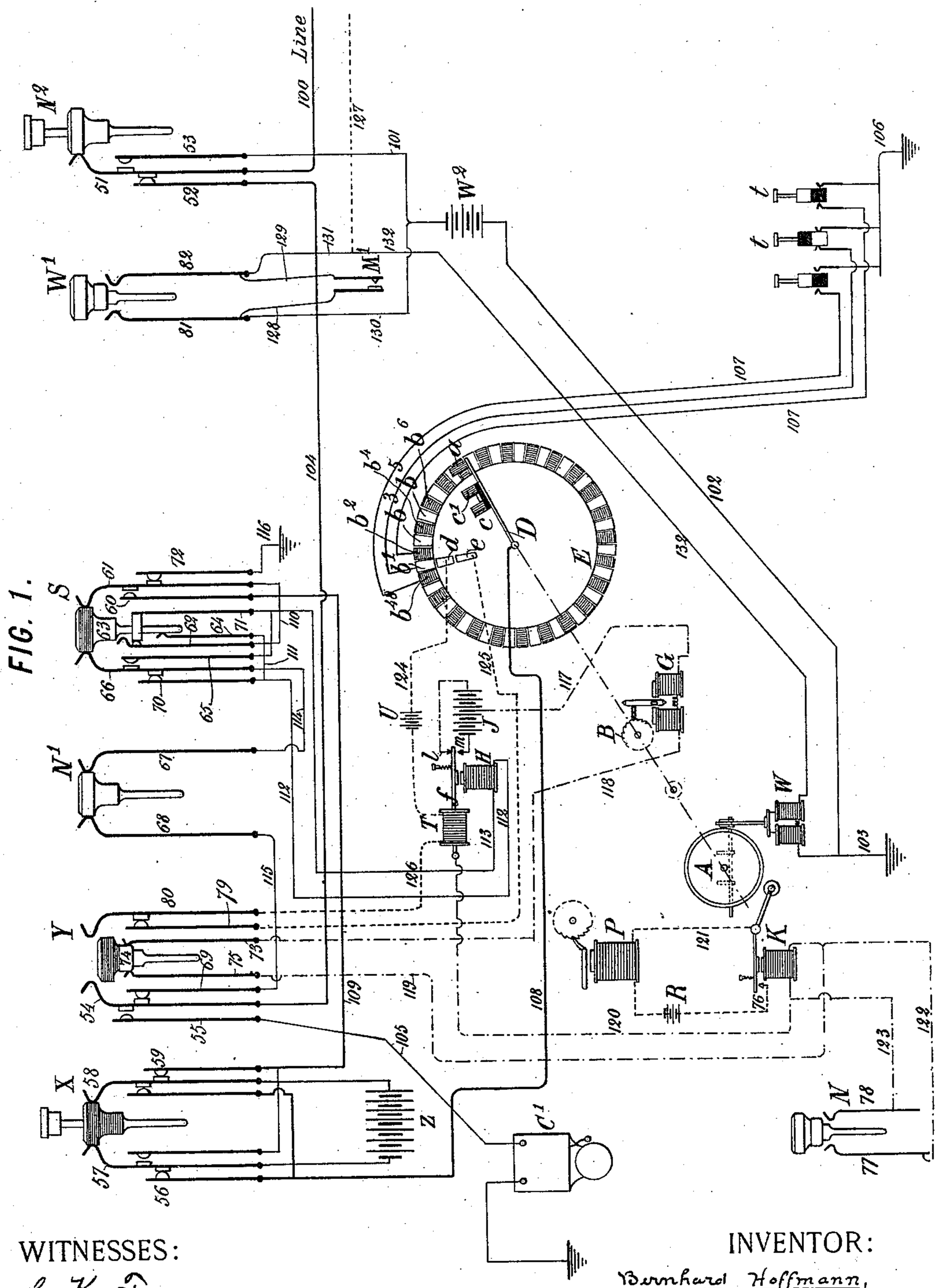
(No Model.) 6 Sheets—Sheet 1.

B. HOFFMANN.

PRINTING TELEGRAPH.

No. 574,994. Patented Jan. 12, 1897.

FIG. 1.



WITNESSES:

C. K. Fraser.

Thomas F. Wallace

INVENTOR:

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(No Model.) 6 Sheets--Sheet 2.

B. HOFFMANN.

PRINTING TELEGRAPH.

No. 574,994. Patented Jan. 12, 1897.

FIG. 2.ª

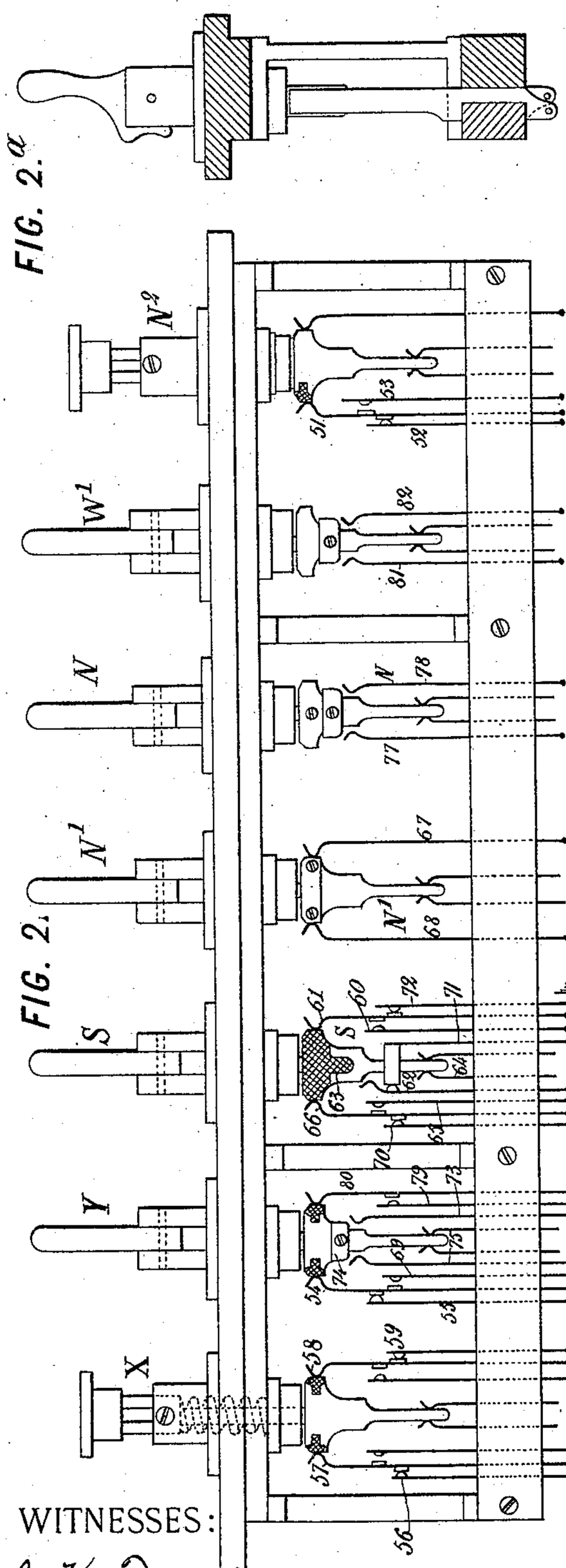

FIG. 2.

