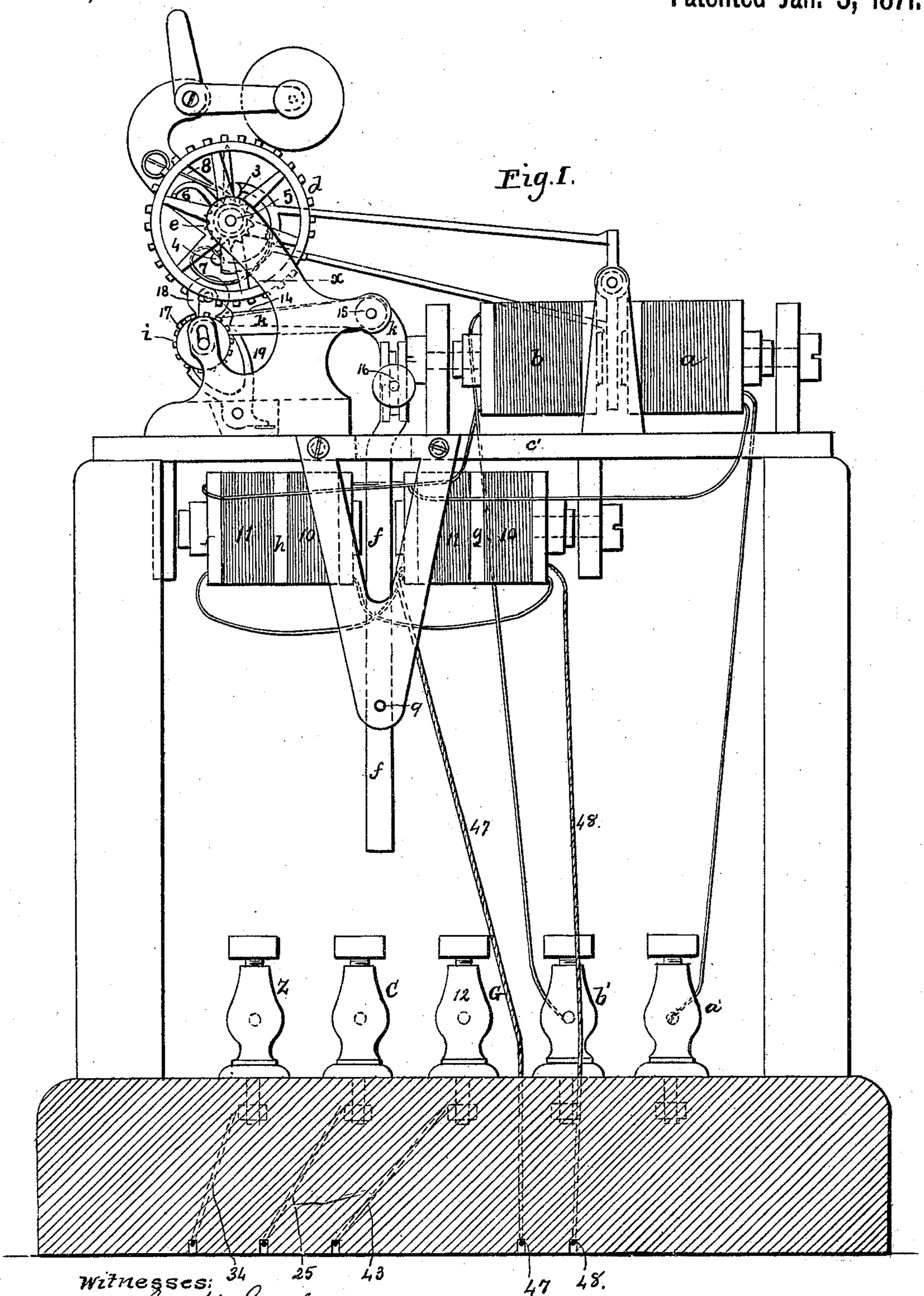
3 Sheets—Sheet 1.

G. M. PHELPS.

Printing Telegraph.

No. 110,675. Patented Jan. 3, 1871.

Fig. 1.



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3 Sheets—Sheet 2.

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Fig. 2.

