No. 695,537. Patented Mar. 18, 1902.

L. CEREBOTANI.

PRINTING TELEGRAPH.

(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 1.

FIG. 1.

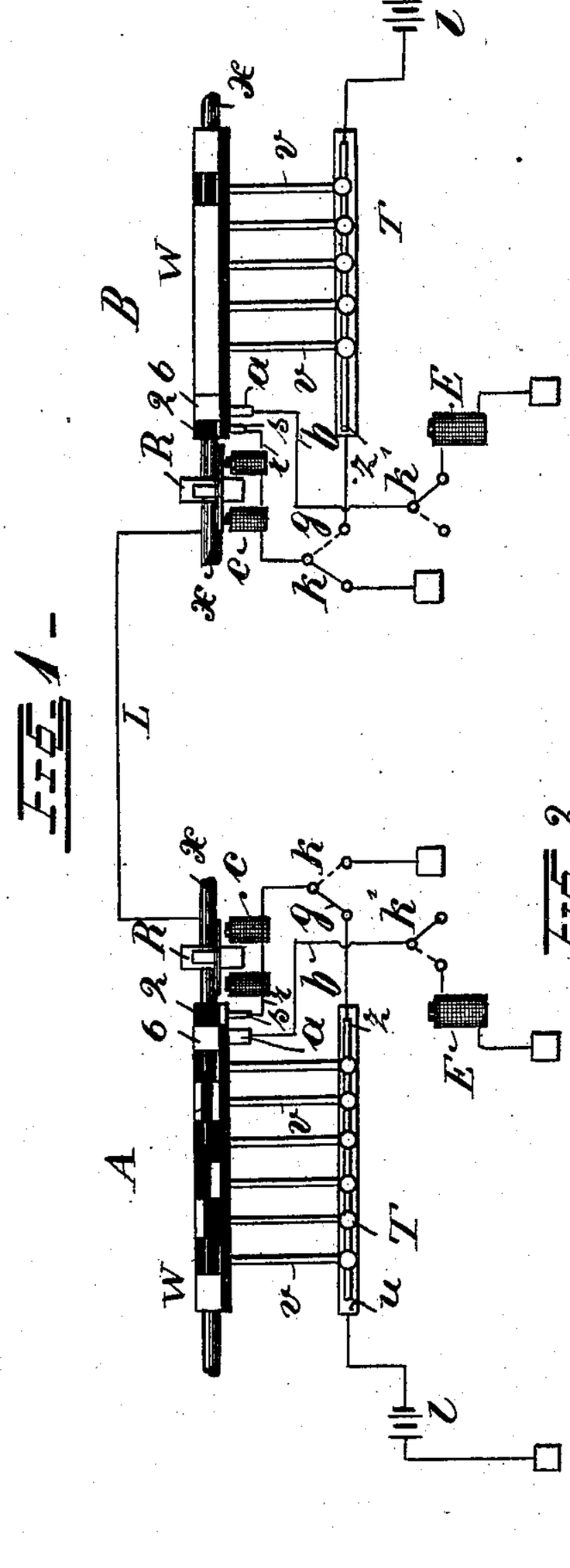

FIG. 2.

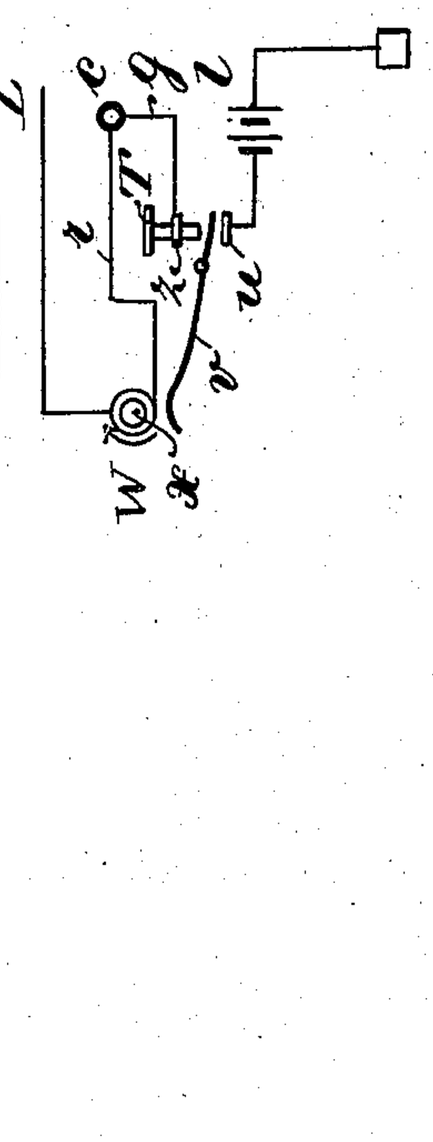

FIG. 3.

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No. 695,537. Patented Mar. 18, 1902.

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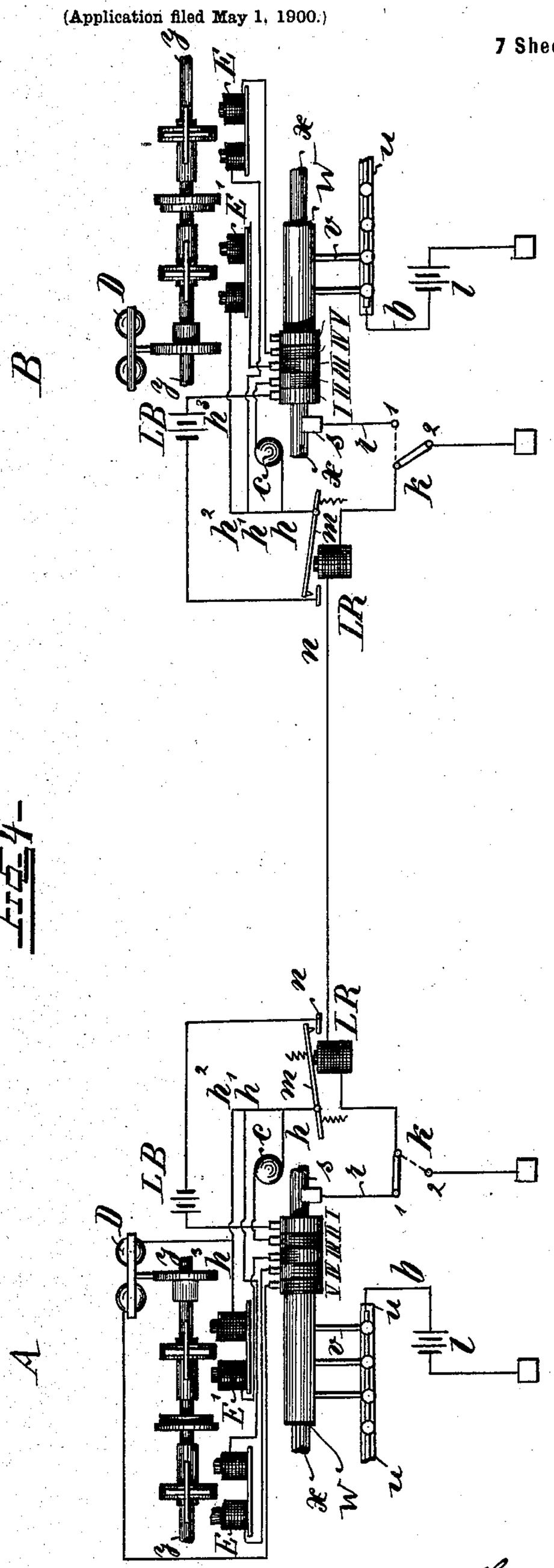
(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 2.

