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PRINTING TELEGRAPH.

No. 388,244. Patented Aug. 21, 1888.

Fig. 1.

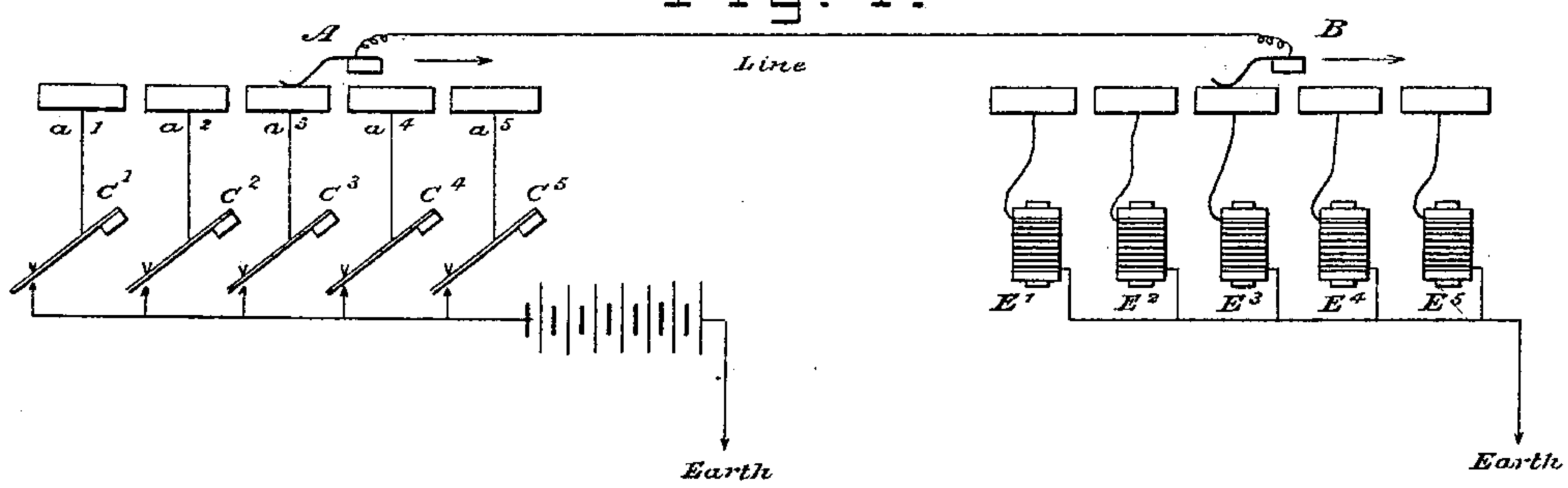


Fig. 2.

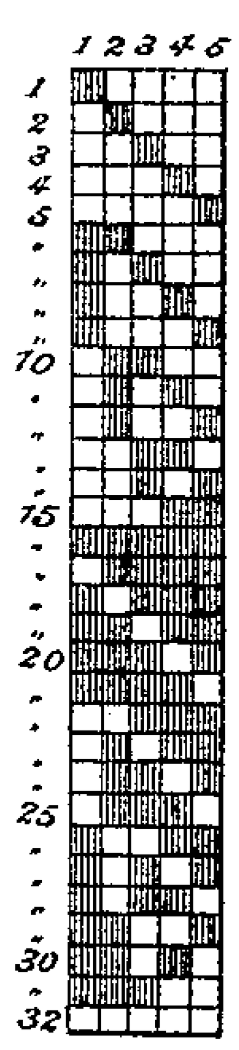


Fig. 3.

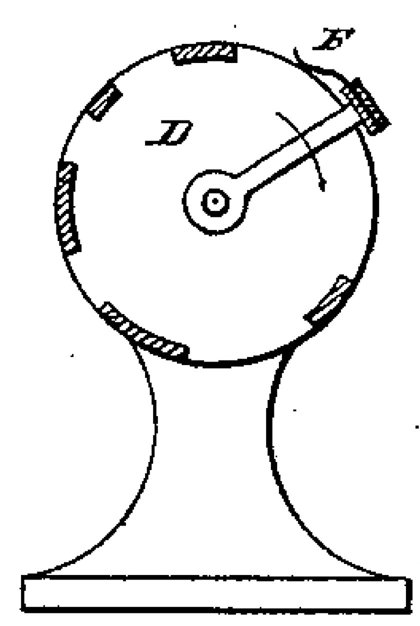


Fig. 5.

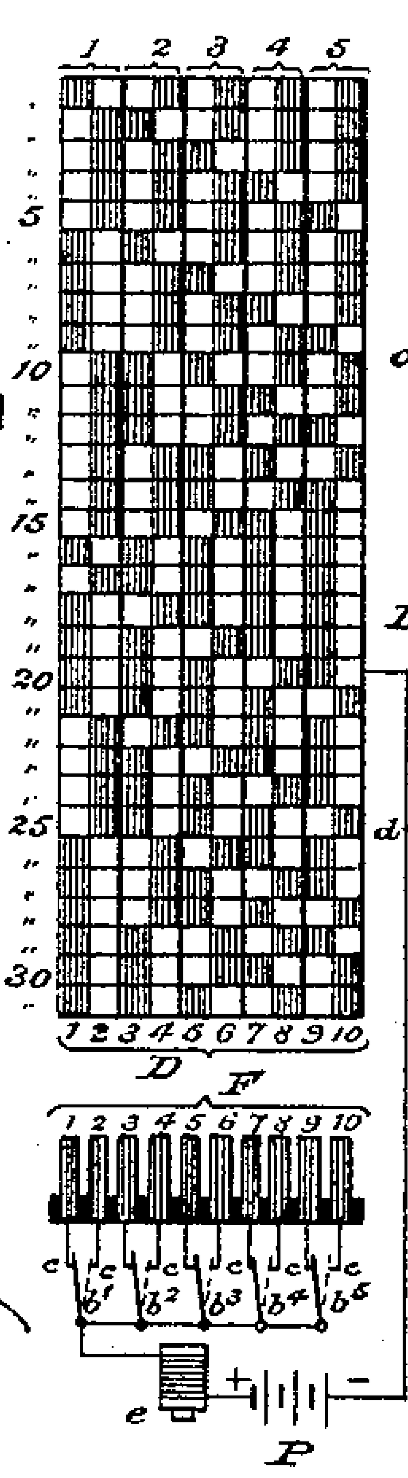


Fig. 4.

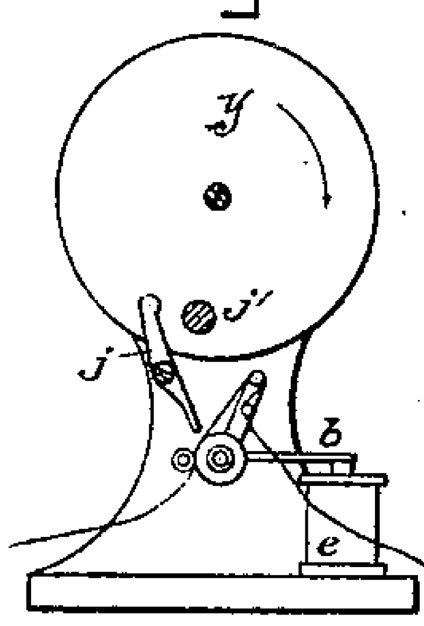


Fig. 9.