FIG. 5.

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(No Model.) 6 Sheets—Sheet 3.

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PRINTING TELEGRAPH.

No. 574,994. Patented Jan. 12, 1897.

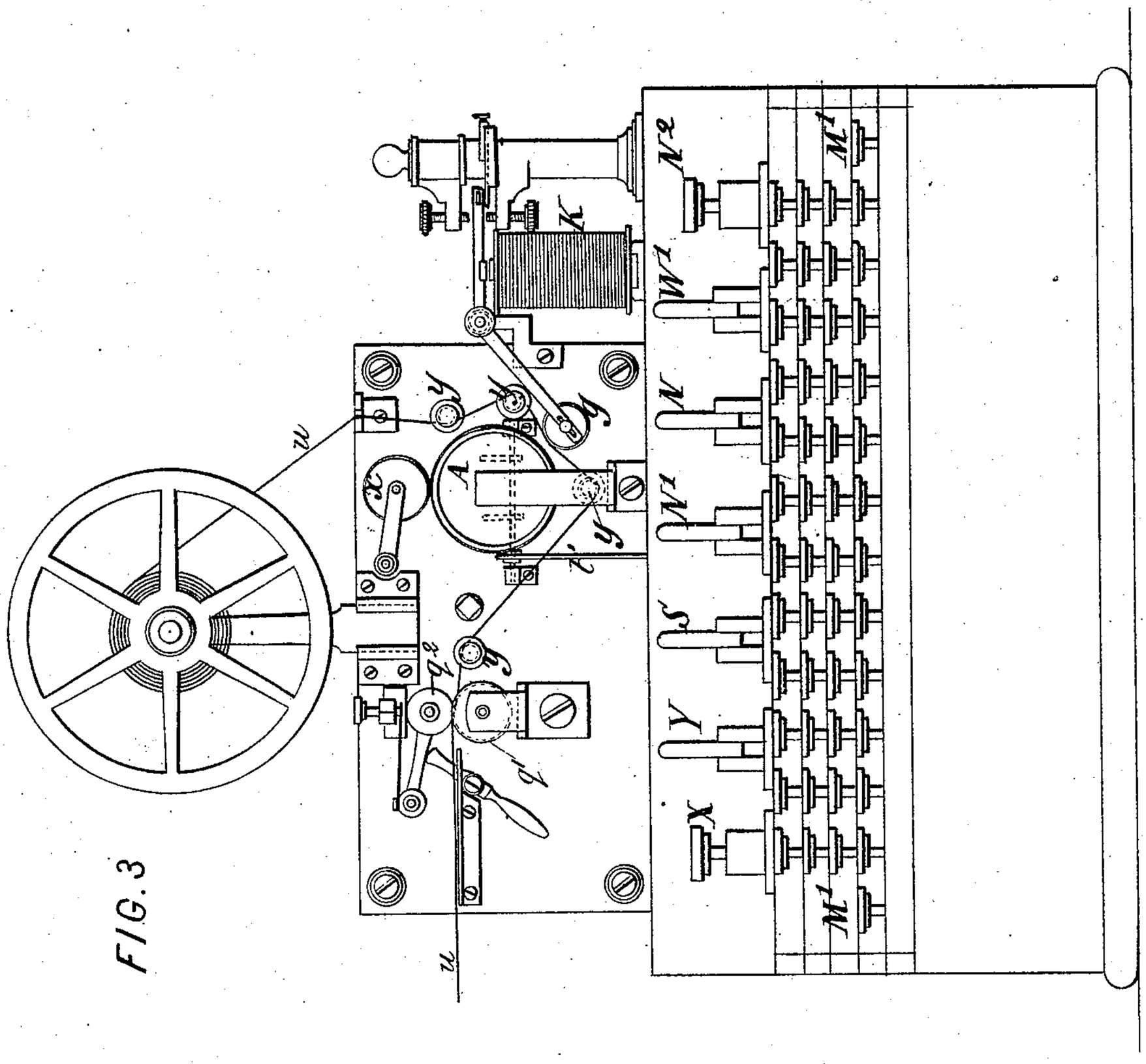

FIG. 3

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(No Model.) 6 Sheets—Sheet 4.