Fig. 4.



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(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 3.

Fig. 5.

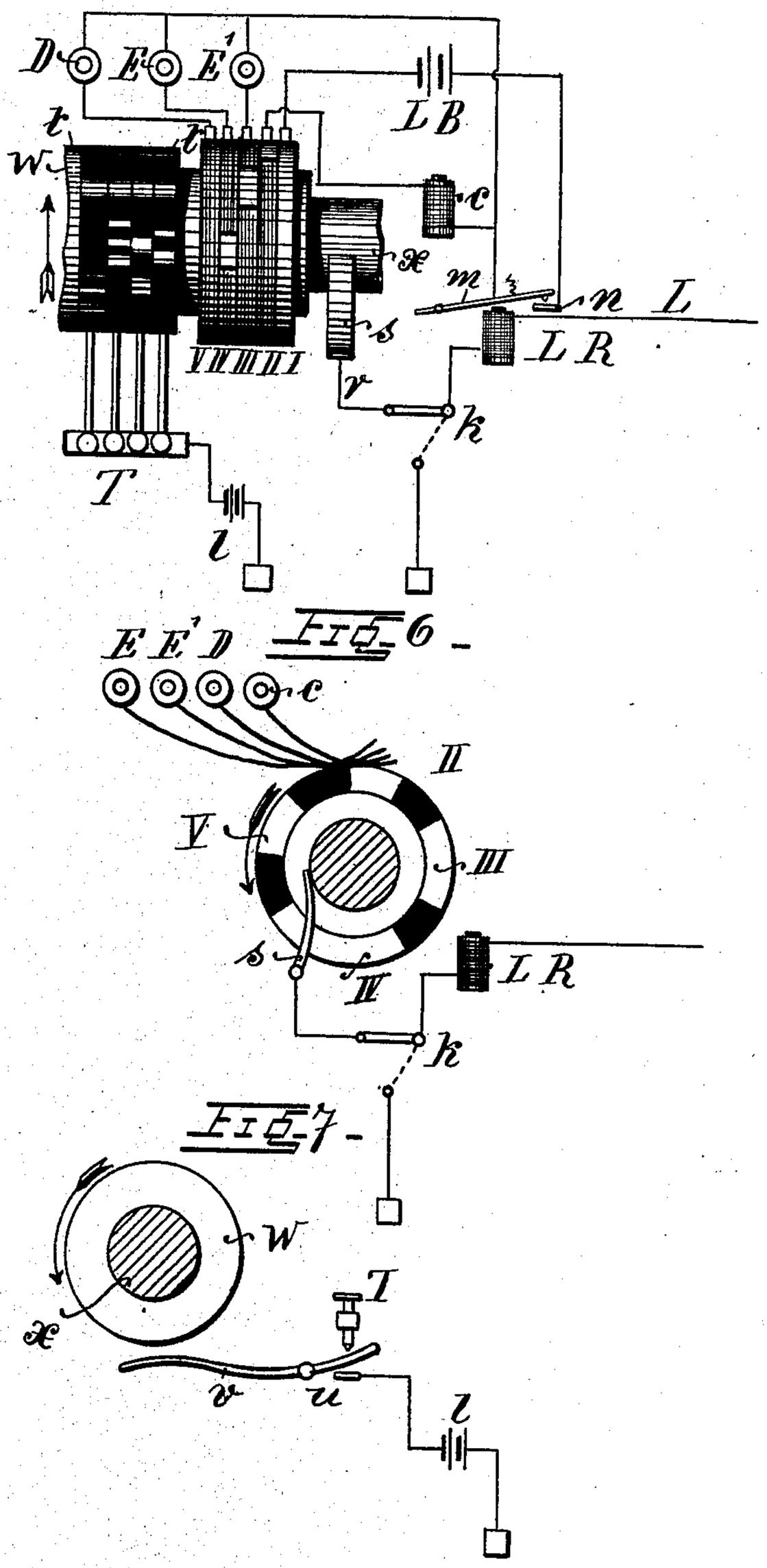

Fig. 6.

Fig. 7.

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PRINTING TELEGRAPH.

(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 4.

FIG. 5.