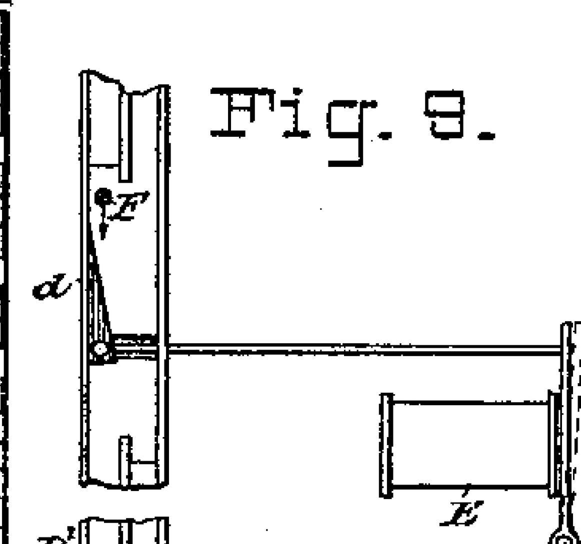


Fig. 10.

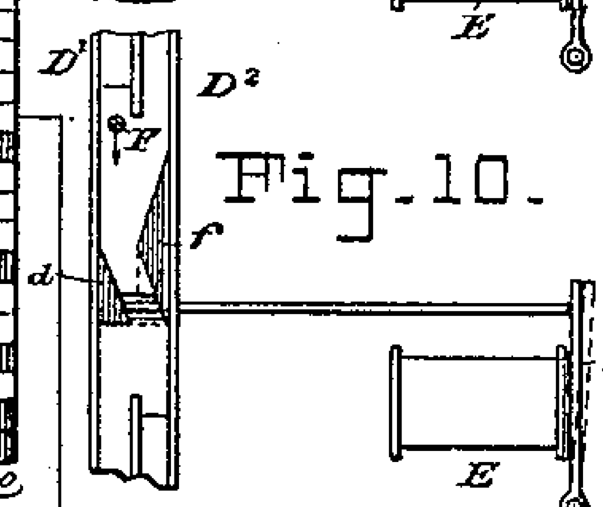


Fig. 7.

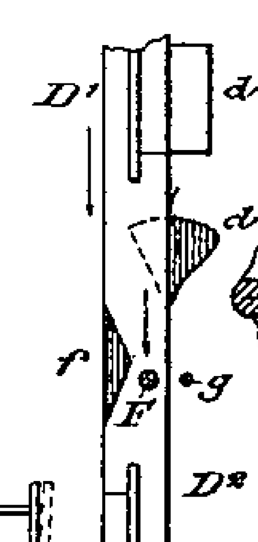
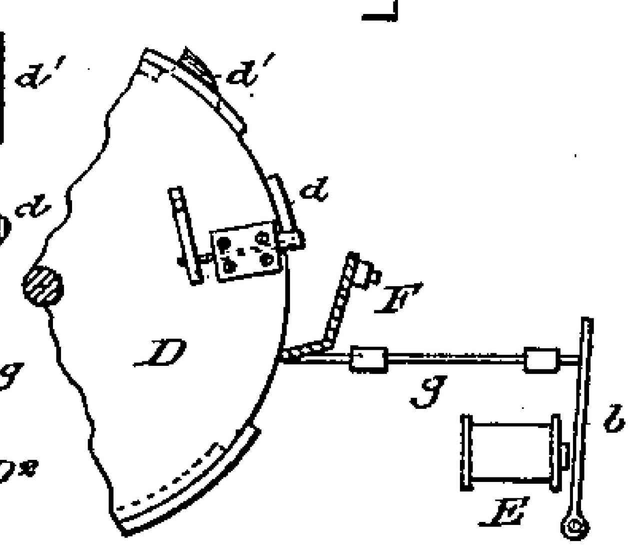


Fig. 6.



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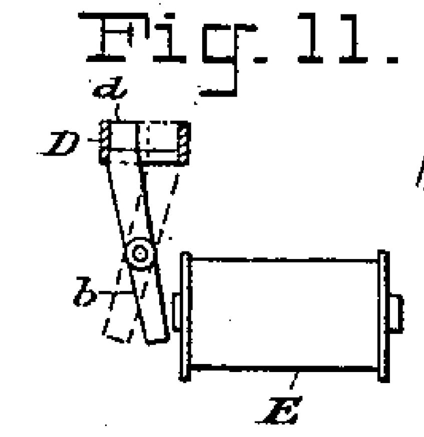

Fig. 8.

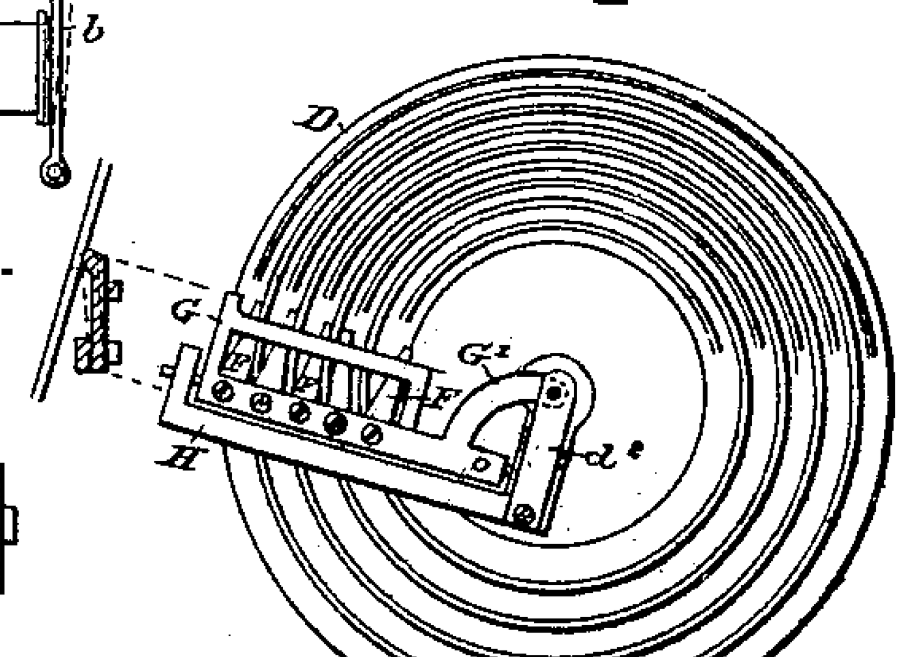

Fig. 13.

