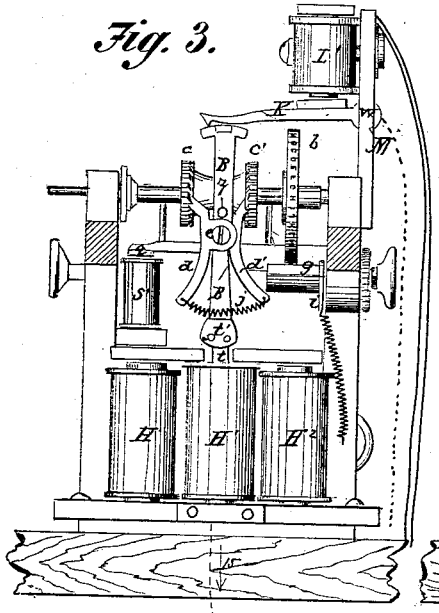
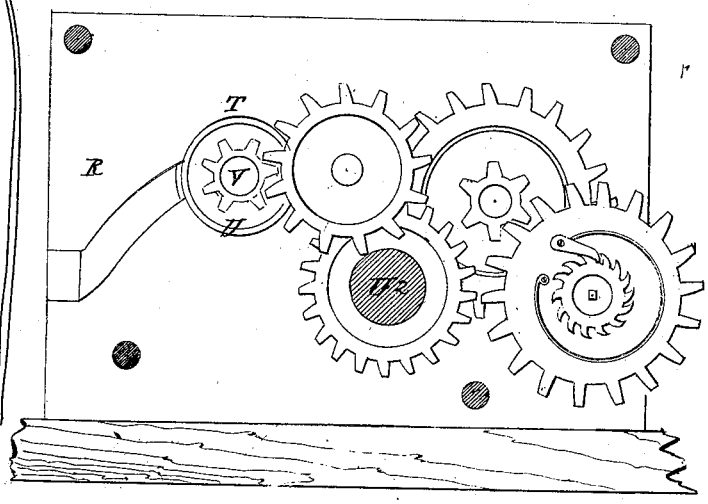


Fig. 4.



WITNESSES

Louis W. Frost

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3 Sheets—Sheet 3.

T. M. FOOTE & C. A. RANDALL.

PRINTING TELEGRAPH APPARATUS.

No. 114,791. Patented May 16, 1871.

Fig. 5.

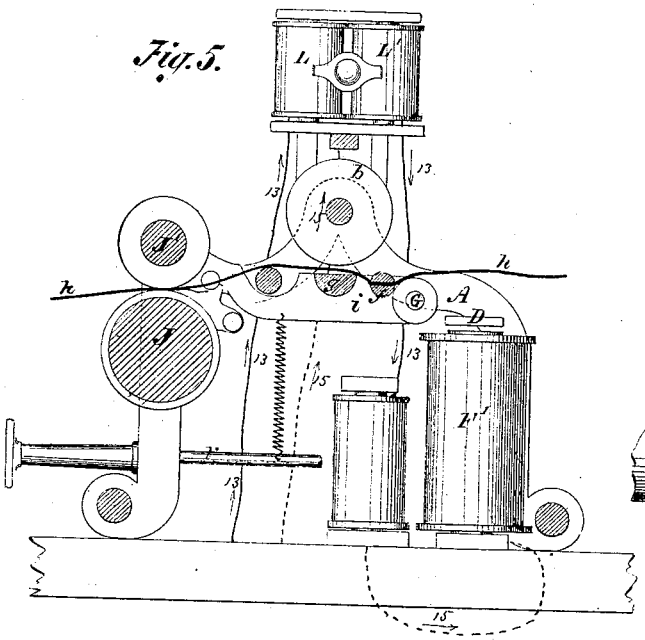
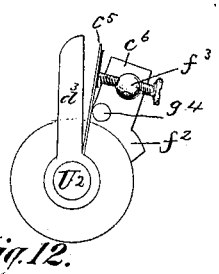


Fig. 12.



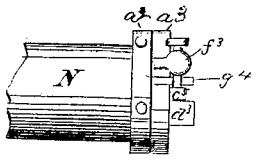


Fig. 9.