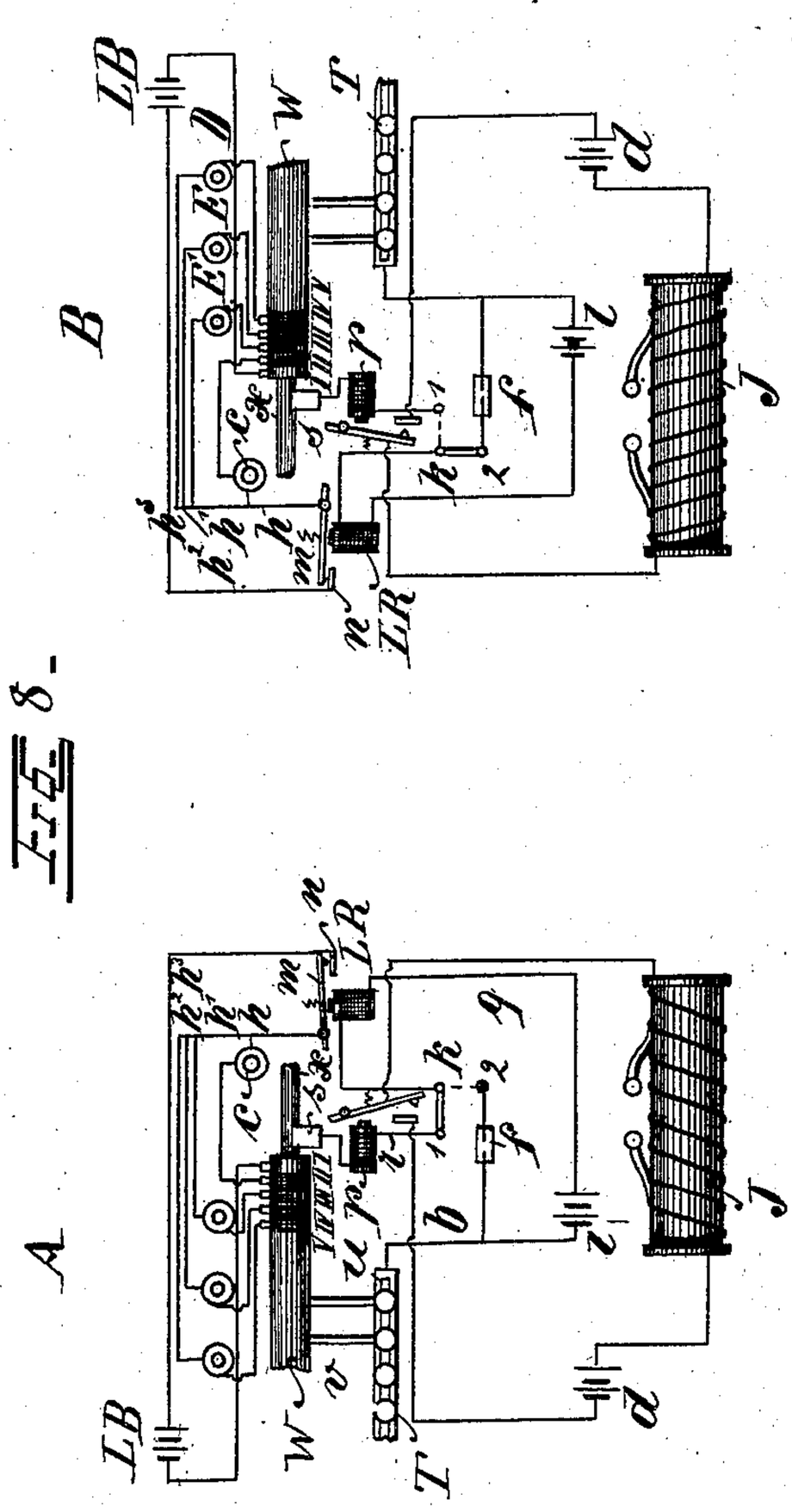
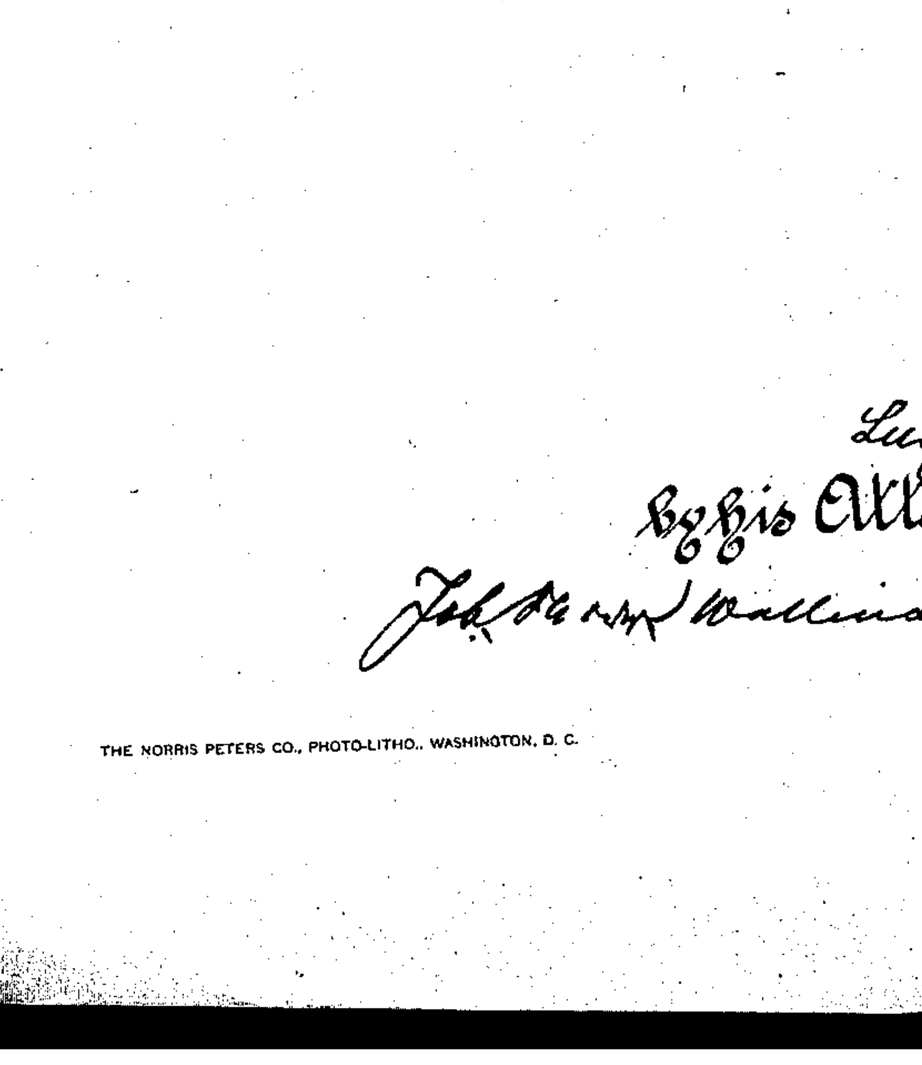


FIG. 6.



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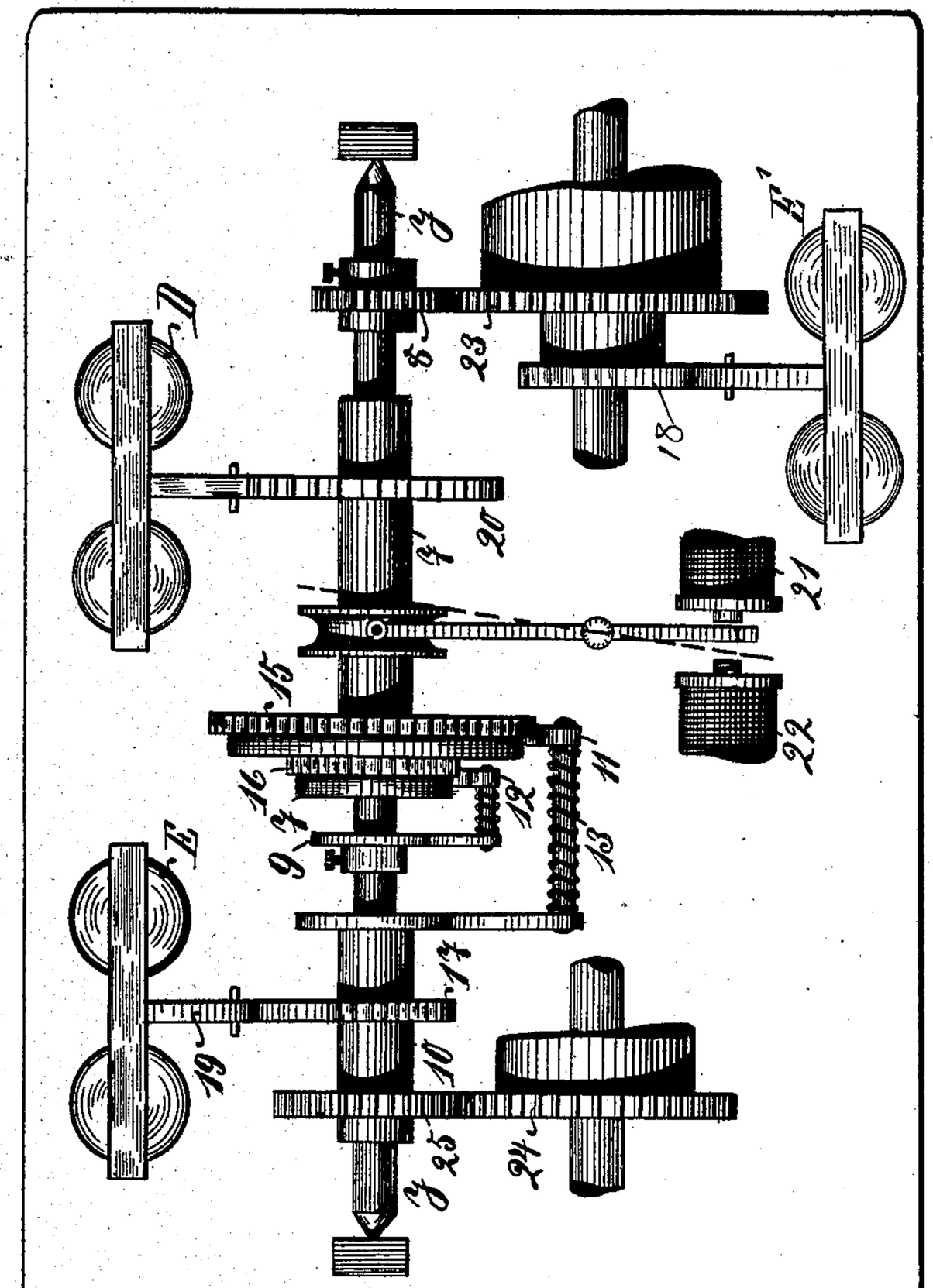
(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 5.