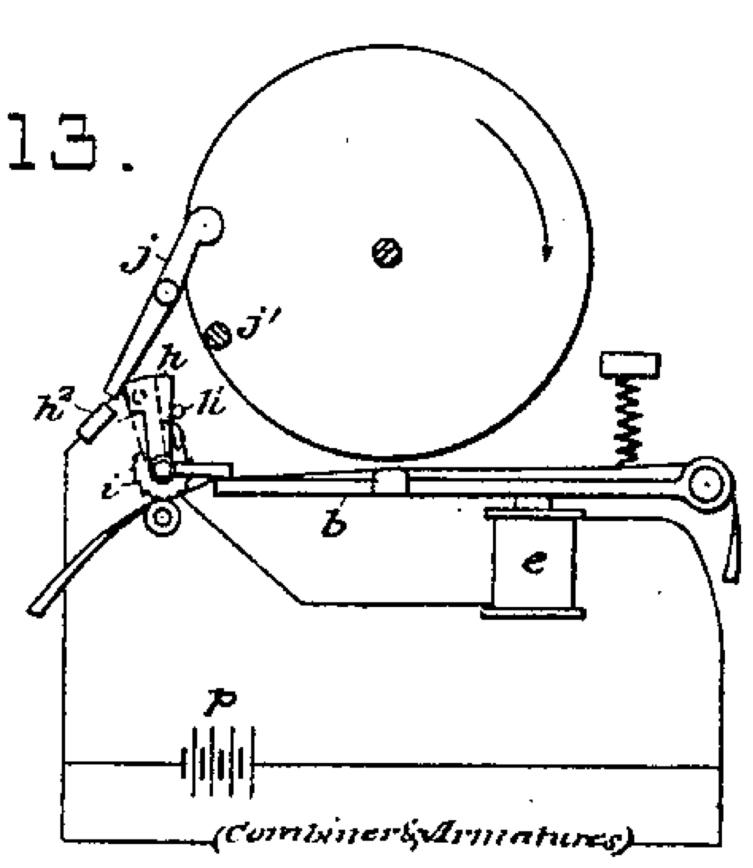

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Fig. 12.

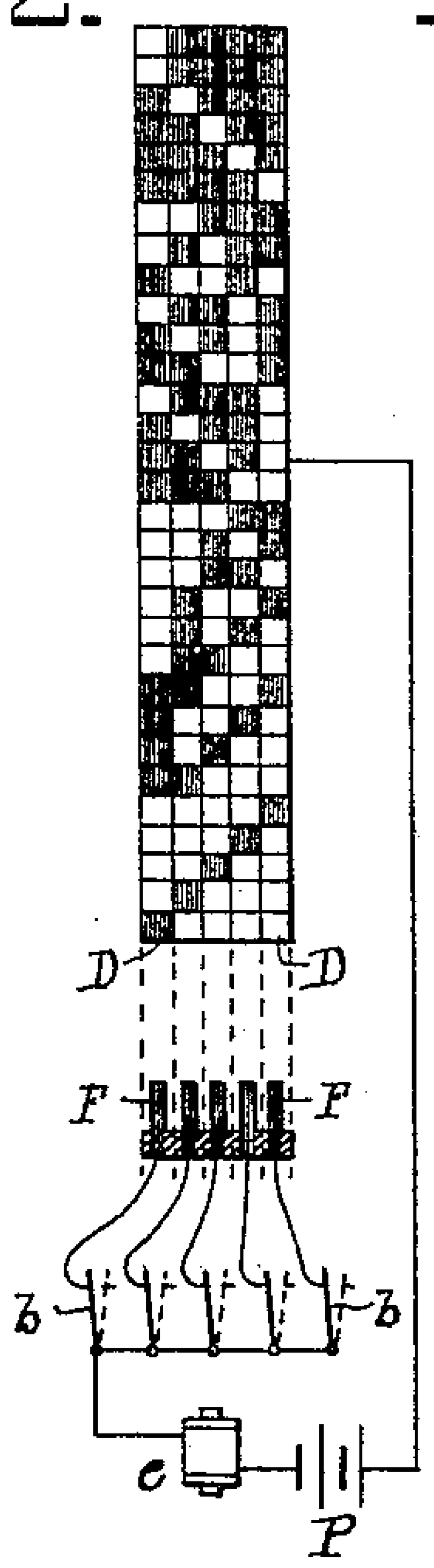


Fig. 14.

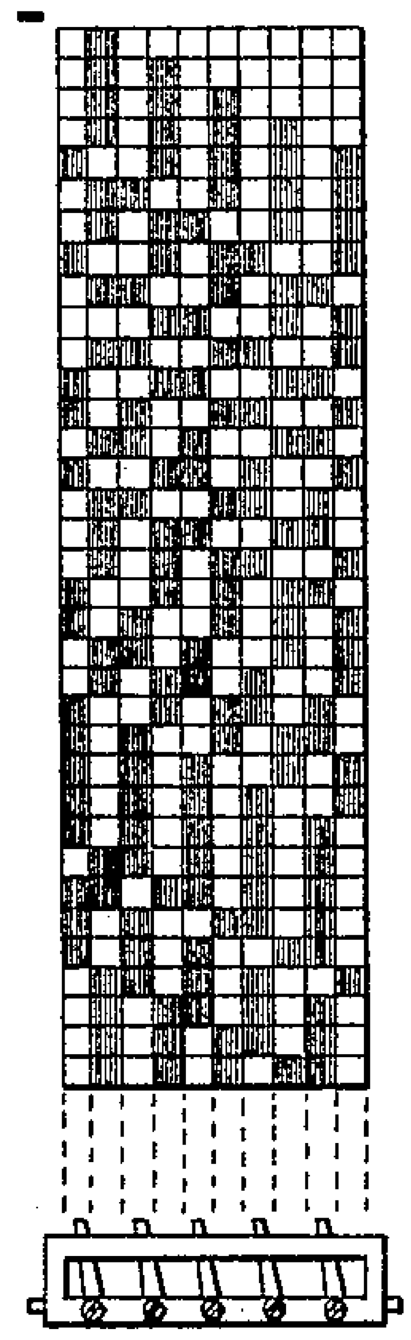


Fig. 15.