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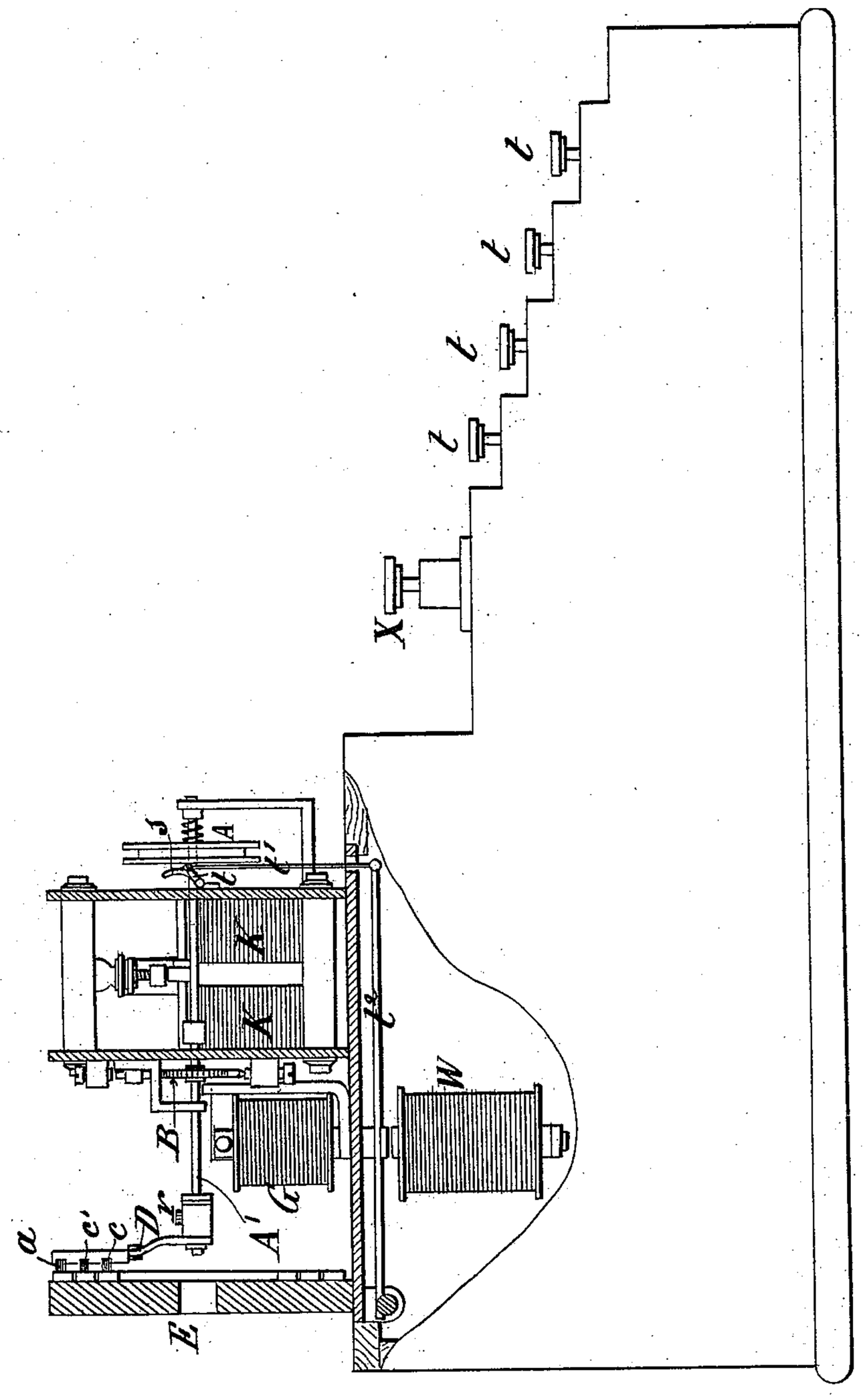
No. 574,994. Patented Jan. 12, 1897.

FIG. 4



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(No Model.) 6 Sheets—Sheet 5.

B. HOFFMANN.

PRINTING TELEGRAPH.

No. 574,994. Patented Jan. 12, 1897.