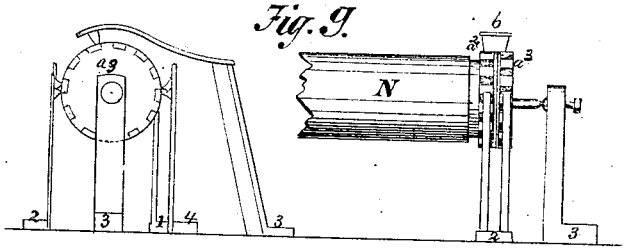


Fig. 10.

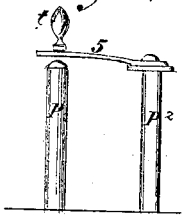


Fig. 11.

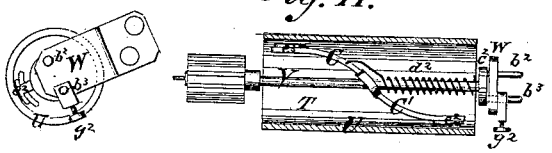
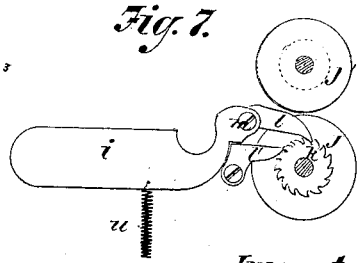


Fig. 7.



Witnesses.

Louis W. Post

Charles G. Loe

Inventors

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Charles A. Randall

UNITED STATES PATENT OFFICE.

THEODORE M. FOOTE AND CHARLES A. RANDALL, OF BROOKLYN, E. D., NEW YORK.

IMPROVEMENT IN PRINTING-TELEGRAPH APPARATUS.

Specification forming part of Letters Patent No. **114,791**, dated May 16, 1871.

To all whom it may concern:

Be it known that we, THEODORE M. FOOTE and CHARLES A. RANDALL, of Brooklyn, E. D., county of Kings, State of New York, have invented a new and useful Improvement in Telegraphic Printing Apparatus and Transmitter; and we do hereby declare the following to be a full, clear, and exact description thereof, which will enable those skilled in the art to which this invention appertains to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a top view of the printing apparatus, the transmitter, and the connections. Fig. 2 is an end view of same. Fig. 3 is a detail section of the printing apparatus, taken on a plane of the line *x x*, Fig. 1. Figure 4 is a detail view of the transmitter. Fig. 5 is a detail section of the printing apparatus, taken on a plane of the line *y y*, Fig. 1. Fig. 6 is a detail side view of the printing apparatus. Fig. 7 is the paper-feeding mechanism. Fig. 8 is a separate pair of magnets for working the improved unison-stop and the unison mechanism. Fig. 9 is the pole-changer. Fig. 10 is the extra key and circuit-closer. Fig. 11 is a detail view of a governor for the transmitter. Fig. 12 is a modification of the improved circuit-breaker.

Similar letters indicate corresponding parts.

This invention relates to a one-wired telegraphic printing apparatus, in which a compound magnet is used, said magnet being composed of three helices, arranged to a back piece or bar, to which is attached a vibrating armature; the said bar extending through the core of the center helix and hinged at the bottom, the compound magnets being connected with the line and local circuit. The escapement consists of two ratchet-wheels, provided with beveled teeth, facing each other, and with intervening pawls or dogs attached to the vibrating armature and oscillating thereon parallel with the type-wheel shaft. The alternate action of the negative and positive poles of the line-battery over the center helix of the compound magnets, and a local battery over the outside coils, or a local battery on the center helix of the compound magnets and line-current over the outside coils, or a line-current over all three helices of the compound magnets, thereby imparting a to-and-fro movement of the vibrating armature, an oscillating movement of the pawls or dogs, and a step-by-step movement of the type-wheel, throwing it in a correct position at every stroke, thereby saving time in the operation of working the type-wheel.

The paper-feeding mechanism consists of two rollers, the upper or auxiliary roller being elastic or otherwise, and the under roller being elastic. An intermittent rotary motion is imparted from the printing-lever by means of two pawls or dogs acting in connection with a ratchet-wheel which is mounted on the shaft of the lower feed-roller.