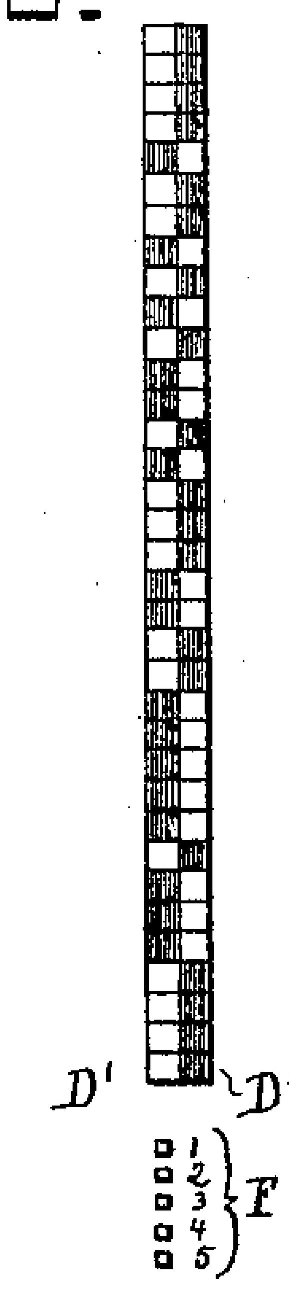
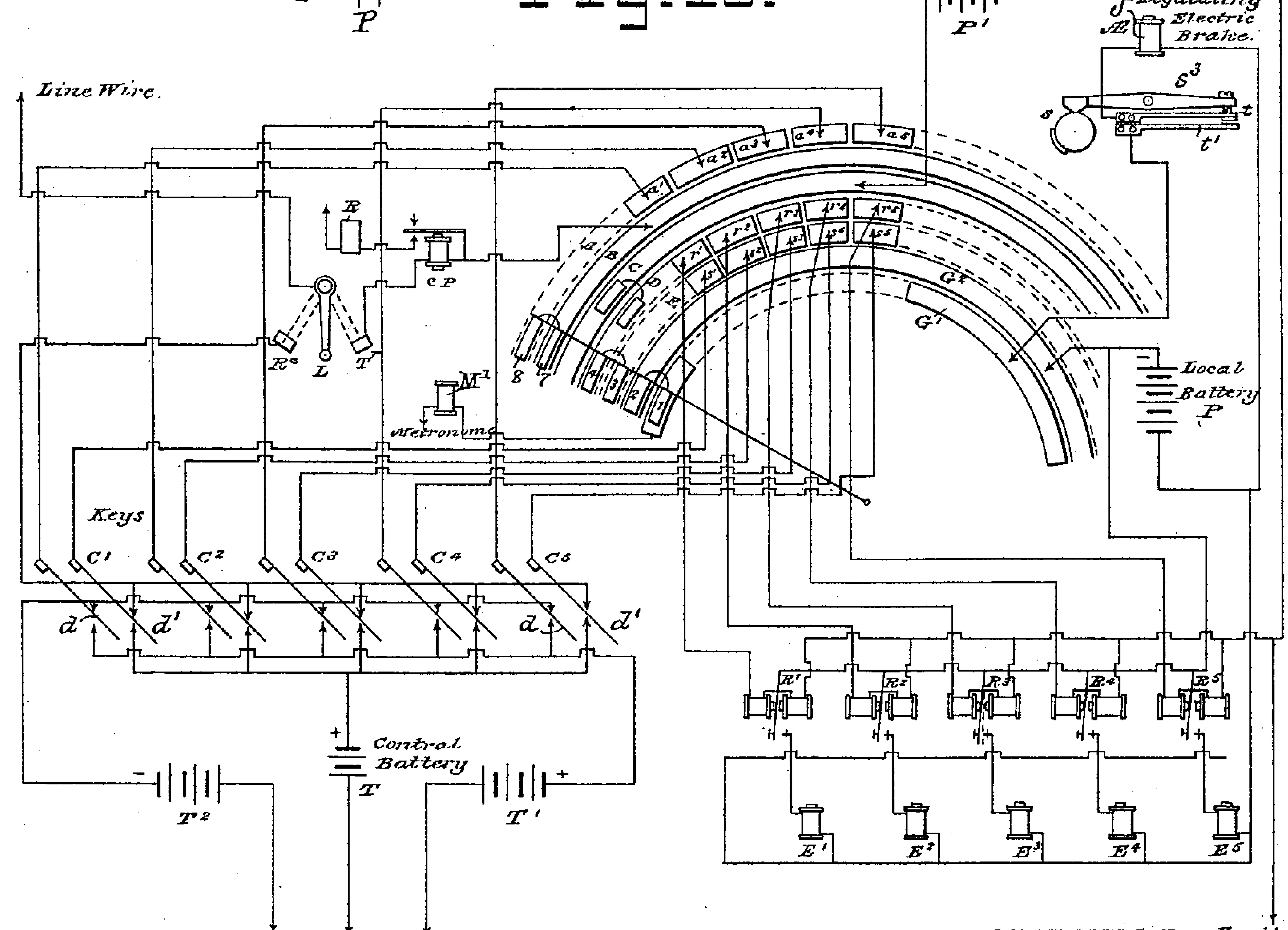


Fig. 16.



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J. M. E. BAUDOT.

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Fig: 17.