FIG. 7

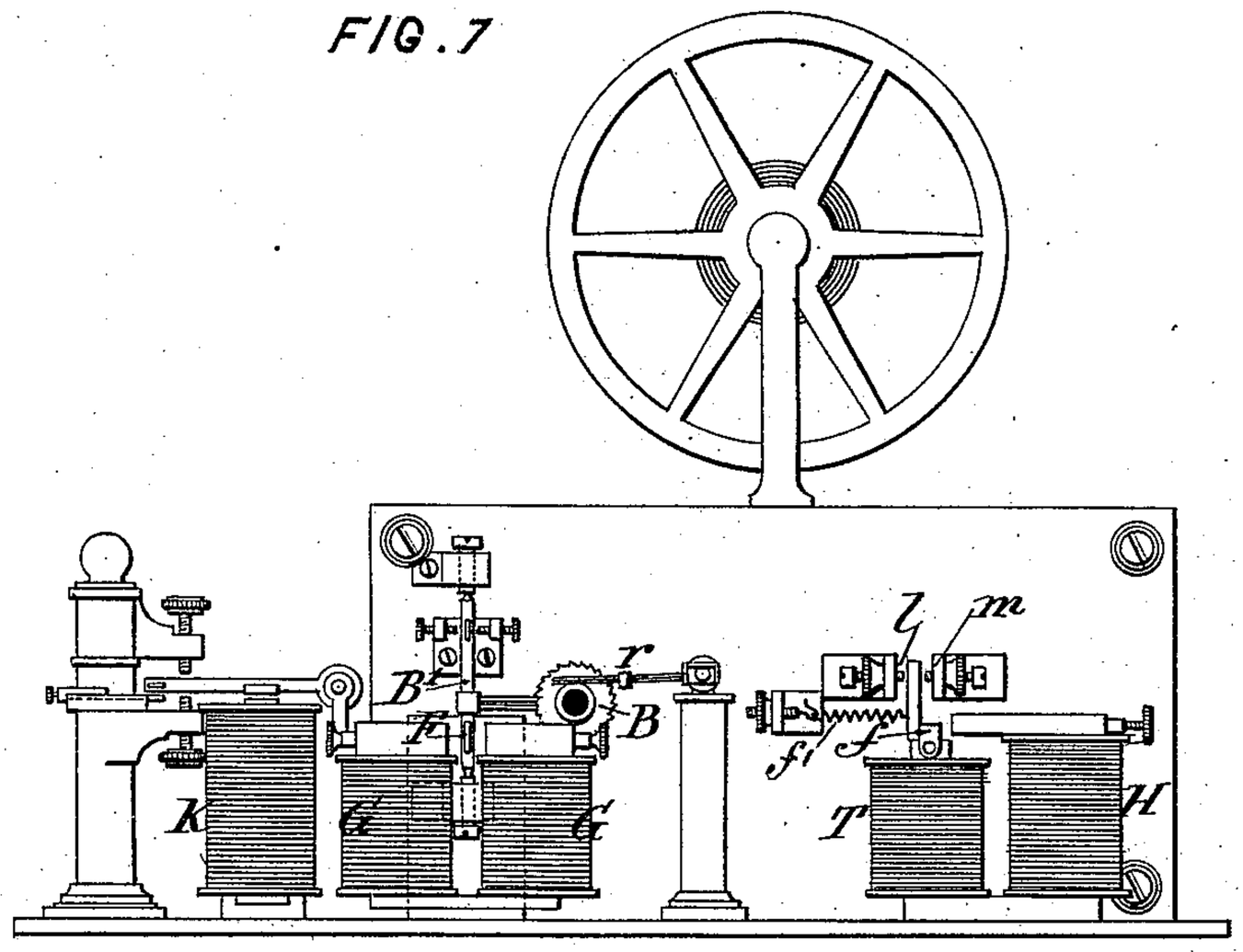
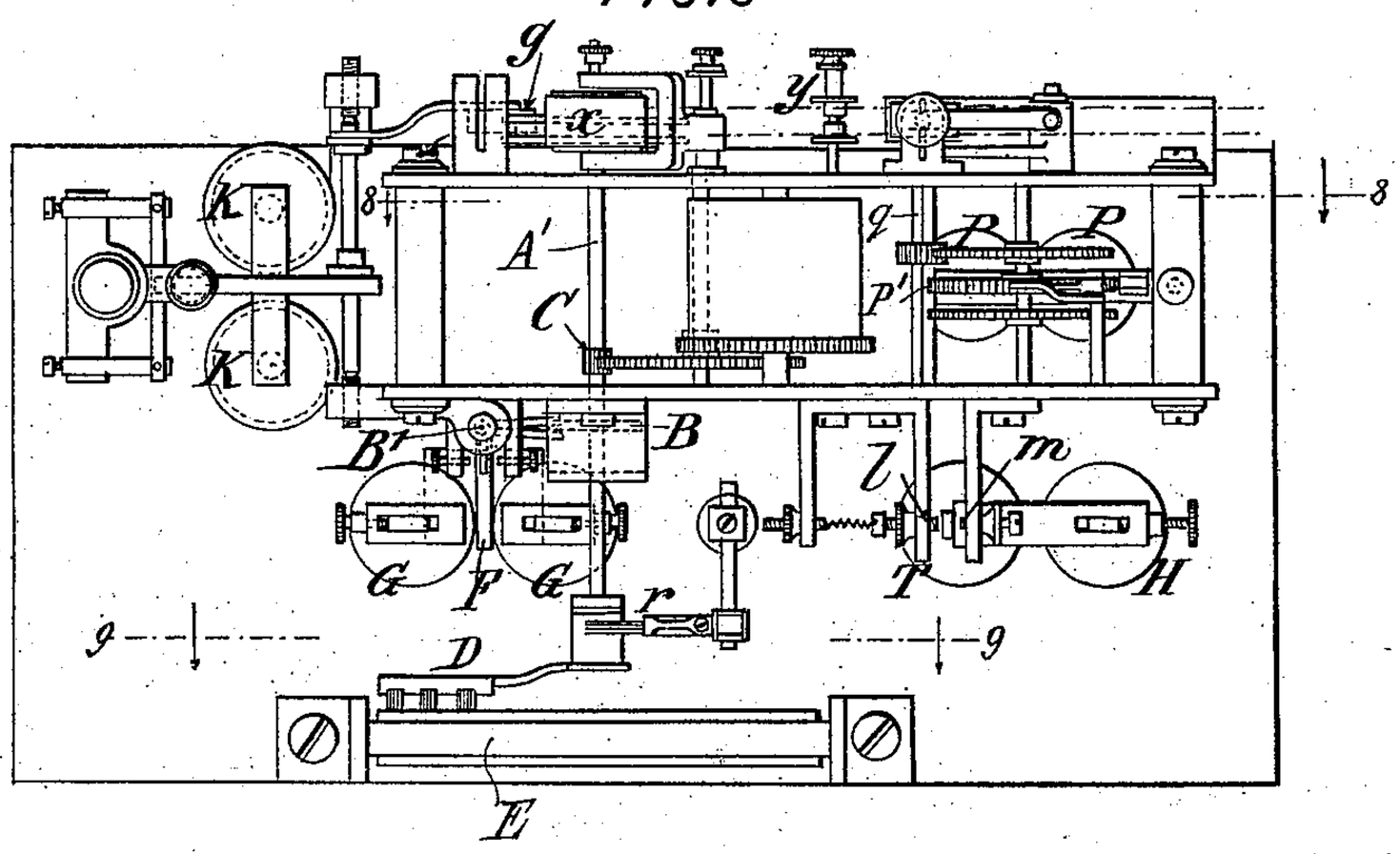


FIG. 6



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(No Model.) 6 Sheets—Sheet 6.

B. HOFFMANN.

PRINTING TELEGRAPH.

No. 574,994. Patented Jan. 12, 1897.