The upper pawl or dog, being attached to the printing-lever, permits the paper on the roll to be drawn forward the required distance after each impression, while the under or auxiliary pawl or dog, which is attached to the frame, acts as a check to the backward movement of elastic roller, and also as a stop to the movement of the printing-lever. There are two pins projecting from the type-wheel shaft, which act in combination with an anchor and the electro-magnet in the circuit, and with the printing-magnet, and are operated by the same current as the printing-magnet, and not by a secondary current. These pins are termed the pallet and stop pins, the former operating so as to throw the anchor in the way of the latter, thereby stopping the type-wheel uniformily at a certain point, termed the starting-point or unison. In printing, the circuit over the printing-magnet passes over the small or unison magnet, and the armature attached to the anchor is attached to the magnet, and the anchor is thrown out of the path of the stop-pin, which allows the shaft and type-wheel to revolve, and by printing a letter before the type-wheel and shaft make a revolution the stop-pin is prevented from engaging the anchor, so that, by a continued printing, the type-wheel revolves free; and it is brought to unison by means of the stop-pin and the anchor as soon as the printing is discontinued. The anchor can also be dislodged from the stop-pin by means of the printing-lever. Suspended over the printing apparatus is the electro-magnet, to which is attached

a lever bearing on the vibrating armature, by means of which, when it rests in a certain position, a local current is formed through the printing-magnet. and the printing is done.

The pole-changer consists of a cylinder or drum, in connection with two metallic wheels or pieces with an equal number of teeth, and insulated spaces, which are wider than the teeth. The wheels or pieces are connected with battery by springs, and attached to the cylinder or drum, which is driven by wheels and weights, whereby the negative and positive poles of a battery are used alternately, and which can be cut off altogether by stopping the cylinder by means of pins in the cylinder, and keys not shown.

The extra circuit-closer, used in connection with an extra key for closing the negative or positive pole of battery, is for repeating a letter any number of times without moving the type-wheel.

The governor for the transmitter consists of a cylinder and a double arm, which is pivoted to and swinging upon a shaft running through the cylinder. On the ends of the arm are attached friction-pads, the speed being regulated by means of a spring and adjuster.

In the drawings, Figure 1, Plate 1, is the receiving and sending instruments, with their connections.

The letter A represents the frame, which forms the bearings for the working parts of the receiving-instrument. In the upper part of this instrument is secured the shaft *a*, on which is mounted the type-wheel *b*. A step-by-step motion is imparted to this shaft *a* by an escapement, which consists of the two wheels *c* and c^1, provided with beveled teeth, facing each other, the said wheels being set on type-wheel shaft *a*, with the intervening pawls or dogs *d* and d^1. These pawls or dogs are operated in combination with each other, by means of a spiral spring, *j*, and are attached to the vibrating armature B, Fig. 3, secured to a bar, *t*, at *t'*, extending through the core of the center helix H^1, and hinged at the bottom of said helix by means of a pin, and oscillating thereon parallel with the type-wheel shaft *a*. (See Fig. 3, Plate 2.)

The alternate action of the negative and positive poles of a line-battery over the center helix H^1, Fig. 3, of the compound magnets H, H^1, and H^2, and a local battery on the helices H and H^2, or the alternate action of the negative and positive poles of a line-battery over the helices H and H^2, and a local battery on the helix H^1, or a line-current over all three helices of the compound magnets H, H^1, and H^2, imparts a to-and-fro motion to the vibrating armature B, and an oscillating movement of the pawls or dogs *d* and d^1, which are caused to act alternately on the ratchet-wheels *c* and c^1, so as to propel the type-wheel shaft *a* step by step, and thereby throwing the type-wheel *b* in a correct position at every stroke over the platen *g*, Fig. 5, and hold it in this position until the impression is taken. The platen *g* is attached to the printing-lever *i*, which is mounted on the rock-shaft G, having its bearings in the frame A. (See Fig. 5, Plate 3.) From this rock-shaft G extends an arm, E, Fig. 1, to which is secured the armature D of the printing-magnet F and F'. Wherever the current is made to pass through the printing-magnet F and F', the armature D is attracted, and the platen *g* is pressed up against the circumference of the type-wheel *b*. (See Fig. 1, Plate 1.)