Fig. 9.



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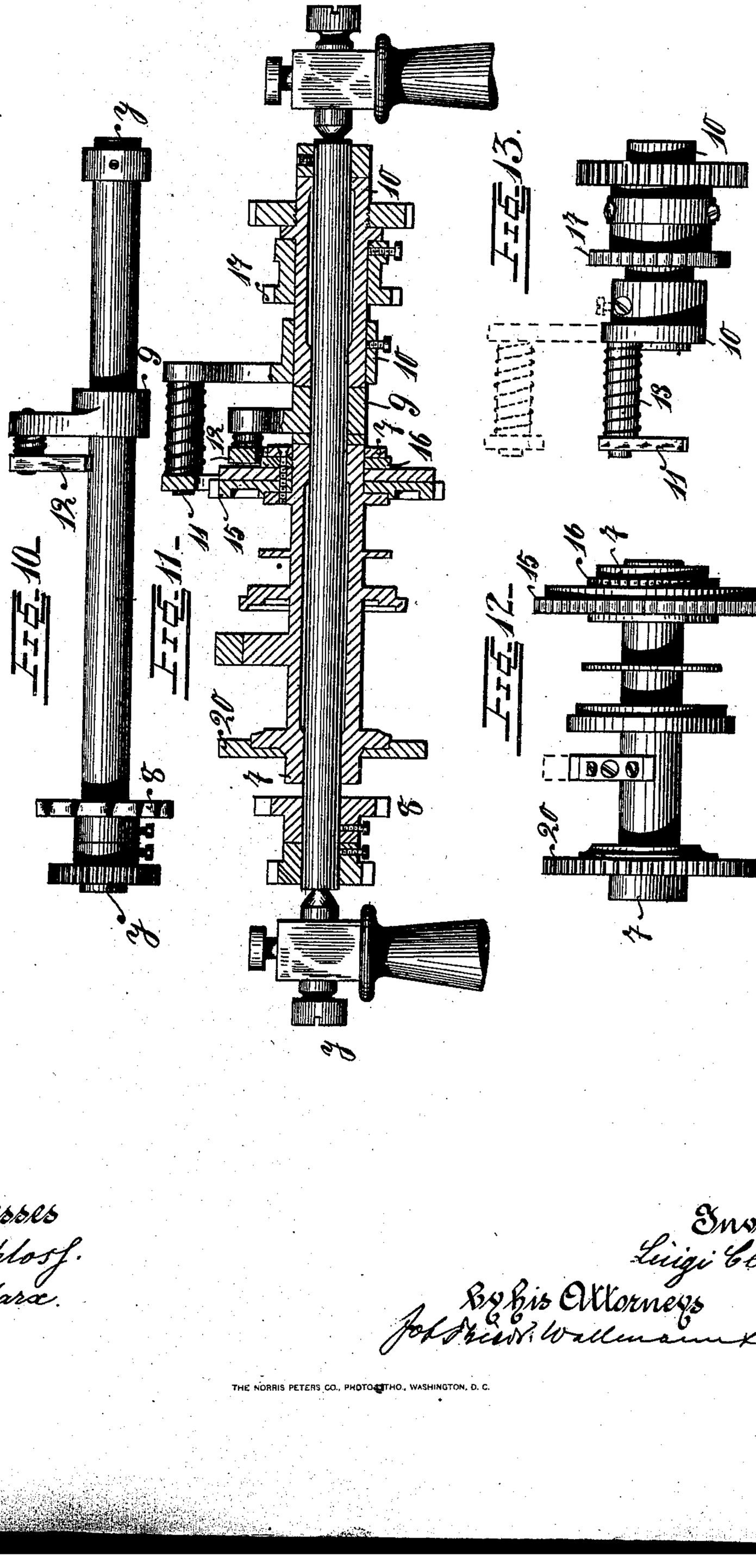
(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 6.



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(Application filed May 1, 1900.)

(No Model.) 7 Sheets—Sheet 7.

FIG. 10.

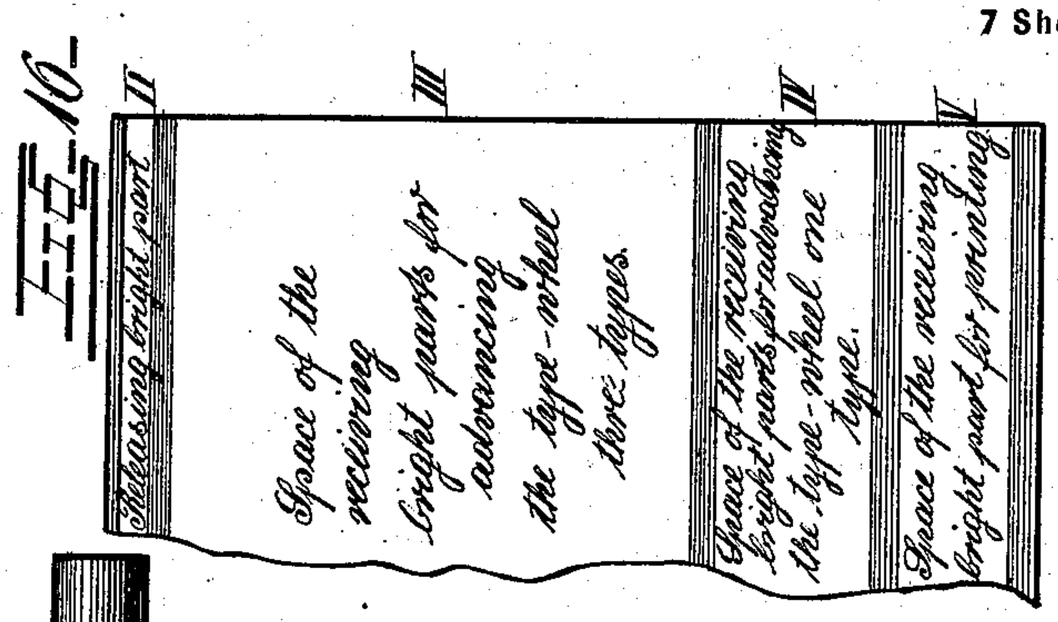


FIG. 14.