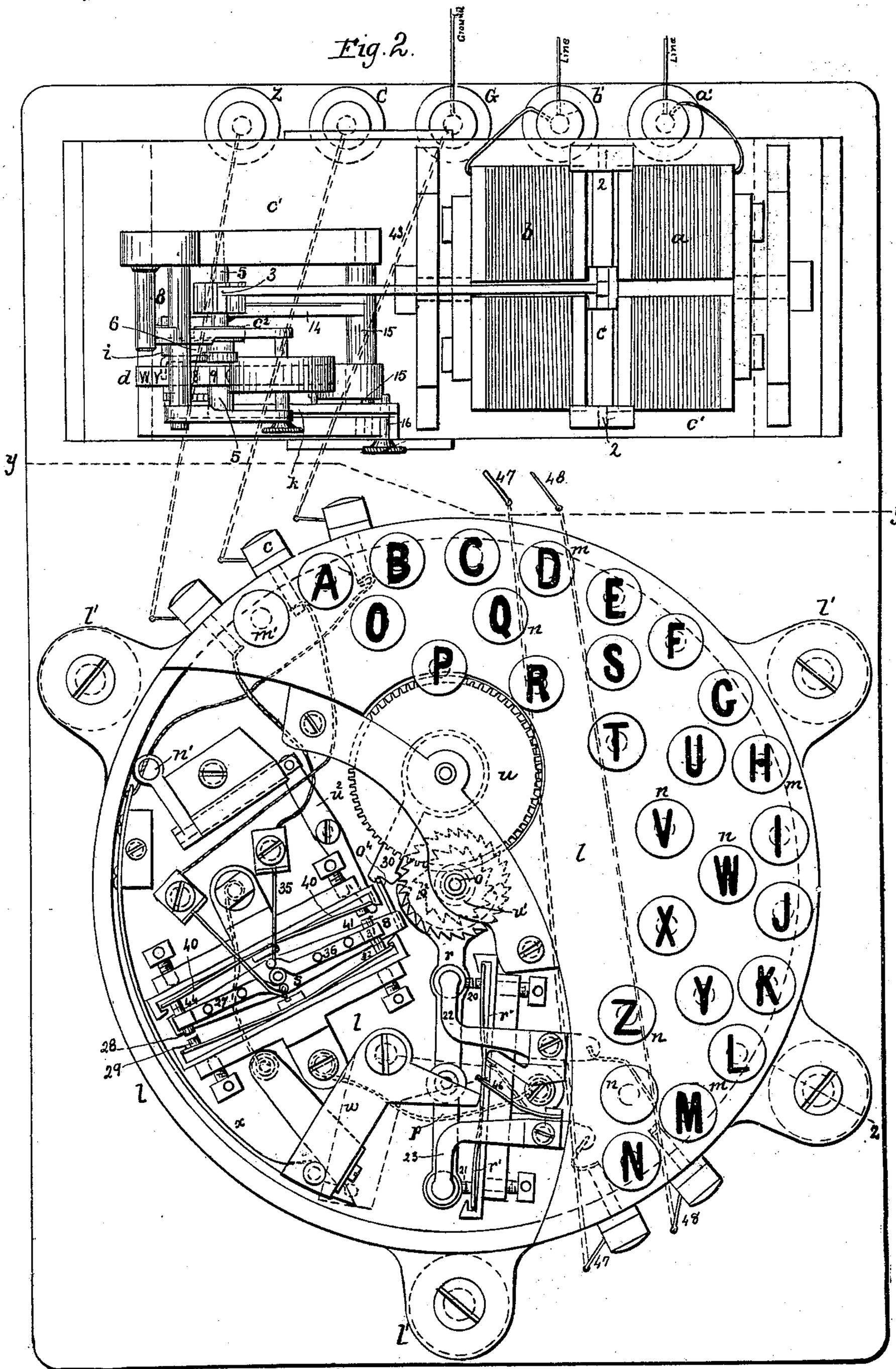

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Fig. 4