FIG. 8

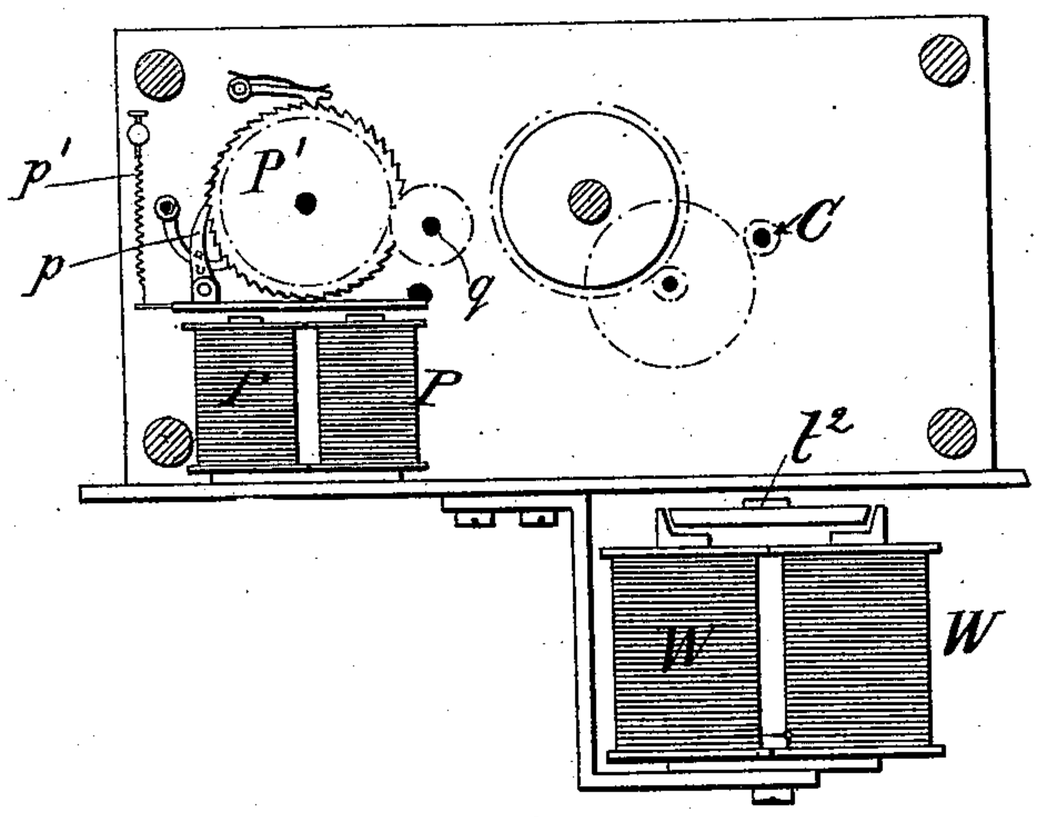


FIG. 9

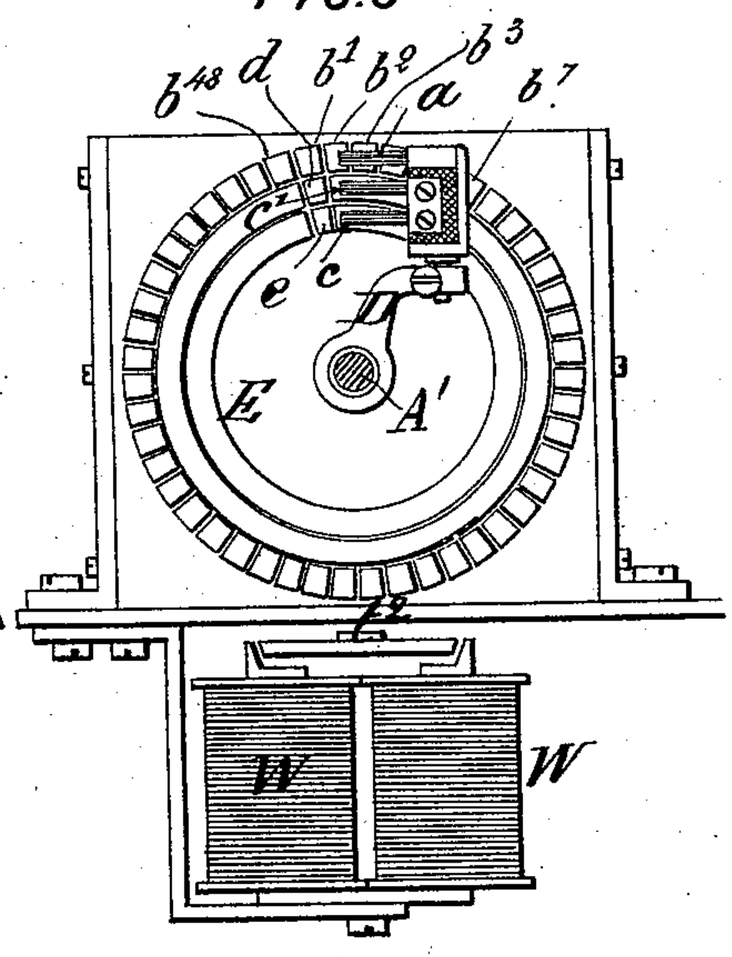


FIG. 11

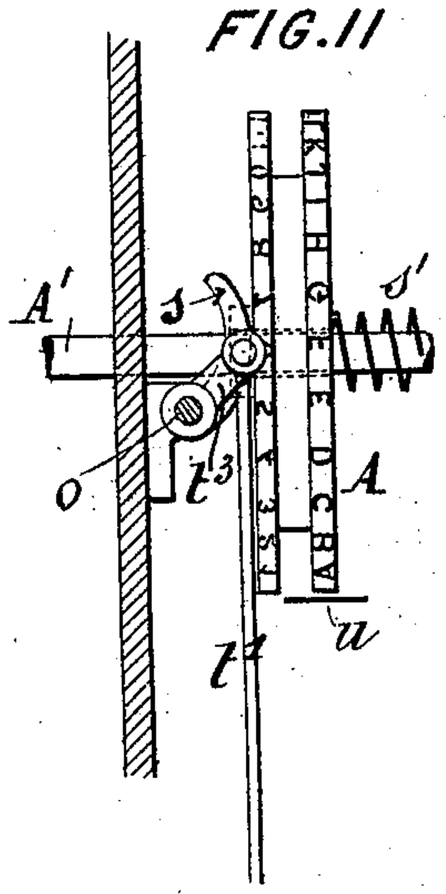


FIG. 10

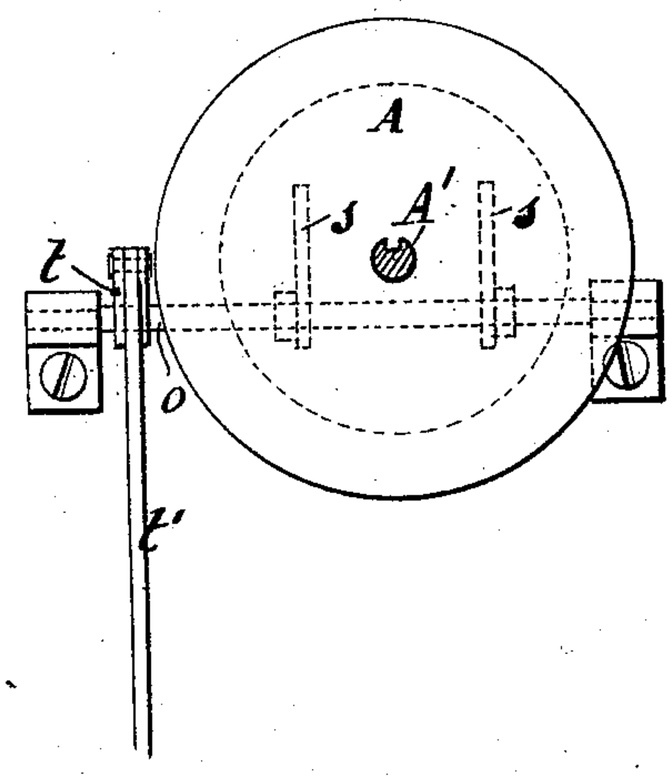
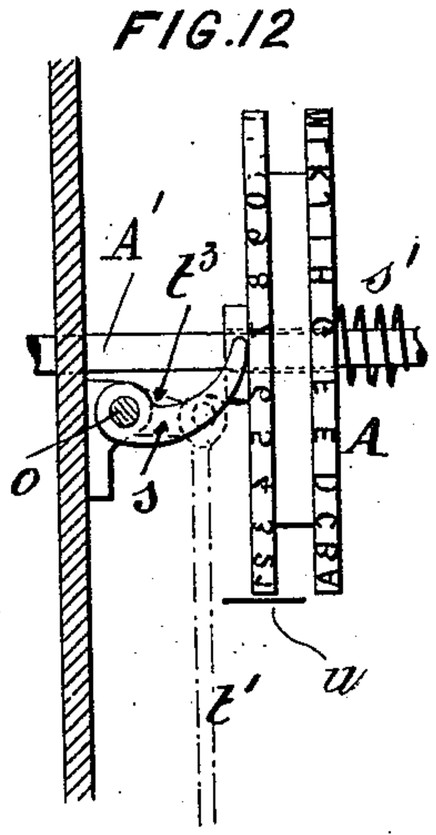


FIG. 12



WITNESSES:

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UNITED STATES PATENT OFFICE.