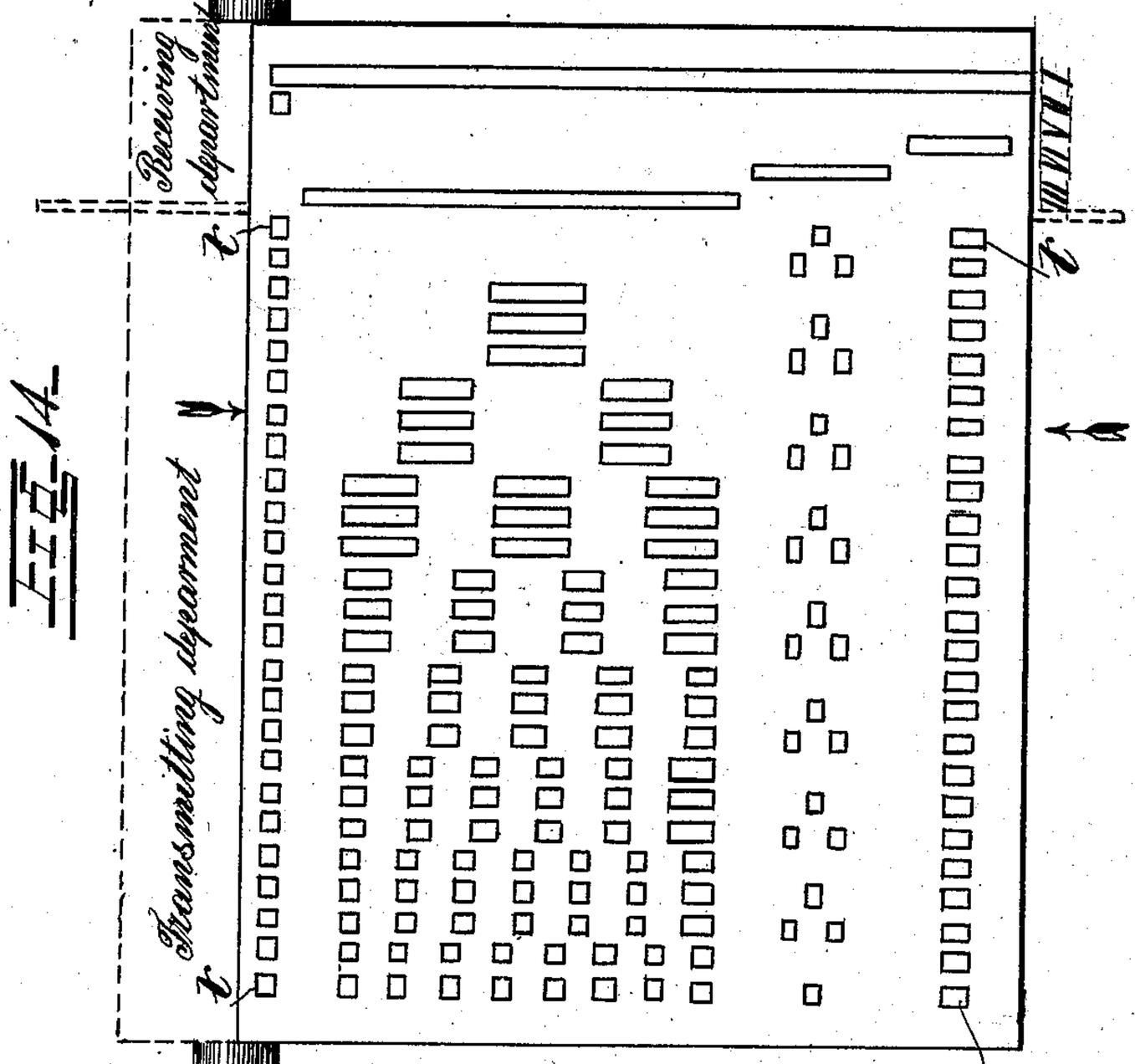
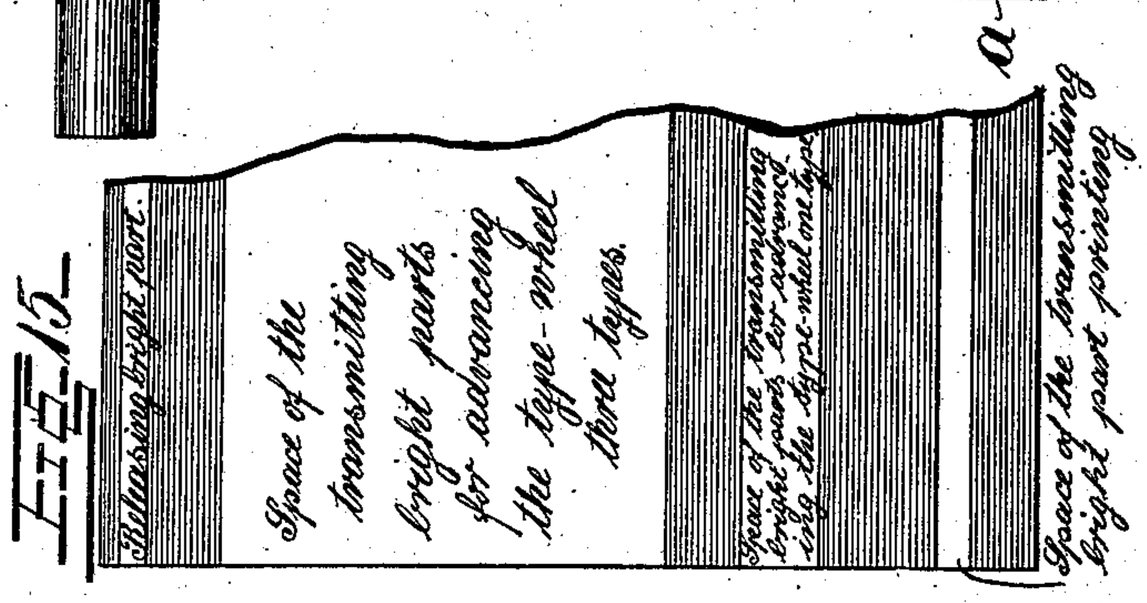


FIG. 15.



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UNITED STATES PATENT OFFICE.

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PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 695,537, dated March 18, 1902.

Application filed May 1, 1900. Serial No. 15,146. (No model.)

To all whom it may concern:

Be it known that I, LUIGI CEREBOTANI, a subject of the King of Bavaria, residing at Munich, in the Kingdom of Bavaria and German Empire, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

The present invention relates to that class of printing-telegraphs in which depression of a key at the transmitting-station results in a number of current impulses being sent; secondly, in these impulses adjusting the type to be printed at the receiving-station; thirdly, in printing with such type, the receiver remaining at rest, and, lastly, in reinstating the normal position of the apparatus when the printing has been completed.

The essential features of the new invention consist, firstly, in the type being adjusted and the printing effected by one and the same kind of current, whether plus or minus, strong or weak, rapid or slow; secondly, in the whole twenty-five type being adjusted by at most eight current impulses, so that the speed of telegraphing is greatly accelerated, and, thirdly, in the use of a coherer or the like being permissible, so that the invention can also be employed for telegraphing without a wire.

The invention comprises, essentially, two separate but coöperating apparatuses—the transmitting and receiving devices. As regards the receiving arrangement, this differs from prior similar constructions, inasmuch as in the present case there are two escapement-wheels provided, which alternately operate the axle of the type-wheel in such manner that while the one escapement-wheel is operating the other remains uninfluenced by the rotating axle and can stand at rest. The transmitting devices likewise differ from prior like transmitters—firstly, the present arrangement is such that the transmitting devices influence each other mutually at the two terminal stations in such manner that when the cylinder or the pointer at the one station rotates through the depression of a key the cylinder or the pointer at the other station likewise rotates; secondly, the motion of the receiving devices at the two end stations is dependent upon that of the transmitting devices in question.

The quintessence of the invention may be summed up as follows: If a key is depressed at one end station current impulses are transmitted from the battery at this station, which both here (transmitting-station) and also at the corresponding end station, by means of the transmitting device itself, excite a local current. This latter is such that by means of a single relay it exercises a fourfold effect. The first line current impulse operates the clockwork at the transmitting device, (so that the cylinder or the pointer of this transmitting device rotates at both stations simultaneously.) The effect of a part of the succeeding impulse is to operate an escapement at the receiving apparatus. The effect of another part of the likewise succeeding impulse is to operate another escapement at the receiving apparatus, and finally the effect of the last current impulse is to print, whereupon the original position is again taken up.