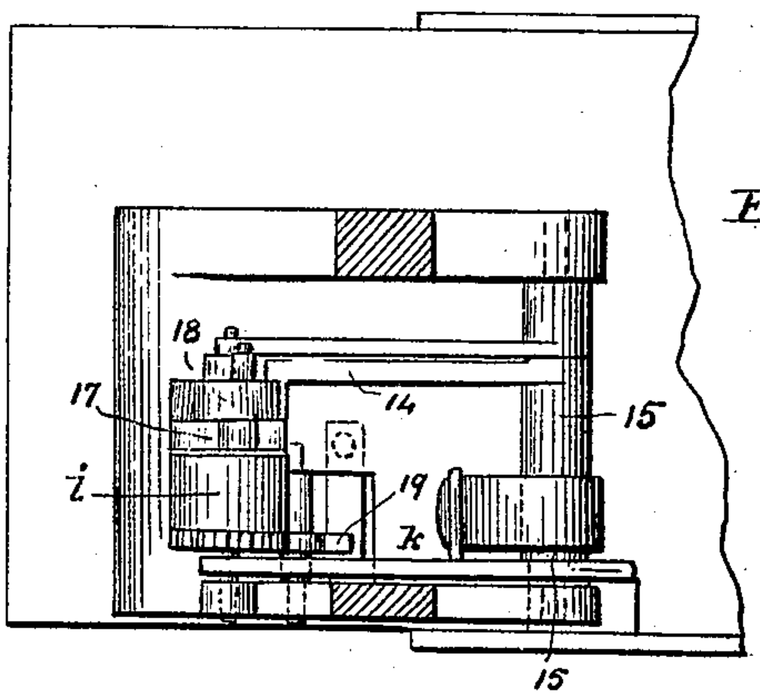
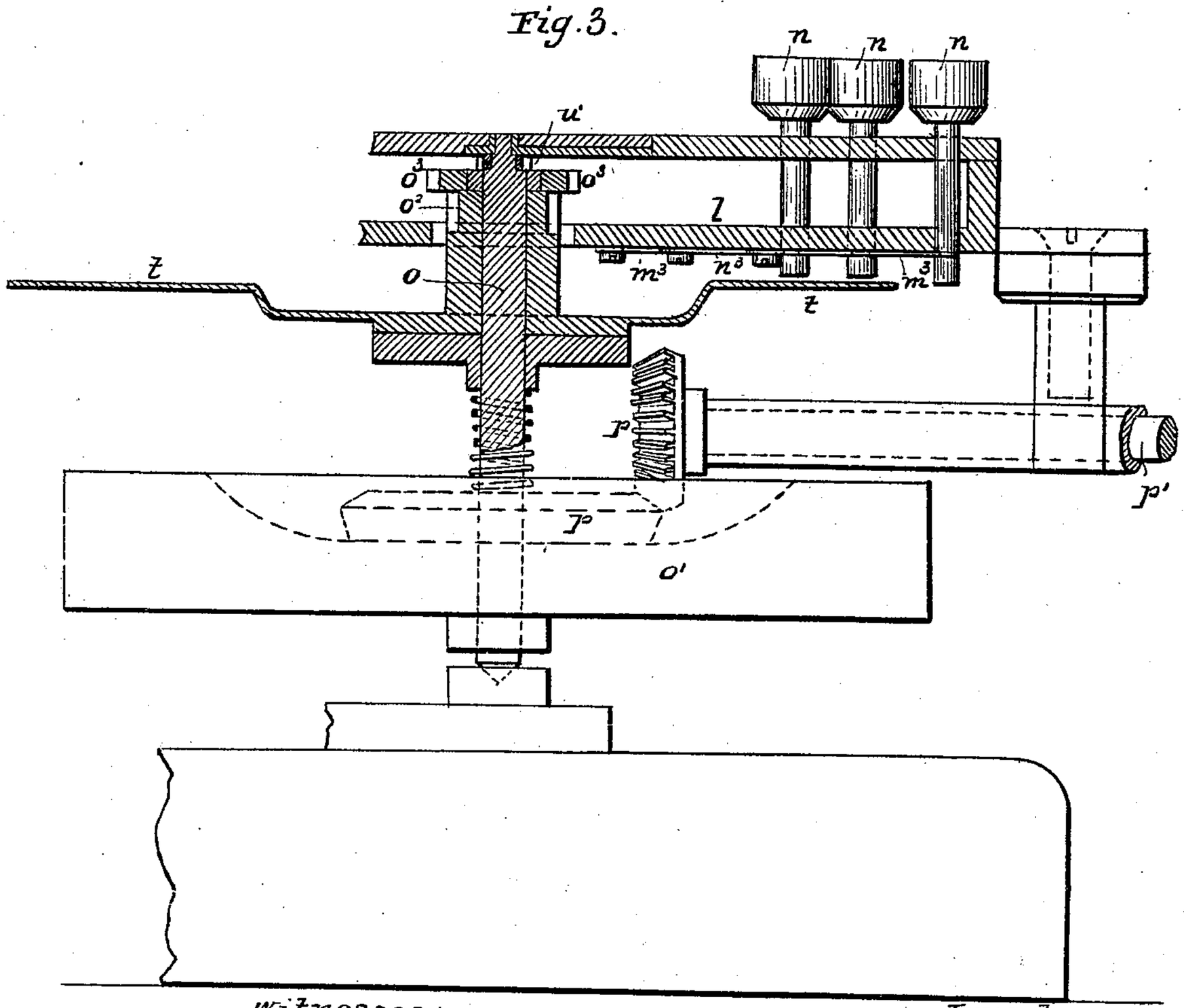


Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE M. PHELPS, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN PRINTING-TELEGRAPHS.

Specification forming part of Letters Patent No. **110,675**, dated January 3, 1871.

To all whom it may concern:

Be it known that I, GEORGE M. PHELPS, of Brooklyn, E. D., in the county of Kings and State of New York, have invented and made an Improvement in Printing-Telegraphs; and the following is declared to be a correct description thereof:

Telegraphs have heretofore been made in which one line-wire has been used to move the type-wheel by pulsations of electricity of one polarity, and the impression has been given by reversing the polarity. In other instances two wires have been employed—one to set the type-wheel, the other to give the impression.

My invention, as distinguished from all other telegraphs, relates to the use of two line-wires operating two electro-magnets that move the type-wheel through the action of an escapement, said magnets being charged alternately for operating the said escapement.

The printing is effected by the action of electro-magnets, with sectional helices so arranged in connection with the two main lines that the reversal of the current in either main line gives the impression; and the transmitting-instrument is employed that automatically reverses the current upon either of the main-line wires when the given letter has been brought to its place.

The successive features of construction and operation are hereafter set forth in order.

In the drawings, the type-wheels and magnets are shown in Figure 1, the bed of the apparatus being in section at the line *y y*, Fig. 2; a general plan in Fig. 2, the bed of the transmitter being broken open, and in Fig. 3 a vertical section is shown of the transmitting-instrument. Fig. 4 is a sectional plan below the line *x x*, Fig. 1.

Receiving portion of the instrument: The magnets *a* and *b* are connected to the two main-line wires and clamps, *a'* *b'*, coming from the distant station. The transmitting portion of the apparatus is arranged so as to close the circuit alternately upon coils *a* and *b*, so that the armature *c* is attracted first to one magnet and then to the other, and thus caused to vibrate and be held in either direction. The armature *c* hangs on the axis 2, (supported by the frame or bed c^1,) and from said axis extend the escapement arms and pallets 3 and 4, which are wedge shape and act upon the ratchet-wheel *e* to move that and its shaft 5 and type-wheel one division each vibration of the escapement, as in my patent of June 22, 1869.

It is to be understood that there are half the number of teeth in the wheel *e* that there are divisions in the type-wheels, and hence that the pallet 3, when pressed into the wheel by the magnet *a*, moves the type-wheel one division, and the reverse motion of the armature *c* moves the type-wheel the next division.

The type-wheel *d* is loose on its shaft 5, but an arm, 6, on the shaft forms a stop, against which the type-wheel is brought by a spring, 7. This makes the machine work more freely, because the inertia of starting the type-wheel is lessened, the spring yielding, but bringing the type-wheel to the stop-arm before the printing takes place.

A pawl, 8, and ratchet-wheel c^2 prevent any back motion to the type-wheel. The horseshoe-magnet *f* is hung on centers 9, and the poles are between the sectional coil electro-magnets *g* and *h*.

Each magnet *g* or *h* is made of two separate coils or helices, the wire from the helix of the magnet *a* leading, as shown, through the sections 10 of the magnets *g h*, and the wire from the magnet *b* leading through the sections 11 of the magnets *g h*, and these wires ultimately reach the ground-connection from 12, as hereafter described.