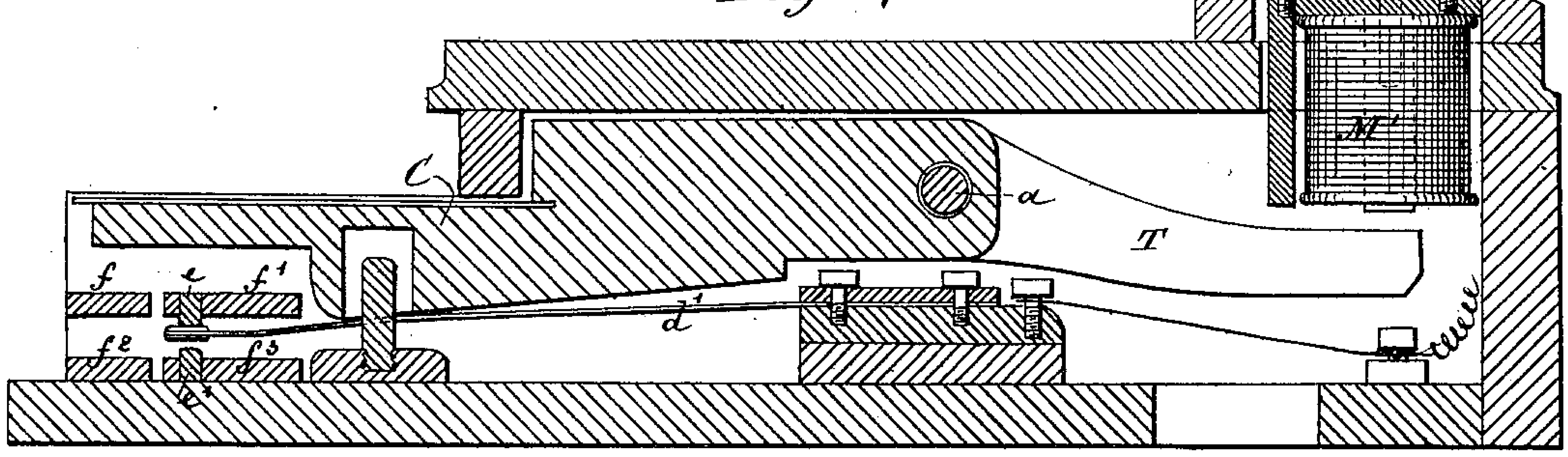
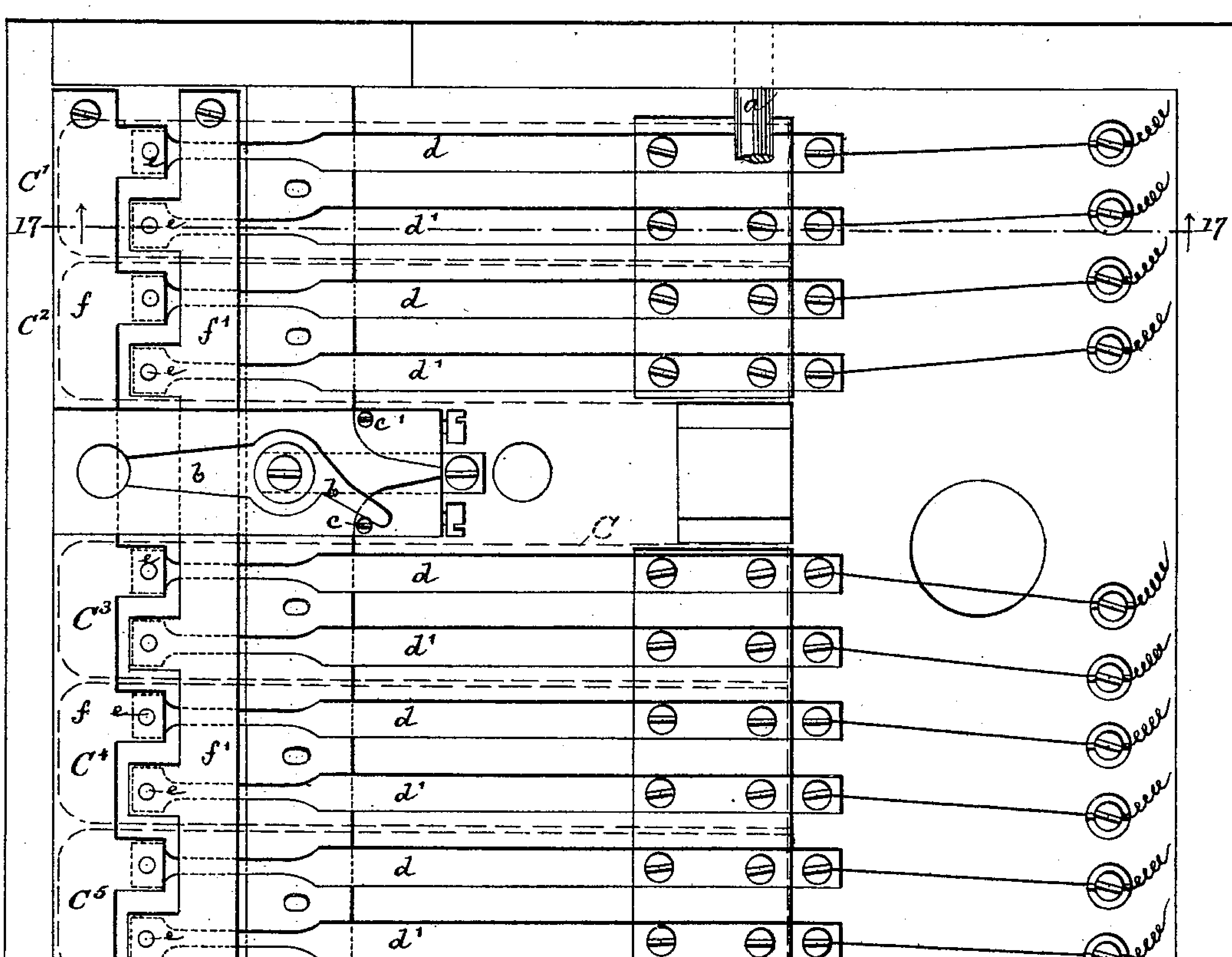


Fig. 18.



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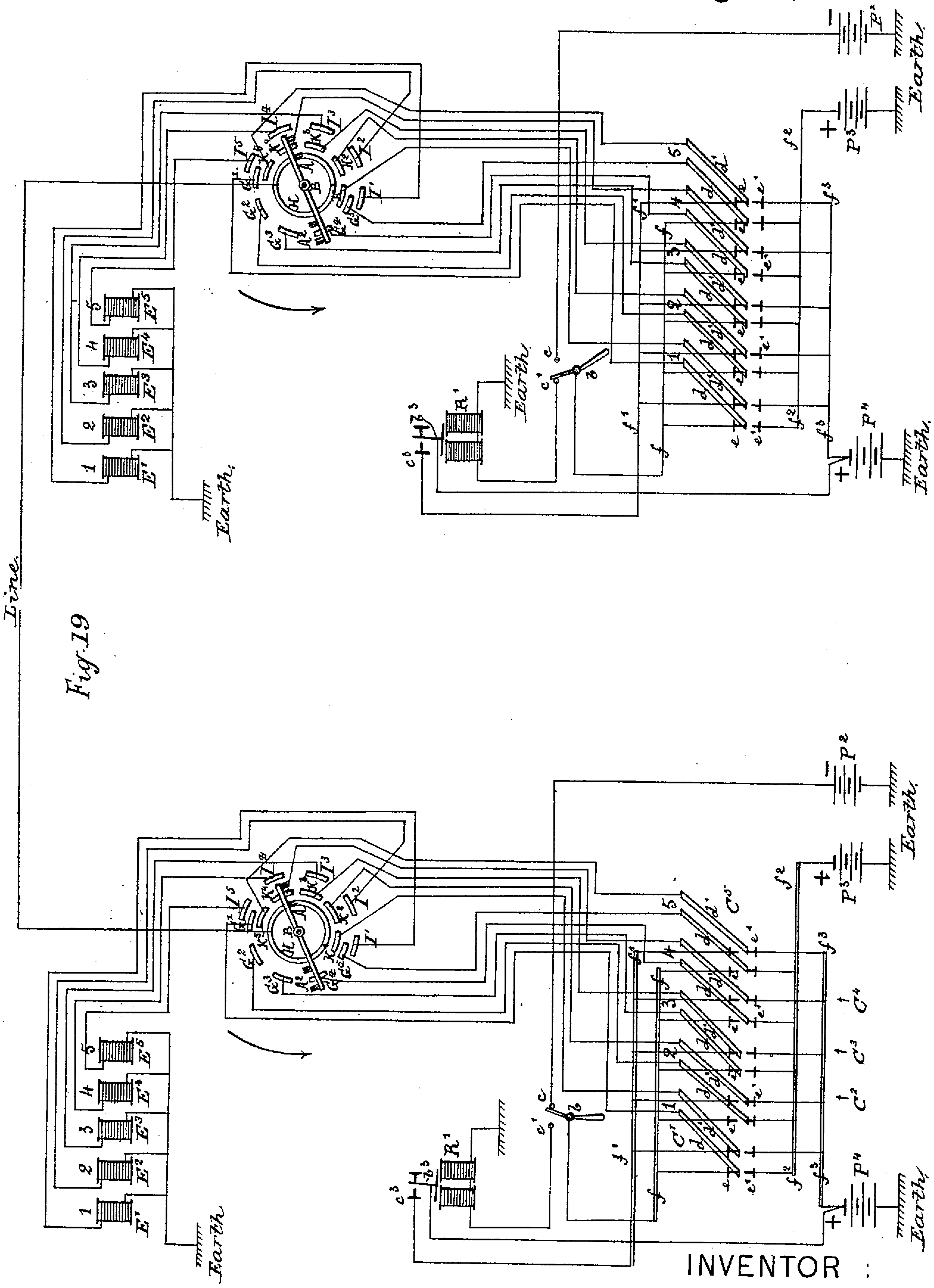

Fig. 19

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Fig. 20.