The invention is illustrated by the accompanying drawings.

Figure 1 is a diagram illustrating the system upon which the transmitting arrangement is based. Figs. 2 and 3 are detail views of parts of Fig. 1. Fig. 4 is a general view of the whole arrangement for transmitting and receiving telegrams at both end stations. Fig. 5 shows in particular the system of distributing the current. Figs. 6 and 7 are detail views in connection with Figs. 5 and 4 to be referred to. Fig. 8 illustrates the system of telegraphing, a coherer or the like being employed and the line connecting the two terminal stations being dispensed with. Fig. 9 shows the general arrangement of the new receiving device so far as the principal parts are concerned. Figs. 10, 11, 12, and 13 are detail views of the principal part of the receiving apparatus, and Figs. 14, 15, and 16 are planimetric diagrams of the surface of the transmitting-cylinder—that is, the transmitting and receiving parts (bright parts) in their actual number and arrangement.

As regards the unity of the invention here described, it may be remarked that although the main feature is a receiving device with

two escapements, &c., the character of this receiver is such that it requires a similarly peculiar device at the transmitter. The one cannot, therefore, be dealt with without at the same time considering the other. In prior similar apparatus the operation of the receiver is dependent upon the coöperation of the polarized relay, and since different kinds of current are used the line cannot be dispensed with. In the present case, on the contrary, the operation of the three electromagnets at the receiver are dependent upon a single neutral relay. The distribution of the impulses of current arriving is, besides this relay, solely dependent upon the synchronism of the movements of the transmitting-cylinder at the two end stations. (This synchronism, it may be remarked, need not be mathematically correct, and can never cease.) Thus the current impulses arriving can be of any desired kind, strength, and duration. For this reason the present printing-telegraph can be employed without a line.

It is clear from the above that the three main features of the invention—the receiving arrangement, the system of transmitting, and telegraphy without a wire—are intimately connected, so as to form, essentially, one single invention.

Before entering upon a description of the nature and operation of the new arrangement in detail it may be well to explain in general (cp. Fig. 1) how two different effects are produced at the two end stations by the depression of a key at one of the stations—that is to say, rotation of the cylinder, and during such rotation operation of the receiver.

A and B are the two terminal stations.

W (at both stations) is a cylinder rotating on the shaft *x*.

T represents the keys, (cp. Fig. 2;) *v*, the metal strips which connect the keys with the cylinder, inasmuch as the surface of the latter lightly slides by them. The cylinder is divided into as many zones as there are keys. The zones are composed of bright and insulated parts. In addition to these the cylinder has two zones 2 6, against which contact-springs *a s* operate. The one is connected by the wire *b* with the switch *k'*, the other by the wire *p* through the electromagnets *c* with the switch *k*. In this figure the switch *k* at the terminal station A is shown connecting its wire with the metal strip *z* and the switch *k'* as cutting out the electromagnet E, while at the station B the two switches are shown in their reversed positions. (Cp. Fig. 2.) The electromagnet *c* directly it operates starts a clockwork, which sets the cylinder *w* in rotation. The manner in which the clockwork is started (or stopped) on the magnet operating (or becoming inoperative) by means of the wheel R, rigidly connected with the cylinder, is shown in Fig. 3. The current from the line-battery *l* at the station A takes a course as below described. The one pole of the battery being connected with the metal strip *u*, (cp. Fig. 2,) if a key T is depressed and the cylinder is at rest the current can only pass through the second rigid metal strip *z* (through which the pin of the key projects) and then through the wire *g*, switch *k*, electromagnets *c*, wire *r*, contact-spring *s*, (cp. Fig. 2,) metal cylinder W, shaft *x*, and line L to the second station B, where the current passes through W *s r c k* to earth. If now such a current passes through a key being depressed, the electromagnets *c* (at each station) operate and the cylinder W is rotated. During this rotation no current can pass through *z g c r* when the bright part of the zone 2 has passed the contact-spring *s*. On the other hand, the current will pass through the metal strip *v* of the depressed key whenever this strip comes in contact with a bright part of the zone in question. It should be noted that during the time that the transmitting bright parts are passing the strip *v* the bright parts of the zone 6 also pass the contact-spring *a*. The current would then pass as follows: strip *u*, strip *v*, bright part of the zone corresponding to the depressed key, shaft *x*, line L, and at the station B, shaft *x*, bright part of the zone 6, contact-spring *a*, wire *b*, switch *k'*, receiver E to earth. The purpose of the switching needs no further explanation. If *k'*, for instance, were not switched to break the circuit, the current would remain at the station A and would not pass through L to station B. In general with this arrangement the switches should be so left as at the station B when no telegram is being transmitted, but only received, and turned, as at the station A, when it is desired to telegraph. From this explanation it is clear that the depression of a key can effect two operations at the two end stations—that is, the rotation of the cylinder and the transmission of a current to the receiver, which effects printing of a letter or the like.

According to Fig. 1 there can only be a single exciting receiver-magnet, while according to the new arrangement three receiver-magnets must operate one after the other, this requiring a peculiar arrangement of the zones of the cylinder. Furthermore, the receiving apparatus of Fig. 1 does not operate at the transmitting-station, while with the new arrangement not only the receiver at the other station, but also the receiver in the transmitting-station, operates. Finally with the new arrangement there is only one relay employed, which influences both the electromagnets at the receiver and the releasing-magnet, and therefore only one switch and simple contact connection through the key of the corresponding metal strip with the battery—that is to say, the metal strip *z*, Fig. 1, may be dispensed with—is necessary.

With the new arrangement, Figs. 4 and 5, the transmission is effected as described below. The manner in which the printing of any desired letter is effected within a maximum of eight to nine impulses of current,

either with or without line, by the three magnets at the receiver influenced by the transmitter will be described later.