In the paper-feeding mechanism, the strip of paper *h*, Fig. 5, on which the impressions are made, is taken from a roll, (not shown in drawing,) and drawn through the guide *f*, which projects from the printing-lever *i*, and thence passes over the platen *g*, through the paper-feed, (see Fig. 5, Plate 3,) which is composed of two rollers, J and J', the upper or auxiliary roller, J', being elastic or otherwise, and the under roller, J, being elastic. These feed-rollers are placed so close together as to take hold of the strip of paper, thereby compelling the same to be drawn through by friction, whenever a motion is imparted to them from the printing-lever *i*. On the shaft of the lower feed-roller J is mounted the ratchet-wheel *k*, and working in this ratchet-wheel *k* is the pawl *l*, which is attached to the printing-lever *i* by the pivot or screw *m*. (See Fig. 7, Plate 3.) This roller J is propelled at each stroke of the printing-lever *i*, and the paper so drawn along as to leave the proper spaces between subsequent impressions taken thereon. (See Fig. 1, Plate 1.) The springs *n* and *n'* are attached to the frame A, and bear upon the shaft O of the upper roller J', thereby producing friction sufficient to hold the paper in position.

The spiral spring *u* (see Fig. 6, Plate 1) connects with the printing-lever *i* and the rod *v*, by which it is adjusted, so as to impart a quick or slow motion to the printing-lever *i*. The stop-pawl *l'*, Fig. 7, applied to the ratchet-wheel *k*, prevents a retrograde movement of the feed-rollers *j* and *j'*, and also acts as a stop to the printing-lever *i*. (Shown in Fig. 7, Plate 3.) From the type-wheel shaft *a* project two pins, *o* and *o'*, which are set in relation to certain letters on type-wheel *b*. This relative arrangement of the pins *o o'* to the letters on the type-wheel is not essential to their operation. (See Fig. 8, Plate 1.) These pins act in combination with a swivel-anchor, P, pivoted on the traverse *r*, Fig. 1, or otherwise, and also with an armature, *q*, attached to one end, bearing on unison-magnets *s* and *s'*. As the type-wheel shaft *a* revolves, the pallet-pin *o'*, the end of which is beveled off, strikes on one end of the anchor P, and depresses the same, thereby raising the other end of the anchor in the path of the stop-pin *o*, arresting the type-wheel *b*.

In printing, the current over the printing-magnets F and F' passes over the small magnet *s* and *s'* in the circuit with the printing-magnet F and F', attracting the armature *q*

on the anchor P, thereby releasing the stop-pin *o*. (See Fig. 1, Plate 1.) By continued printing, before the type-wheel *b* makes two revolutions, the stop-pin *o* is prevented from coming in contact with the anchor P, thereby allowing the type-wheel *b* to go free, and is arrested as soon as the printing is discontinued. By this arrangement two or more instruments working in the same circuit are readily kept in unison.

In printing any letter, the anchor P is also released from the stop-pin *o* by means of the lever w^4, which is attached to the rock-shaft G. (Shown in Figs. 1 and 8, Plate 1.) This lever w^4, rigid to rock-shaft *g*, and operated at the same time with the printing-lever *i*, is made to strike on one end of the anchor P, throwing the other end of the anchor P out of the path of the stop-pin *o*. The printing-current is formed by the connection of the lever K hinged at *w* on an upright plate, M, to which are attached the electro-magnets L and L′, the lever K bearing on the vibrating armature B as soon as the line-currents over the electro-magnets L and L′ are broken. (Best seen in Figs. 1 and 3, Plate 2.)

The pole-changer, connecting with the transmitter, (shown in Fig. 1, Plate 1,) consists of a cylinder or drum, N, in connection with two metallic wheels or pieces, a^2 and a^3, provided with an equal number of teeth, and insulated spaces, which are wider than the teeth. (See detail, Fig. 9, Plate 3.) The wheel a^3 is connected with the cylinder N, and the wheel a^2 is insulated from it, and from the wheel a^3, the springs 2 4 6 bearing on periphery of the circuit-wheels a^2 a^3, and spring *i* bearing on side of wheel a^2, the standard 3 supporting cylinder N connecting the circuit-wheels a^2 a^3 with the battery and line, so that the negative and positive poles of the battery are used alternately through the wheels a^2 and a^3, and upon the line and instruments, and the battery can be cut off altogether by stopping the cylinder N, so that the springs 4 shall rest upon an insulated space.