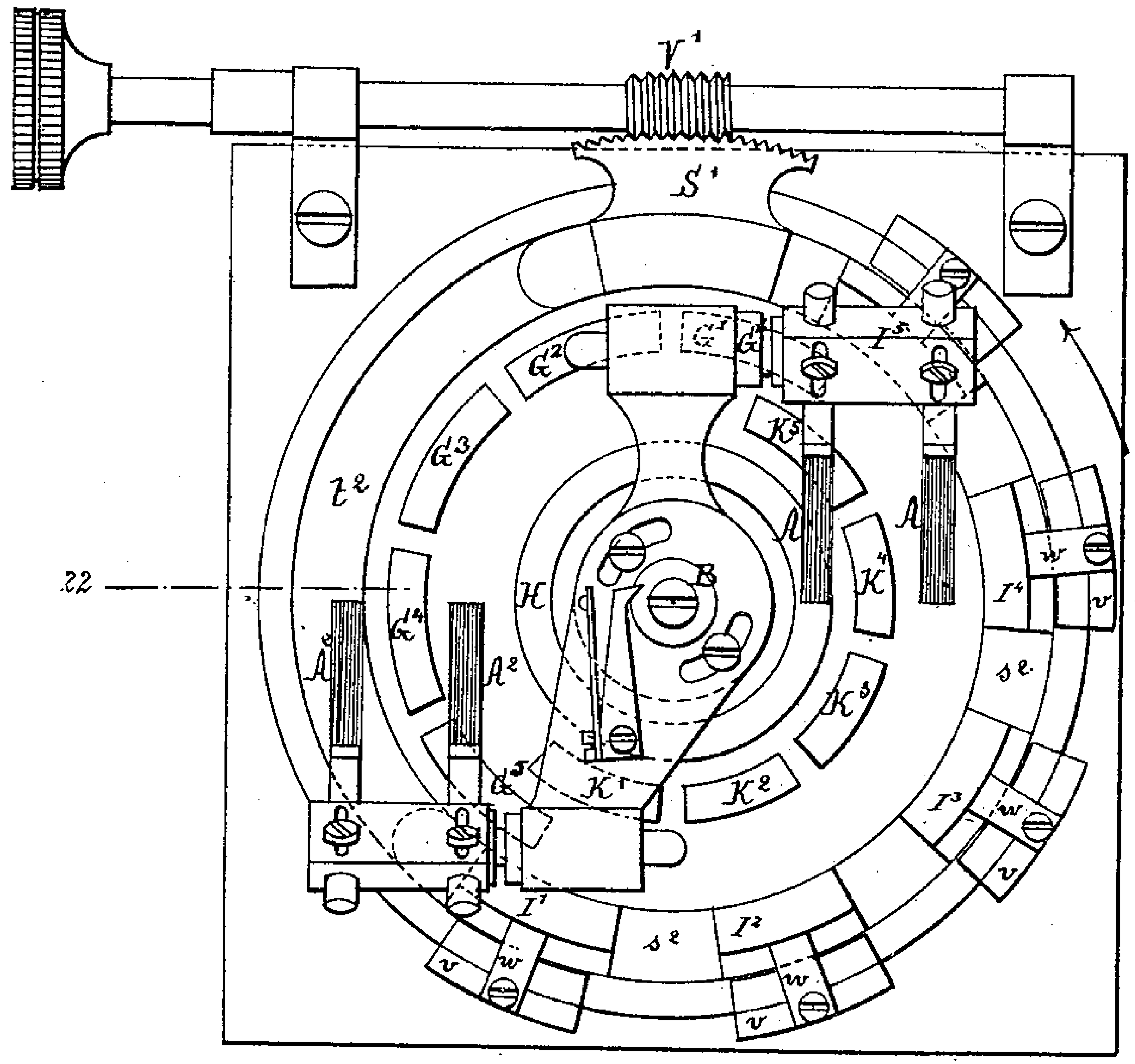


Fig. 21.

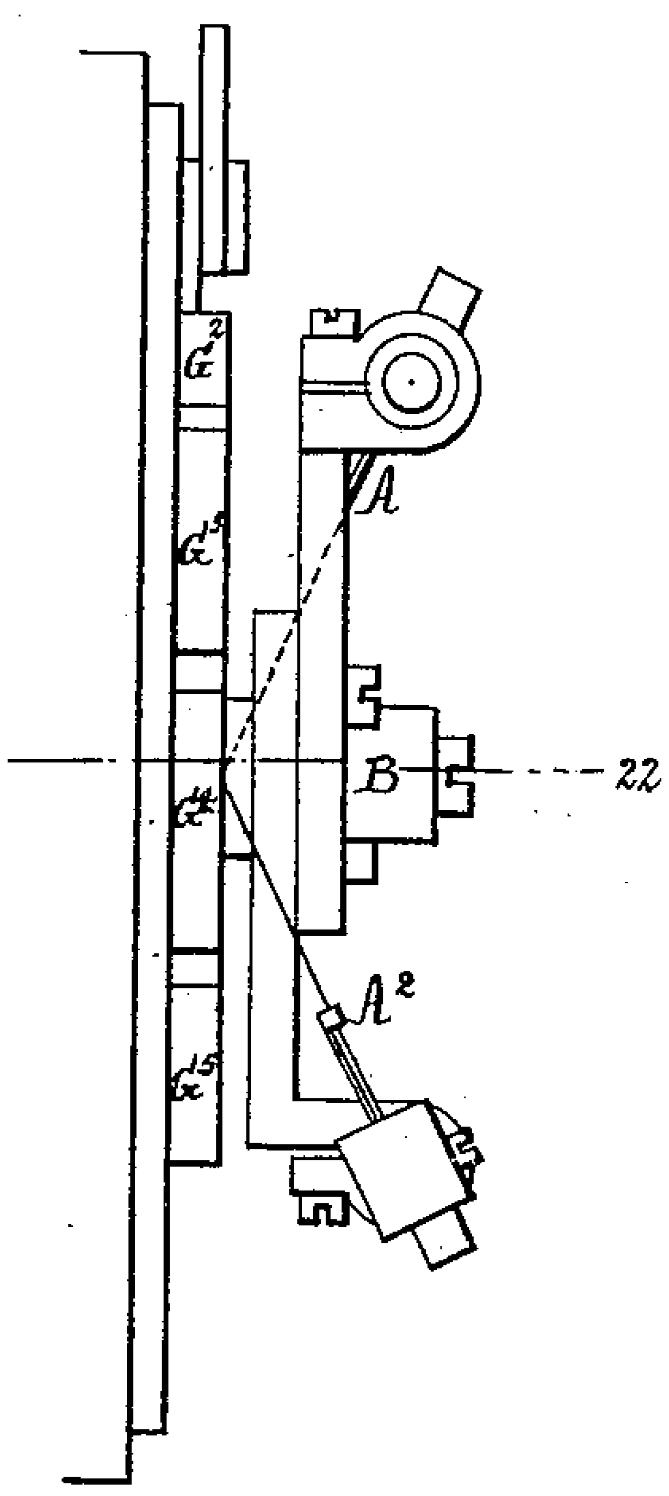
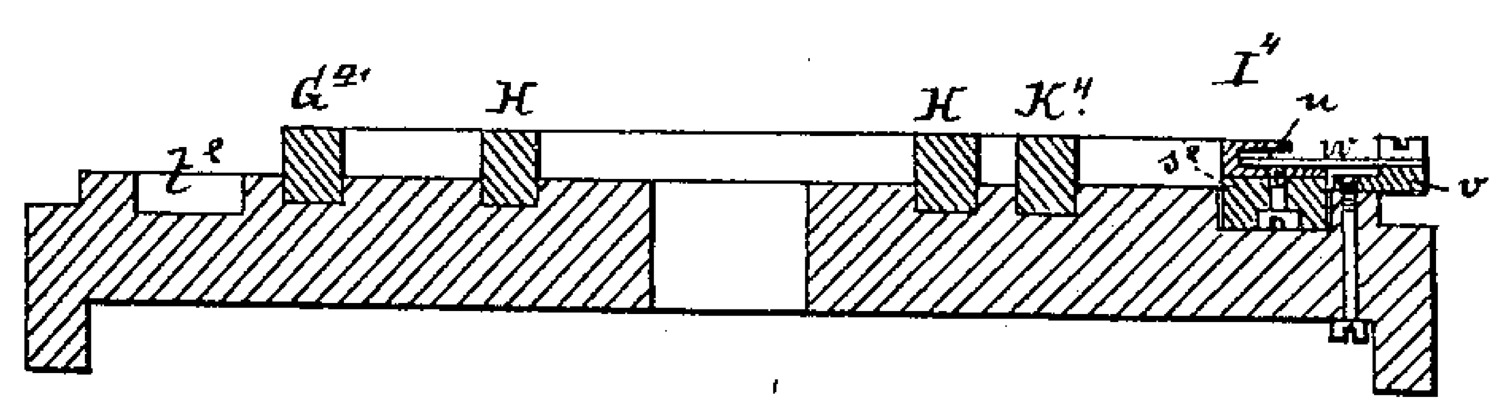