The receiving zones of the cylinder W are five in number—viz., those which are marked I II III IV V. The surface of the zone I is bright all over, while the surfaces of the remaining zones are only partly bright—that is to say, the bright part of one zone terminates exactly at the point where the bright part of another commences, (cp. Figs. 5 and 14,) the latter of which shows in planimetric diagram the complete surface of the cylinder and the bright parts relatively to one another, both as regards position and length. It should be remarked that while in Fig. 1 the bright part of the only receiver zone 6 was connected with the shaft metallically here all the bright parts of the receiver zones are, though mutually connected, insulated from the shaft of the cylinder—that is, there is no metallic connection between them and the bright parts of the transmitter zones, which latter are naturally in metallic connection with the shaft *x*. This mutual connection and the whole insulation of the shaft *x* are effected by a kind of metal ring, which rigidly surrounds the cylinder covered with insulating material and forms the basis of the five receiver zones, as shown in Fig. 6. During rotation of the cylinder these zones, as also the shaft of the cylinder *x*, bear against suitably-arranged contact-springs. The contact-spring *s*, Figs. 4, 5, 6, is connected by the wire *r* with the switch *k*. The wire then runs to the line-relay LR. The switch *k* when turned interrupts this circuit. If at one station—for instance, A—the connection is made, at the other station B it is broken. From the contact-piece *n* at the line-relay LR a wire runs to the pole of a local battery LB. From the other pole of this battery a wire runs to the contact-spring at the zone I. From the armature *m* a wire runs, branching at *h* to the electromagnet *c* and from here to the zone II. The same wire from *m* runs also, branching at h^2 to the electromagnet E′ and thence to the zone III. A third branch *h′* runs to the electromagnet E and thence to the contact-spring of the zone IV. A fourth wire branches at h^3, running to the electromagnet D and thence to the zone V. The one pole of the only line-battery *l* is connected through *b* with the metal strip *u*. (Cp. also Fig. 7.) When the bright part of a receiver zone passes its contact-spring, current impulses pass from a transmitter zone (cp. Fig. 14, transmitting-section) the key of which is depressed and operates at a certain electromagnet. In the position of rest of the cylinder all the metal strips *v* stand in connection with those bright parts *t t* in the row of which the bright part of the zone II lies, Fig. 14, which latter has to transmit the current to the releasing-electromagnet *c*, Figs. 4 and 5. Further, the length of the bright parts of the zones III IV V is greater than the space of the transmitter zone inside which the corresponding bright parts are, as shown in Figs. 5, 14, 15, 16, which indicate the actual number, size, and arrangement of the bright parts. It is clear from this, firstly, how through simple depression of a desired key the cylinder will rotate at each station; secondly, how the depressed condition of a key during a revolution without coöperation of the finger in the first place may transmit one or more impulses of current from one and the same battery which operate only at one of the electromagnets, in the second place may transmit one or more impulses of current which operate only at the second of the electromagnets referred to, and finally transmit constantly an impulse of current whereby the third electromagnet is operated, and, thirdly, how the distribution of these impulses of current, which only operate at the receiver, is effected with precision, even when the cylinder does not run quite regularly. When no telegram is being sent, the switch *k* at the two end stations is turned so as to break the circuit. If now it is required to telegraph from A, it is only necessary to turn the switch and depress the letters to be sent with the finger successively, raising them after the completion of a revolution. The first effect is the starting of the clockwork at both stations. From the line-battery *l* (station A) the current goes direct to the metal strip *u*, from here through the spring and metal strip *v* to the depressed key, to the first row of bright parts *t t*; further, to the shaft *x*, contact-spring *s*, wire *r*, switch *k*, over the relay LR, line L, and through the like line-relay of the station B to the switch *k*, and thence to earth. This fisrt simultaneous operation of the single relay LR causes release of the clockwork at both stations in the following manner: Both relays LR LR operate for the first time simultaneously. The armature *m* is thus attracted and the magnet *c* is traversed by the local current LB, for from the one pole of the battery LB the current passes through *n* to *m*, over *h*, around *c* to the contact-spring of II, and, since the contact-spring bears against a bright part here, from this bright part to the zone I and through its contact-spring to the other pole. At this moment only *c* is in the circuit, while the other magnets E′ E D remain outside the local current-circuit. The result is that both electromagnets *c c* operate and the cylinder is rotated at both stations simultaneously. During rotation, however, the same metal strip *v* comes in contact first with those bright parts which correspond with the long receiving bright parts of zone III. (Cp. Figs. 5 and 14.) Here the line-relay LR operates likewise at both end stations as often as the contact-spring *v* in question makes contact with the corresponding bright parts. The result is that now the electromagnet E′, which alone is in the circuit LB, operates at both stations. Its contact-spring is passed now by the bright places of the zone III. The current from LB thus comes to *n m* h^2,

from here to the said contact-spring, to the bright part of the zone III, to the zone I, and from here through the contact-spring to the other pole. Both cylinders, however, rotate further, and the same metal strip can contact with those bright parts of its zone at the same moment when at both stations the bright part of the zone IV passes its contact-spring. Here likewise the single-line relay operates *toties quoties* at both end stations, and it is clear that to this latter operation the operation of the magnet E must correspond. Finally the same metal strip which is in metallic connection with the transmitter-battery by reason of the depressed key makes contact with the last bright part. At this moment the relay operates for the last time, and therefore also the magnet D.

From the above it is obvious how a single wire after the depression of a key (not of a keyboard—as, for instance, with the well-known Meier and Baudot arrangement) through the same current serves to operate intermittently four electromagnets at both of the stations. This same intermittent operation of four electromagnets can also, without any alteration whatever of the new arrangement, by means of the same system be operated at both stations without any line. The only additions at the end stations to the arrangement shown in Fig. 4 are, first, (see Fig. 8,) an inductor J, with its battery *d* for the primary current, which is only closed when a transmission is made; secondly, a so-called "coherer" *f* or the like of such kind that it only influences the local current LB, and thereby the four electromagnets, when a telegram is sent from the other station hither; thirdly, the insertion of an electromagnet *p*, which closes the battery whenever a transmitting impulse flows from the battery *l*. If, for example, it is desired to telegraph from the station A to station B, Fig. 8, without a wire, the switch must be turned—that is, the pivotal point of the switch *k*, connected with the stud 1. (When it is not desired to telegraph, the stud 1 should be cut out and the stud 2 cut in.) When this is done, one proceeds in the same manner as if there were a line. The key is depressed, and the current passes from the pole of the battery *l*, over *b u v s p* 1 *k* LR *q*, to the other battery-pole *l*. It has already been explained that through this connection first the releasing-magnet of the end station A (where *w* rotates) and then the electromagnets at the receiver of the same transmitter-station operate. The manner in which a like effect is produced at the other station B is explained below.

As already mentioned, upon depression of the key the current generated flows around the electromagnet *p*. The latter therefore operates and breaks the circuit from *d* at each operation. This current, however, produces a powerful spark at the inductor J. That the tension of an inductor affects a coherer or the like at a great distance is well known. Such a coherer is also arranged at the terminal station A, but in such manner that there is no result following its being influenced. The contrary is the case with the coherer *f* at the station B, where the switch connects *k* with 2. Here the influence of the tension at the inductor J of the station A results in closing of the battery *l*, (station B.) In this circuit, however, there is only the line-relay LR inserted, while the magnet *p* is cut out, and the result is that now the relay LR through *f*, being influenced by the tension at the station A, operates (in the same manner as at the station A) the electromagnets *c* E′ E D, and therefore the same results are produced as at station A. The wires are so arranged that *p* remains out of circuit when a despatch is being received. Were this not the case the inductor J would enter into operation needlessly on every occasion and would cause more or less disturbance.

The manner in which the electromagnets at the receiver through their intermittent operation causes a letter to be printed will now be explained. Prior receivers of similar kind are already known. The maximum of the number of the current impulses effecting adjustment of the type is the same here as that of the number of alphabetical signs. The chief features of such receivers consist, first, in the operation of an escapement-wheel on a shaft, which releases itself from the former after printing; secondly, in the automatic coupling and uncoupling of this escapement-wheel by means of two current impulses from a local battery; thirdly, in the coöperation of two polarized electromagnets of special construction, of which the one only reproduces positive current impulses and effects adjustment, while the other only operates in response to a negative current and causes printing.