If a positive current pass through either *a* or *b*, the magnet *f* will be attracted, say, to the magnet *g*, because both magnets *g h* will be so charged that their respective poles will attract or repel, and hence the magnet *f* will remain in the normal position shown; but if the current passing through *a* or *b* is reversed, so as to be a negative current, the poles of the magnets *g* and *h* will both be reversed, and hence the magnet *f* will be moved toward the magnet *h*, and there held until the polarity is again changed.

An arm from the magnet *f* operates the bent lever *k*, that swings upon the axis 15, and carries the impression-roller *i* at one end. The connecting-pin 16, between the arm of the mag-

net *f* and the lever *k*, is in slots in the respective parts, and is adjustable, being clamped to one of the parts, so that the movement of the roller *i* can be regulated with accuracy, it being necessary for operations hereafter named that the paper which intervenes between the impression-roller and type-wheel should not remain in contact with the said type-wheel, but the impression will be given by the momentum carrying the roller *i* and paper into contact with the type, and then the former will fall away, leaving the type-wheel free to be rotated even when the magnet *h* is holding the roller *i* and paper toward the type-wheel.

The paper passes below a finger, 17, and is fed along between the rollers *i* and 18, the latter being upon a spring-arm, 14, that is pressed toward the roller *i*.

The spring-pawl 19 gives rotation to the roller *i*, to feed the paper as said roller *i* is moved away from the type-wheel.

Transmitting portion of the instrument: A circular bed, *l*, is provided upon columns *l'*, and the finger keys *m n* are in concentric or parallel arcs of circles, in two or more rows. I have shown three of those rows, and the letters, characters, or spaces of these are to correspond with those of the type-wheel *d*.

The central shaft *o* is revolved by friction from the fly-wheel o^1 and gearing *p*, that connects with the horizontal shaft *p'* and a crank.

Upon the shaft *o* is an escapement-wheel, o^2, with the same number of teeth as the wheel *e*, and this, in revolving, gives vibration to the swinging lever *r*, and alternately closes and breaks the circuits, through the line-wires *a' b'*, to the magnets *a b*, the points 20 and 21 acting as the circuit-closers. The connection from these points 20 and 21 to the wires may be of any desired character. I have shown the insulated springs 22 and 23 as bearing upon the insulated blocks of the lever *r*, that carry the points 20 21. The spring *r'* and supporting-block are also insulated, and are connected to one pole of the battery, as hereafter set forth.

From the binding-screw *c* the metallic connection is by the wire 25, spring 26, insulated tongue 27 on the lever *s*, points 28 29, spring and block *s'*, also insulated and connected to the block and spring *r'*, so that a positive current will be sent by either of the line-wires *a' b'* to the respective magnets of the receiving-instrument.

Upon the sleeve that carries the wheel o^1 is also a wheel, o^3, with ratchet-teeth corresponding in number to the characters and spaces upon the type-wheel *d*, and said sleeve also carries an arm or arms, *t*. The finger-keys *m n* are made with vertical sliding pins, and are kept up by springs m^3 n^3. The arm *t* revolves beneath the lower ends of these pins, and when one is depressed the arm *t*, coming in contact, stops the motion of the arm *t*, sleeve, and wheels o^2 o^3; but the shaft *o* continues to revolve, the frictional connection allowing thereof.

If the finger-keys were arranged in a circle, then only one arm, *t*, would be required, and the arrangement of the characters of the type-wheel and those of the keys corresponding. Then the type-wheel and wheels o^2 o^3 revolving synchronously, in consequence of the pulsations of electricity that incite the magnets, the type of the wheels would be in position when the arm *t* was arrested by the corresponding key, and the transmission of further pulsations stopped; but in consequence of the finger-keys being arranged within a half-circle, the arm *t* is double, one end acting with the outer half-circle of finger-keys, and the other end being shorter, so as to act with the inner range or ranges of keys. The positioning of these finger-keys and stop-pins properly in relation to the characters on the type-wheel can be effected by a skilled mechanic.

This arrangement of finger-keys is much more convenient than they would be if in a circle or in a straight line, because they are contiguous to the ends of the fingers, and within a range easily spanned by the fingers of one hand.