BERNHARD HOFFMANN, OF PARIS, FRANCE.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 574,994, dated January 12, 1897.

Application filed July 17, 1895. Serial No. 556,240. (No model.) Patented in France December 1, 1894, No. 243,305.

To all whom it may concern:

Be it known that I, BERNHARD HOFFMANN, a subject of the Emperor of Austria-Hungary, residing in Paris, France, have invented certain new and useful Improvements in Printing-Telegraphs, (the same being the subject-matter of Letters Patent in France, No. 243,305, dated December 1, 1894,) of which the following is a specification.

This invention relates to printing-telegraphs adapted for printing on a continuous band or tape of paper. The apparatus at both the transmitting and receiving station comprises a transmitting-keyboard, a receiving mechanism, a call-bell, and a series of switches or commutators for effecting different circuit connections, the two stations being connected by a single line-wire or by two line-wires.

Figure 1 of the accompanying drawings is a circuit diagram showing the circuit connections of one station. Fig. 2 is an elevation of the switches or commutators, of which Fig. 2^a is a side elevation in transverse section. Fig. 3 is a front elevation of the transmitting and receiving instrument. Fig. 4 is a side elevation thereof, partly in vertical transverse section. Fig. 5 is a front elevation of a few of the transmitting-keys, showing their circuit connections. Fig. 6 is a plan of the receiving instrument. Fig. 7 is a rear elevation thereof. Fig. 8 is a vertical section on the line 8 8 in Fig. 6, looking from the front. Fig. 9 is a sectional elevation on the line 9 9, looking from the front. Fig. 10 is a fragmentary enlarged front view showing the printing-wheel and accessories. Figs. 11 and 12 are sectional side views of Fig. 10.

I will first describe the construction of the combined receiving and transmitting instrument.

A type-wheel shaft A′ carries a type-wheel A, a ratchet-wheel B, the terminal wheel C of a clockwork, and a commutator-arm D. The type-wheel is formed on its periphery with the letters of the alphabet, figures, or other characters in relief, Fig. 11. The arm D carries at its outer extremity a brush a, capable of rubbing over a circular series of metallic segments b' b^2 b^3 to b^{48}, arranged in a circle on an insulated dial or commutator E, Fig. 9. This arm D also carries a pair of brushes c c', connected together but insulated from the arm and arranged to touch two supplemental segments d e on the commutator. The current passes to the shaft A′ and arm D by means of an insulated brush r. The segments b' b^2, &c., are of even number, (forty-eight are shown,) are insulated from one another, and are connected with the corresponding keys on the keyboard. These keys are constructed as shown in Fig. 5, being pressed up by springs and being alternately earthed and open-circuited. By pressing on the keys t' t^2 to t^{47}, which are normally earthed, they are open-circuited. By pressing on the open-circuited keys t^2 t^4 to t^{48} they are earthed. The first key communicating with segment b', which corresponds in position with the auxiliary segments d e, should be normally in communication with earth.

The ratchet-wheel B is engaged by an escapement mounted on a spindle B′, Figs. 6 and 7, having a polarized armature F, which vibrates between the opposite poles of a polarized electromagnet G. If this magnet be traversed successively by currents in different directions, the armature F oscillates between its poles and the escapement moves forward one tooth at each alternation of current. This permits the shaft A′ to revolve forward intermittently and causes the brush a to come successively into contact with the segments b' b^2, &c.

The magnet G is controlled by a relay H, having a polarizable armature f. The local battery J is connected at its center to the armature f and at its opposite poles to the contacts l m, Fig. 7. In the circuit of this battery is connected the magnet G and a printing-magnet K.

The printing-magnet K carries on its armature a roller g, which, when the magnet attracts its armature, presses the paper band against the type-wheel A, Fig. 3, and thereby causes the printing of the character which at this instant coincides in position with the printing-roller. The types are inked by a roller x. The printing-magnet H is preferably a slow-charging magnet.

For advancing the paper band after each impression an electromagnet P, Figs. 1 and 8, is provided, which is in the circuit of the battery R, which is closed whenever the armature of magnet K is attracted. Thereupon

the magnet P attracts its armature, thereby drawing down a pawl *p*, Fig. 8, to engage with a new tooth on a ratchet-wheel P′, and when the current is broken the armature-spring *p′* draws up the armature and causes the pawl *p* to push the ratchet-wheel P′ forward one tooth. This ratchet-wheel being geared to the shaft *q* of a roller *q′* turns this roller, and as the band is pressed between this roller and a spring-pressed roller q^2, Fig. 3, it is drawn forward by this movement a distance equal to the width of the character printed.

The several commutators or switches X Y, &c., are provided for controlling the circuit connections and the operation of the instruments. The switch N^2 is for calling up the opposite station. The switch S is up while receiving and is turned down while transmitting. The switch Y is turned up normally ready to receive a call and is turned down before transmitting or receiving. The switch X is a pole-changer used for reversing the normal direction of currents over the line for bringing the instruments to synchronism. The switch N′ is for breaking the circuit in order to stop the operation of both instruments. The switch N is pressed down in case it is desired that the transmitting instrument shall not print.

For enabling synchronism to be effected an electromagnet-coil T is arranged for polarizing the armature *f* of the relay H. It is placed in the circuit of the battery U, which is closed by the contact of the brushes *c′ c* with the segments *d e* of the commutator. This occurs at one instant in the rotation of the arm D, and if at this instant the relay H is traversed by a current of normal direction the armature *f* is attracted the same as if no current traversed the magnet T; but if the line-current traversing the relay H is of the opposite to the normal direction the polarization of the armature *f* prevents its being attracted by the relay H, and hence has the same effect as if the corresponding key *t* at the transmitter were pressed down, that is, the instrument is stopped.

The paper band, which is unrolled from the reel above the receiver, is led by guide-rollers *y y* to the feed-roller *q′*.