Fig. 22.



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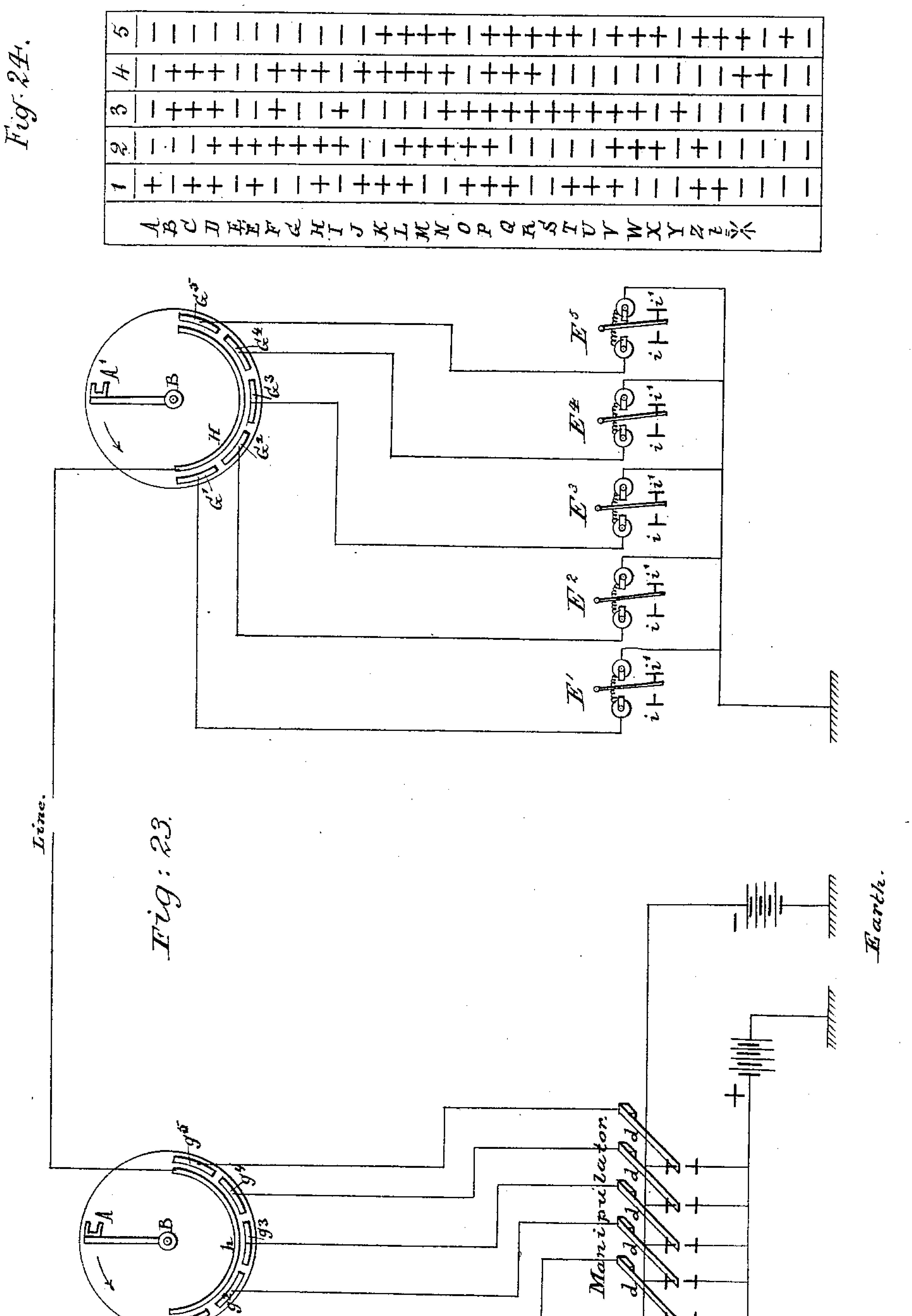