The wheel *u* is driven continuously by a pinion, u^1, on the upper end of the shaft *o*, and acts, by a friction at its under side, to press the detent-arm 30 toward the teeth of the wheel o^3; but the inclines of said teeth constantly press back said detent while the wheels o^2 o^3 and arm *t* are revolving; but when they are stopped the friction of *u* carries the detent 30 into the teeth of o^3, and taking a stud, o^4, upon the insulated lever *s*, and moving that sufficiently to separate 28 and 29 after connecting 31 and 32, so that without giving a separate pulsation at the receiving-station the polarity of the current is changed through either of the magnets *a* or *b*, causing the horse-shoe-magnet *f* to be moved, and effect the printing, as aforesaid. After the detent 30 has connected 31 and 32 the electricity passes from the negative pole Z through the wire 34, spring 35, and insulator-tongue 36 on the lever *s*.

In order to set the type-wheel at the distant station, or several type-wheels at various receiving-stations, in harmony with the transmitting-instrument, the key n^1 is pressed down, which, by the slide u^2, moves the lever *s*, to make the negative connection with Z through 31 32, and the instrument is run, as before, and the distant type wheel or wheels are revolved until stopped by the arm 6, (the impression-roller being held toward the type-wheel by the negative current,) and when sufficient pulsations have been sent to insure the proper position of all the type-wheels, the blank key m^1 is depressed, which arrests the arm *t* at the point that is in harmony with the position of the type-wheels. The key n^1 is then released, leaving the instruments in their normal condition.

When the instrument is used for sending a communication the lever *w* is in the position shown in Fig. 2, so that the negative pole Z

the binding-screw and ground, or when the negative current is sent to the distant station the positive pole *c* is connected to the ground through the wire 25, spring 26, tongue 27, spring 40, block 44, stud 42, lever *w*, spring *x*, wire 43, to the binding-screw G, thence to the ground.

When the machine is set to take a message the lever *w* is to be changed to the position shown in Fig. 2 by dotted lines, in which case the lever *w* will be disconnected from the stud 42, and in metallic contact by the spring 46, with the wires 47 and 48 that pass from the magnets *g h* and *a b*, the current going through the lever *w* to the spring *x*, wire 43, and binding-screw G.

I claim as my invention—

1. Two magnets operated alternately through two line-wires, in combination with the armatures, escapement, type-wheel, and printing mechanism, substantially as and for the purposes set forth.

2. A magnet constructed in two sections or coils, and charged by pulsations over one of two line-wires, and operating upon an armature to effect the printing, substantially as set forth.

3. The combination of the horseshoe-magnet, printing-lever actuated thereby, and the two electro-magnets and circuits for moving the said horseshoe-magnet, substantially as set forth.

4. The combination of electro-magnets, having sectional coils, two line-wires, and mechanism for setting the type-wheel, with mechanism for giving an impression by an armature operated by said sectional coil electro-magnets, substantially as specified.

5. Two electro-magnets, operated through separate line-wires to set the type-wheel, in combination with an electro-magnet, operated by the reversal of the electrical current to give the impression, substantially as specified.

6. An impression-lever in which the pressure-pad gives the impression by the momentum, and moves away from the type, in combination with a stop on the impression-lever and a stop on the type wheel or shaft, substantially as specified.

7. The type-wheel, connected to the shaft by a spring and stop, substantially as and for the purposes set forth.

8. The finger-keys of the telegraphic transmitting-instrument arranged in two concentric arcs of circles, as and for the purposes specified.

9. Two rotating arms, forming stops, in combination with finger-keys, arranged in two arcs of circles, and with mechanism for giving electrical pulsations simultaneously with the revolving of the said arms, substantially as specified.

10. The circuit-closers operated alternately, substantially as specified, in combination with two line-wires and receiving mechanism, substantially as set forth.

11. The automatic detent, operated by friction, in combination with the current changes or switches for changing the polarity of the current, substantially as specified.

12. The finger-key m^1, combined with the current-changing switches, substantially as and for the purposes specified.

13. The arrangement, substantially as specified, of the circuit-closing mechanism and connections, so that the ground-connection is automatically made with either polarity of the current by the movement of the lever *s*, substantially as set forth.

14. The lever *w*, in combination with the receiving and transmitting connections, arranged, substantially as specified, to adapt the device to forwarding or to receiving messages.

Signed this 23d day of July, A. D. 1870.

G. M. PHELPS.

Witnesses:

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CHAS. H. SMITH.