I will now trace the several circuits and describe the operations of transmitting and receiving in detail, referring particularly to Fig. 1.

When the instruments are not in use, all the switches or commutators X, Y, S, N′, N, W′, and N^2 are up, all but the first and last being provided with operating-handles, which are turned up, as shown in Fig. 2. The transmitting-operator wishing to call the receiving-station presses down the switch N^2, which causes spring 51 to leave spring 52 and touch spring 53. The latter is in connection through wire 101 with battery W^2, which connects through wires 102 and 103 to earth. By this movement a current is sent from earth over wires 103 102, battery W^2, wire 101, springs 53 51 to line-wire 100 to the opposite station. Arriving at this station the current enters by line 100, passes from spring 51 to 52, thence by wire 104 to spring 54 of switch Y, which is normally in contact with spring 55 thereof, and thence by wire 105 to call-bell C′, and thence to earth. The receiving-operator may answer the call by pressing down his switch N^2. The receiving-operator then, in order to receive the message, turns down his switch Y, which breaks connection with the call-bell and establishes connection from the line-wire through wire 104 and intervening connections to the commutator S, and thence through relay-magnet H to earth. The transmitting-operator also turns down his switch Y and also his switch S to put the latter in the transmitting position. This turning down of switch S connects the dial-commutator E through its arm D and the line-battery Z through the relay-magnet H and the switch Y to the line.

As soon as both switches Y have been turned down the instruments at both stations will begin to revolve and will run synchronously, by reason of the intermittent impulses or pulsations of current sent over the line, until they are stopped by a cessation of these impulses, as will be explained. The path of the current then is as follows, assuming the brush *a* to be in contact with one of the dial divisions or segments which connects through its key *t* to earth: Starting from earth the current passes by wire 106 through one of the keys *t* and the corresponding one of the wires 107 connecting these keys to the dial-segments, from the corresponding segment into the brush *a*, arm D, and wire 108 to commutator X, by springs 56 57 thereof through line-battery Z, by springs 58 59 through wire 109 to commutator S, which is pressed down, springs 60 61 thereof, wire 110, spring 62, switch-stem 63, spring 64, wire 111 and wire 112 through magnet H, by wire 113 to commutator S, thence through springs 65 and 66 to wire 114, to switch N′ by springs 67 68 thereof, and wire 115 to commutator Y by springs 69 and 54 thereof, to wire 104, and thence to line.

At the receiving-station the current entering by the line passes through wire 104 to commutator Y, by springs 54 and 69 and wire 115 to switch N′, by springs 68 67 thereof and wire 114 to commutator S, which is up; by springs 66 70 thereof and wire 112 to magnet H, through this magnet and wire 113 back to commutator S, by springs 71 and 62 thereof through wire 110, and by springs 61 and 72 to wire 116, which leads to earth. Hence the passage of the current over the line has energized the relay H at both stations, and this relay H attracts its armature *f* against the stop *m*. This sends a current from the battery J through a local circuit to the magnets G and K, as follows: from stop *m* through one half of battery J to wire 117, thence to magnet G, thence by wire 118 to commutator Y, through spring 73, conducting-body 74 and

spring 75 by wire 119 to magnet K, thence by wire 120 to the relay-armature *f*, and through this back to the stop *m*. This polarizes the magnet G and throws its armature to one side, so as to release the escapement-wheel B and cause the type-wheel arbor and arm D to move one space. This brings the brush *a* on the next segment of the dial E, which communicates with a key *g*, which normally is isolated from the earth, so that no current passes over the line. Consequently both relays H, being demagnetized, release their armatures *f*, which are pulled away by their retracting-springs *p* and touch the opposite stop *l*. This causes a current in the local circuit from the battery J in contrary direction by using the other half of the battery, thereby polarizing the magnet G oppositely and throwing back its armature and again releasing the escapement, which permits the wheel B, type-wheel A, and arm D to advance another step, thereby bringing the brush *a* onto a segment connected through this key *t* with the earth. Thereupon the current again passes over the line by the route first traced, again energizing both relays H and attracting their armatures *f* against the stop *m*, repolarizing the magnet G and again advancing the escapement, type-wheel, &c. These movements take place at rapid intervals, so that the arbors of both transmitting and receiving instruments revolve intermittently and in synchronism, but not necessarily in unison. During this rapid rotation the printing-magnet K receives alternating pulsations; but being a slow-charging magnet these neutralize each other and its armature is not attracted. When from any cause the succession of pulsations and interruptions over the line is suspended, both instruments stop, the current from battery J at each station continues to flow, holding magnet G polarized and energizing magnet K, so that its armature is attracted, and the impression-roller presses the paper against the type-wheel to print a character. The movement of the armature of this magnet against its stop 76 closes a local circuit 121, fed by battery R and including magnet P, and energizes this magnet so that it attracts its armature, and upon the breaking of the circuit the retraction of its armature feeds the strip of paper forward.

If it is desired that the instrument at the transmitting-station shall not print, the magnet K may be short-circuited by pressing down the switch N. The current then passes from wire 119 to wire 122, to springs 77 78, and wire 123 to wire 120.

To bring the two instruments to unison, the transmitting operator presses down the pole-changing switch X, the sole effect of which is to cause the current over the line to flow in contrary direction. The relay-magnets H, although oppositely polarized, still attract their armatures *f* in the same manner as before, and the two instruments continue to revolve in synchronism until the one that is in advance reaches a position with its brushes *c c'* bridging the segments *d e* and with its brush *a* on the segment *b'*, which is connected to ground. Thereupon the current flows from the local battery U by wire 124, segment *d*, brushes *c' c*, segment *e*, wire 125 to switch Y, by springs 79 80 thereof and wire 126, through magnet T back to battery U. This energizes magnet T, which polarizes armature *f*, so that this armature is no longer attracted by the magnet H, the effect consequently being the same as if the line-circuit were broken, that is to say, the armature *f* remains against this stop *l*, and the current of last direction through magnet G continues to flow, thereby stopping the escapement action and bringing the instrument to rest. If the receiving instrument is the one in advance, it alone stops when it reaches this position and the transmitting instrument continues to run until it also reaches the same position, whereupon it is stopped in like manner. Then by releasing the key X the two instruments are simultaneously liberated and revolve in unison. If on the contrary the transmitting instrument is the one in advance, both machines will be stopped when the transmitting instrument reaches the described position, since thereby the alternate makes and breaks of current over the line are stopped. By then releasing the key X an instant until both instruments have advanced one tooth and then pressing it down again both instruments are again set to running, but with the receiving instrument in advance, whereupon the receiving instrument will stop in the unison position caused by the stoppage of the transmitting instrument in like position. Hence before commencing to transmit a message it is necessary, in order to always insure complete synchronism, for the operator to thus press twice on the button X.