The employment of polarized magnets (and therefore the transmission of two kinds of current—positive and negative) is with receivers such as referred to only necessary because the receiver is inserted directly in the line-circuit, &c. If, however, such receiver were employed in connection with the present transmitting device, polarized magnets, &c., would be no longer necessary, though no change would be required in the apparatus. This is clear, since after the magnet *c* has caused rotation of the cylinder W in the two terminal stations, Fig. 4, one of the magnets E E′, likewise in both terminal stations, would adjust the type and the magnet D would effect printing. Such is, in fact, in all essentials the present receiver apart from a certain modified construction, to be hereinafter referred to. The main distinguishing feature of this invention as compared with prior constructions is that instead of one escapement-wheel for adjusting the type two escapement-wheels are arranged, which the magnets E E′, Figs. 4 and 9, operate, the arrangement being such that the

wheels one after the other cause unequal advances of the printing-wheel, without, however, obstructing each other's action. The advantage of this arrangement consists in an essentially smaller number of current impulses being required for adjustment of the type. With this arrangement, Figs. 14, 15, and 16, advance of one escapement-wheel one step (*i. e.*, an impulse of the magnet influencing it) causes advance of the printing-wheel by one type, while a step forward of the other escapement-wheel effects advance of the printing-wheel through three type. The adjustment of twenty-four type by means of this combination of three and one is effected by a maximum of nine current impulses. If, for instance, the sixteenth type is to be adjusted, only six impulses of current are necessary—viz., five for the escapement-wheel effecting advance of three type and one current impulse for the escapement-wheel effecting advance of the printing-wheel by one type. Figs. 9, 10, 11, 12, and 13 show the manner of carrying this into effect. The shaft of the toothed wheel 8, Figs. 9, 10, and 11, is rigidly connected with the shaft *y y* and similarly the feed and check device 9 12. The former (and thus the shaft *y y* and device 9 12) is influenced by a clockwork which is controlled by the escapement-wheel 18, Fig. 9—that is, by the electromagnet E'. On the shaft *y y* a sleeve 10 is loosely mounted, but so that it cannot slide longitudinally of the shaft. Rigidly connected with this sleeve is the feed and check device 11 13. The rotation of this sleeve is dependent upon that of the escapement-wheel 17 19 and is thus solely dependent upon the operation of the magnet E. The most essential feature of this arrangement is the sleeve 7 7, which is rigidly connected with the type-wheel 20 and coupling device 15 16. This sleeve is not only capable of rotation about the shaft *y y*, but can also be slid along it. How this reciprocating sliding motion is imparted by means of a local current or electromagnets 21 22 and how the original position is again attained as soon as the uncoupling is effected by the check devices 11 12 is already known. The novelty of the present arrangement consists, first, in the manner in which this double coupling and, secondly, how the rotation of the sleeve 7 7 is effected by the feed and check pawls 11 12. As regards the first of these operations, the Figs. 11, 12, and 13 clearly illustrate it. With regard to the second, it will be noticed that the two feed-pawls 11 12 are at the same time check-pawls. The one, 12, is rigidly connected with the shaft *y y* and the other with the sleeve 10, (said shaft and sleeve being independent of each other,) and these pawls engage in the wheels 15 16 in such manner that during the time that the one pawl—for instance, 11, which is rigidly connected with the sleeve 10—advances through rotation of the latter, and consequently pushes along the wheel 15, the other, 12, can remain at rest, since it yields to the force exercised by the pawl 11, which overcomes the pressure of the spiral spring—that is to say, it allows itself to be raised by the tooth of its own rotating wheel 16. The stop-wheels 15 16, rigidly connected with the axle of the type-wheel, are of such form and so arranged that while the wheel 15 advances by one tooth the type-wheel advances by one type. The advance of the wheel through one tooth, on the other hand, corresponds to the advance of the type-wheel (as assumed) by three type, or (what is the same) each current impulse operating at the magnet E causes the advance of the type-wheel by one type and each current impulse at the magnet E' the advance by three type. In order to better explain this, a complete example on the basis of the above will now be given, showing the truth of the remarks made and the essential connection between the several statements. Suppose the seventh letter from the right, Fig. 14, (the corresponding bright part is indicated by an arrow,) is to be transmitted from the sending-station. The first operation is, as explained, whether with or without wire, the release of the wheelwork through the response of *c c* by means of the receiver bright part II, and thus the rotation of the cylinder at both end stations. During the rotation within the field of the transmitter, bright parts, &c., the two long bright parts corresponding with the bright parts of the zone III (receiver-department) first act. When this is so, two current impulses pass one after the other, which result in the repeated response of E', Figs. 4 and 9, at the two end stations, with simultaneous response of LR LR, in well-known manner. These two operations of E' effect, by means of the escapement-wheel 18, through the wheels 23 8, a corresponding rotation of the shaft *y*, and thus of the part 9 12. The pawl 12 carries the wheel 16, and with it the whole system 7, forward, so that, first, the wheel 15 slides under the check-pawl 11, and, secondly, the type-wheel 20 advances through three type. On further rotation of the cylinder, Figs. 4 and 14, a small bright part passes the metal strip *v* of the depressed key which corresponds with the bright part of the zone IV, (receiver-department.) Hereupon likewise a current impulse passes, which results at the two end stations, (by means of the line or without line, as shown,) first, in the single response of LR and at the same time in the likewise single response of E. This attraction at E now causes the wheelwork 24 to operate, and thus rotate 25, with sleeve 10 and check device 11 13, which carries forward the wheel 15, and thus the whole system 7 7, so that, first, the wheel 16 slides under the check-pawl 12, and, secondly, the type-wheel 20 advances by one type. The seventh type is thus adjusted. As soon, now, as the bright part of the row *a*, Fig. 14, which corresponds with the bright part of the zone

V, passes the same metal strip a current impulse is caused, which results likewise in the response of LR and simultaneously of the electromagnet D at the two end stations. The latter effects the printing of the adjusted (the seventh) type. How release of the coupling follows the printing and how after the normal position has been attained the coupling is again effected is already well known.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A printing-telegraph comprising a line-battery *l*, key device *v u*, contact-springs *v*, cylinder-shaft *x*, cylinder W having transmitting and receiving zones arranged as described, a spring *s* contacting with said shaft *x*, a line-relay LR, a local battery LB, electromagnets E E′ D *c*, a printing device operated by said electromagnets E E′ D and switches *k k′* and electrical connecting-wires as shown, all substantially as and for the purposes set forth.

2. The printing device comprising in combination a shaft *y*, toothed wheel 8 rigidly mounted on said shaft and driven by clockwork, escapement-wheel 18 controlling said clockwork, feed and check devices 9, 12 rigidly mounted on said shaft *y*, sliding sleeve 7, means for sliding said sleeve on the shaft *y*, a type-wheel 20 rigidly mounted on said sleeve, toothed wheels 15, 16 rigidly connected with the axle of said type-wheel, a loosely-mounted sleeve 10 on said shaft, wheelwork 24, 25 operating said sleeve 10 and escapement-wheel 17, 19 controlling same, and feed and check devices 11, 13 rigidly connected with said sleeve 10 all substantially as and for the purposes set forth.

3. The cylinder W mounted on a shaft, comprising a transmitting and a receiving department, respectively containing transmitter and receiver zones arranged as described, each being composed of bright and insulated parts, the bright parts of the transmitter zone being all in metallic connection with the said shaft, and the bright parts of the receiving zones I-V being metallically connected together, but insulated from said shaft, substantially as and for the purposes set forth.

4. A printing-telegraph comprising a line-battery *l*, key device *v u*, contact-springs *v*, cylinder-shaft *x*, cylinder W having transmitting and receiving zones arranged as described, a spring *s* contacting with said shaft *x*, a line-relay LR, a local battery LB, electromagnets E E′ D *c*, a relay *p*, an inductor J, a coherer *f*, a printing device operated by said electromagnets E E′ D and switches *k k′* and electrical connecting-wires as shown, all substantially as and for the purposes set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LUIGI CEREBOTANI.

Witnesses:
MARIE VAGEMANFT,
FLORENCE. T. MCDONALD.