To repeat a letter, we close the pole of the battery last used, either negative or positive, as the case may be, by depressing spring 5, Fig. 10, by means of the key *t* upon post P, forming a connection with button S to line. (See Fig. 10, Plate 3.) Attached to the frame R of the transmitter (shown in Fig. 1, Plate 1, and also in Fig. 11, Plate 3) is the governor T, composed of a hollow cylinder, U, through which extends the pinion-shaft V, having its bearings in the frame R and ear W, which is secured to the frame R′, through which play two pins, b^2 and b^3, secured to a collar, c^2, which forms a shoulder for the spiral spring d^2 secured to the arms C and C′, and playing upon the pinion-shaft V. These arms are pivoted upon the pinion-shaft V, and on their ends are fastened friction-pads e^2 and e^3, which bear with a greater or less friction on the inner surface of the cylinder U. To regulate the speed of the transmitter the pins b^2 and b^3 are pressed in or out, and secured by a set-screw, g^2, on the ear W.

In the drawings, Fig. 12, Plate 3, is a modification of the circuit-breaker. Upon the cylinder or drum N are also placed two metallic wheels or pieces, similar in construction to a^2 and a^3, heretofore described. Secured to the inner one, marked a^3, is an upright piece, f^2, from which extends a rubber pin, g^4, and stop-pin f^3. Upon the pinion-shaft U^2 is secured an arm, d^3, from which extends the spring c^5, having platinum at the end, which rests upon the stop-pin f^3, thereby making the circuit.

The cylinder of the transmitter has a series of pins helically arranged thereon, as is common in telegraph instruments. This cylinder is stopped at a definite point by the depression of any one of a series of keys in the well-known manner, but this is not shown in drawing. As the pinion-shaft U^2 revolves the spring c^5—which is rigid to cylinder and stopped with it by pins and keys not shown—coming in contact with the rubber pin g^4 is forced from the pin f^3, thereby breaking the circuit.

In operating our telegraph printing apparatus we employ a compound magnet, composed of three helices, H, H^1, and H^2, and the vibrating armature B, secured to a bar, *t*, at t^1, extending through the core of the center helix H^1 and also the printing-magnet F and F′ and the electro-magnet L and L′—the connection of the compound magnets with the pole-changer; thence through magnet *s* and *s*′, indicated by arrows and figures 15, to switch 22, indicated by arrows and figures 15; thence to button Z, to post 2, indicated by arrows and figures 15. From post 5 to helix H of compound magnet, indicated by a dotted line, arrows, and figures 16, through helix H^2 to switch 20, indicated by arrows and figures 16; thence to button X to post 6, indicated by arrows and figures 16.

Posts 5 and 6, with their connections, represent a local on the helices H and H^2 of compound magnets, which may be cut off by placing switch 20 off of button X.

To repeat a current over the line, and get an extra letter, when printing, without turning the type-wheel *b*, the circuit-closer *p* and p^2 and springs 5 and 6 are used, (see Fig. 10, Plate 3,) the current, either negative or positive as the case may be, going from spring 6 to post P, indicated by arrows and figures 17; then over spring 5 to post P^2; then to button S, indicated by arrows and figures 17; thence to line or circuit breaker N of the transmitter; and the battery is such that a current can be passed in opposite directions over the center helix H^1 while a current is passing over H and H^2, or vice versa, causing the armature B to vibrate.

The current comes in post 2 N, indicated on drawing, Fig. 1, Plate 1, by arrows and figures 10, to spring I, through pole-changer

N to spring Q; thence to binding-post 3, indicated in drawing by arrows and figures 10; thence to ground.

From post 1 P to standard 3, indicated on drawing by arrows and figures 12, through pole-changer N to spring 4; thence to button S, indicated by arrows and figures 12, through switch 7 to switch 8; then either to button 2, to center helix H^1 of the compound magnets, indicated by arrows and figures 12; thence to post 4, indicated by arrows and figures 12, or from switch 8 to button I; then to relay-magnet L, indicated by arrows and figures 13; and from said magnet to center helix H′, indicated by arrows and figures 13, to post 4, indicated by arrows and figures 13.