Having brought both instruments to synchronism, the operator is prepared to transmit a message. For this purpose the keys *t t* are marked with the characters to which they correspond on the type-wheels. The operator presses down the appropriate key, thereby reversing the condition of the segments b^2 b^3, &c., with which that key is connected. If it was a grounded segment, it is open-circuited. If it was an open-circuited segment, it is grounded. The instruments continue to advance intermittently until the brush *a* reaches the segment with which the depressed key is connected, whereupon instead of the condition of the circuit being reversed, as compared with the preceding segment, no such reversal occurs, but the preceding condition is continued, thereby prolonging the action of the relay H at each station, causing the escapement-magnet G to hold the escapement and thereby hold the type-wheel stationary and causing the printing-magnet K to be energized and attract its armature to print the character. Both instruments remain stopped as long as the key is pressed down, but upon

its release the normal condition is reëstablished and both relays H and magnets G respond and the two instruments again intermittently advance until stopped by the pressing of another key.

If it becomes necessary to stop the instruments while the switch Y is down, this can be done by pressing down the switch N′ so as to break the circuit.

The spring of the armature *f* is so adjusted that if while its armature is polarized by the magnet T the magnet H receives no current (which is the case when the key corresponding to segment *b′* is pressed down) the armature *f* is not attracted.

In cases where it is necessary to print more characters than can conveniently be placed upon a single type-wheel, the type-wheel A is made double, that is to say, two type-wheels are fastened together, the one carrying letters and the other figures, or any other desired arrangement of characters. The double wheel can slide on its axis so as to present one or other series of characters in line with a paper strip held on the impression-roller *g*. To effect this, the double type-wheel is splined or feathered upon the shaft A′, as shown in Fig. 10. The movement of the type-wheel is effected by a special electromagnet W, Fig. 4, the armature-lever t^2 of which is connected by a rod *t′* with the arm *t*, Figs. 10 to 12, on a cross-shaft *o*, which carries two cam-arms S S, which bear against the face of the type-wheel on opposite sides of its axis. A spring *s′* on the opposite side presses the double type-wheel against the cams *s*, so that normally the front type-wheel stands in line with the paper band *n*, as shown in Fig. 11, but when the magnet W is excited it presses down its armature and oscillates the shaft *o*, so that the arms *s* press the double type-wheel forward and bring the rear characters into alinement with the paper strip *u*, as shown in Fig. 12.

For exciting the magnet W a key or switch M′ is provided. For convenience two of these switches are preferably arranged on opposite sides of the keyboard, as shown in Fig. 3. Whenever it is desired to print from the rear face of the double type-wheel, one of these switches is pressed down and held as long as this face of the type-wheel is to be used.

The switch W′ is adapted to bridge contact-springs 81 82. The same result is effected by key M′ through wires 128 129. To send a current through the magnets W, the springs 81 82 are connected either by pressing down switch W′ or by closing key M′, in which case the current flows from earth through wire 103 102, battery W^2, wire 130, springs 81 82, wire 131, and line-wire 127. At the receiving-station the current entering by wire 127 finds springs 81 82 disconnected, and hence flows by wire 132 through magnet W, by wire 103 to earth.

I claim—

1. In a printing-telegraph, the following-defined improvements, substantially as hereinbefore specified, namely: the combination of a type-wheel and escapement connected together, an escapement-magnet controlling said escapement, a printing-magnet adapted to act on the stopping of the escapement, a local battery and circuit operating said magnets, a polarized relay controlling said local circuit, a line-circuit, means for sending intermittent currents of normal direction over said circuit, and a pole-changer for reversing said currents at will.

2. The combination of a type-wheel and escapement connected together, an escapement-magnet controlling said escapement, a local battery and circuit operating said magnet, a relay controlling said circuit, normally non-polarized but having a polarizing-coil in a special circuit, contacts for closing said special circuit in the unison position of the type-wheel, a line-circuit, means for sending intermittent currents over said line, of such normal direction as to actuate said relay whether it be polarized or not, and means for reversing the direction of said currents, whereby when said relay becomes polarized it ceases to act and stops the instrument with the type-wheel in said unison position until the normal current is restored.

3. A printing-telegraph comprising a type-wheel, escapement and revolving brush connected together, a dial of segments traversed by said brush, keys connected to said segments, normally alternately grounded and open-circuited, and each adapted to establish the reverse condition when depressed, a line connection from said brush through a line-battery to line, a relay in said line connection, normally non-polarized but having a polarizing-coil in a special circuit, a special segment on said dial and a special brush revolving with said escapement and touching said segment to close said special circuit in the unison position of the type-wheel, whereby in said position the relay is always instantaneously polarized, and a pole-changer for reversing the current from said line-battery, whereby to unison the transmitting and receiving instruments said pole-changer is operated to reverse the current through the relays and thereby arrest each relay when it becomes polarized in the unison position.

4. A printing-telegraph comprising a type-wheel, escapement and revolving brush connected together, a dial of segments traversed by said brush, keys connected to said segments, normally alternately grounded and open-circuited, and each adapted to establish the reverse condition when depressed, a line connection from said brush through a line-battery to line, a relay in said line connection, an escapement-magnet controliing said escapement, a printing-magnet, and a commutator which in the "receiving" position grounds the line through said relay, and in the

"transmitting" position grounds the line through said relay, line-battery, brush, segments and keys.

5. A printing-telegraph comprising a type-wheel, escapement and revolving brush connected together, a dial of segments traversed by said brush, keys connected to said segments, normally alternately grounded and open-circuited, and each adapted to establish the reverse condition when depressed, a line connection from said brush through a line-battery to line, a relay in said line connection, an escapement-magnet controlling said escapement, a printing-magnet, means for polarizing said relay, and a commutator which in the receiving position grounds normal incoming currents through said relay in a prescribed direction, and in the transmitting position connects the keys, segments, brush and line-battery to line through said relay in such order that normal outgoing currents traverse said relay in the same prescribed direction as in receiving, whereby said relay is affected alike by currents of normal direction in either transmitting or receiving.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

BERNHARD HOFFMANN.

Witnesses:

CLYDE SHROPSHIRE,

AUGUSTE MATHIEU.