When using negative pole of battery to line, the current passes from post 2 N to spring I, indicated by arrows and figures 14, through pole-changer N, to spring 4; then to button S, indicated by arrows and figures 14; thence over circuit last described. Using the negative or positive poles alternately causes the armature of the compound magnets to vibrate. By this arrangement the type-wheel *b* is moved one letter every time that the poles of the battery are changed, and by each impulse. The cylinder or pole-changer N is now stopped (by means of pins and keys not shown) so that the points of spring 4 shall rest on an insulated space, thereby breaking the line-current.

As soon as the line-current is broken the lever K of the magnet L and L′ falls upon the vibrating armature B, completing a local circuit from post I to lever K, indicated in drawings Fig. 2, Plate 2, by dotted lines and arrows and figures 15; thence to vibrating armature B, indicated by arrows and figures 15; through magnets F and F′, indicated by arrows and figures 15.

In the drawing, Fig. 12, Plate 3, the current comes in post 2 N, indicated on drawings Fig. 1, Plate 1, by arrows and figures 10 to spring 1; then through pole-changer N to spring 2, then to post 3, indicated on drawing by arrows and figures 10, thence to ground.

The positive current comes in post 1^P to pinion c^4 of transmitter, to screw c^6, to spring c^5; then, through cylinder N to circuit-wheel a^3, to spring 2, thence to binding-post 3, ground; while the negative current comes in from post 2^n to spring I, to circuit-wheel a^2, to spring 4, to button S, through instrument to line, being negative to line. The positive current is now sent to line by turning the pole-changer one space, connecting spring 4 with wheel a^3.

What we claim, and desire to secure by Letters Patent of the United States, is—

1. The compound magnets H, H^1, and H^2, and their vibrating armature B, substantially as and for the purpose hereinbefore set forth.

2. The two oscillating pawls or dogs *d* d^1 attached to the vibrating armature B, and the screw or pivot *e*, and the spring *j* and pin *z* in the vibrating armature B.

3. The combination of said parts *d* d^1, B *e* *j* *z* of the escapement with the ratchet-wheel *c* c^1, when the vibrating armature B moves parallel with the type-wheel shaft.

4. Our devices, the rollers *j* *j*′, the ratchet-wheel *k*, the pawl *l*, the screw *m*, the double-acting pawl *l*′, the springs *n* *n*′, in combination with the printing-lever, substantially as and for the purpose hereinbefore set forth.

5. In combination with the type-wheel shaft, the rigid or adjustable pins *o* *o*′, arranged and operating in the manner and for the purpose herein set forth.

6. The magnet *s* *s*′ and its armature *g*, the lever w^4, rock-shaft G, the anchor P, in combination with the pins *o* *o*′, substantially as and for the purpose hereinbefore set forth.

7. The combination of said parts *s* *s*′ *g* w^4 G P *o* *o*′, actuated either by a line or local circuit, substantially as and for the purposes hereinbefore set forth.

8. The electro-magnet L L′, in combination with the lever *k* and the vibrating armature B.

9. The combination of a circuit-changer, an electro-magnet excited by alternate positive and negative currents, and a local circuit, so connected with the armature of said magnet that when the main current is broken the local circuit will be completed through the printing-magnet in the manner and for the purpose substantially as set forth.

10. The pole-changer or circuit-breaker, composed of the two metallic circuit-wheels a^2 a^3 and their connections, substantially as and for the purpose hereinbefore set forth.

11. The pole-changer, in combination with a train of wheels moved by a spring or weight, and the governor, substantially as and for the purpose set forth.

12. The modification of the circuit-breaker, the upright piece f^2, the rubber-pin g^4, the stop-pin or screw f^3, in combination with the transmitter, substantially as and for the purpose hereinbefore set forth.

13. The extra key *t*, in combination with the pole-changer or any circuit-breaker, substantially as and for the purpose herein set forth.

14. The governor T, composed of the cylinder U, a pinion-shaft, V, a double arm, a spiral spring, friction-pads, an adjuster, in combination with a train of wheels, substantially as and for the purpose hereinbefore set forth.

15. In telegraph-printing apparatus, operated by a single wire, the combination of the circuit-changer, the compound magnet controlling the type-wheel, the unison mechanism, in combination with the type-wheel.

To the above specification of our invention we have signed our names and set our hands.

THEODORE M. FOOTE.
CHARLES A. RANDALL.

Witnesses:
LOUIS W. FROST,
CHARLES G. COE.