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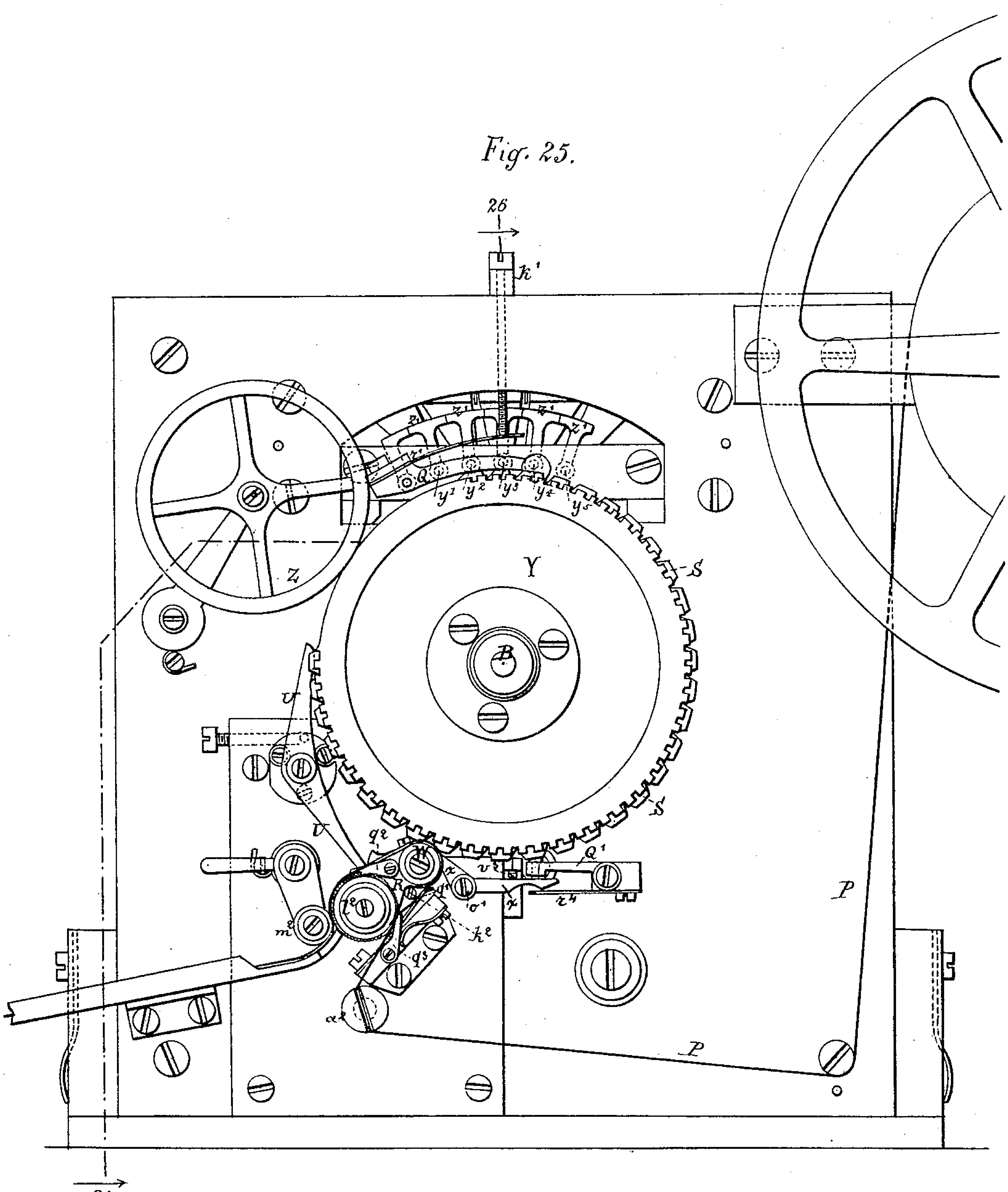

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No. 388,244.

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Fig. 26.

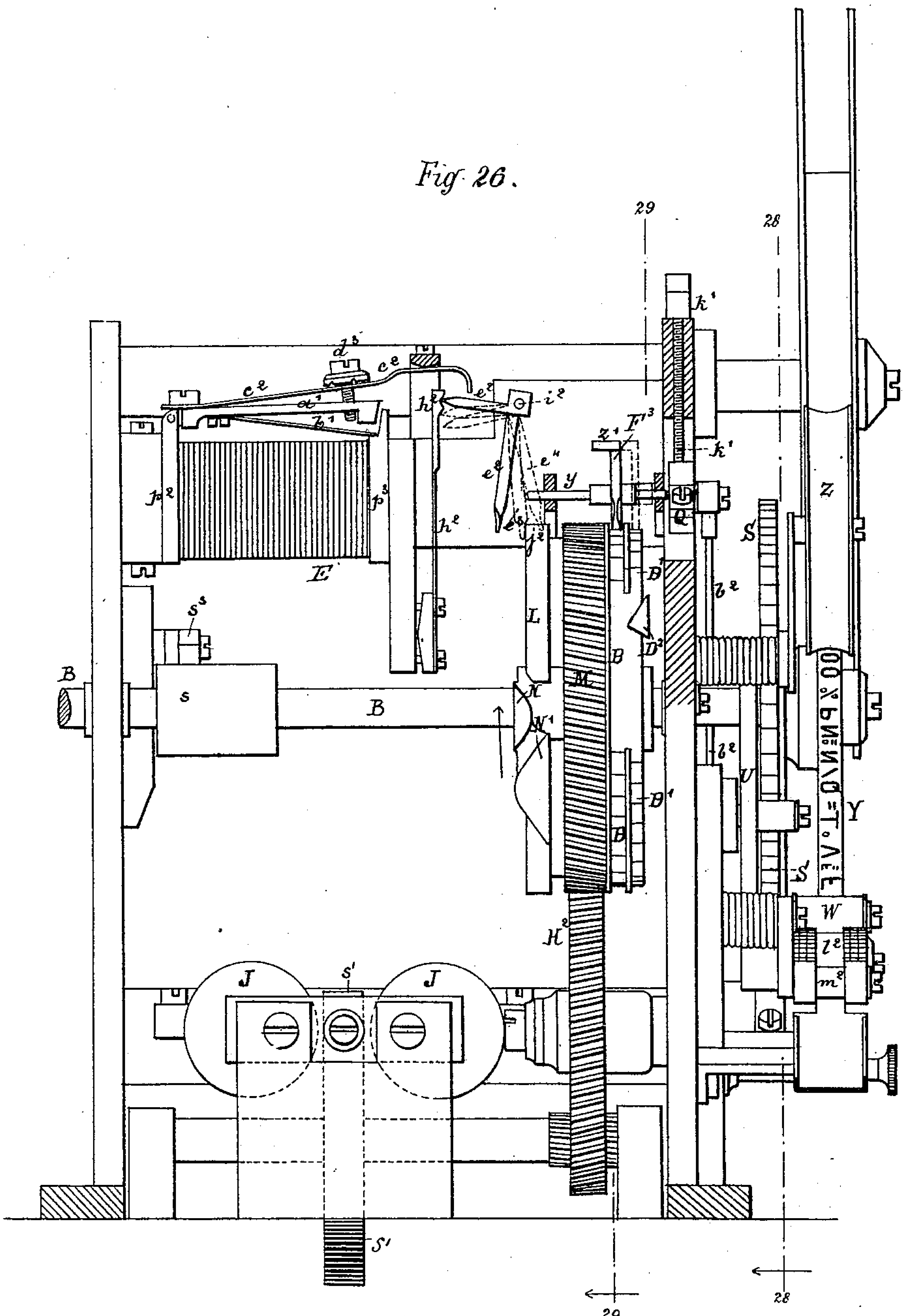

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Fig. 27.

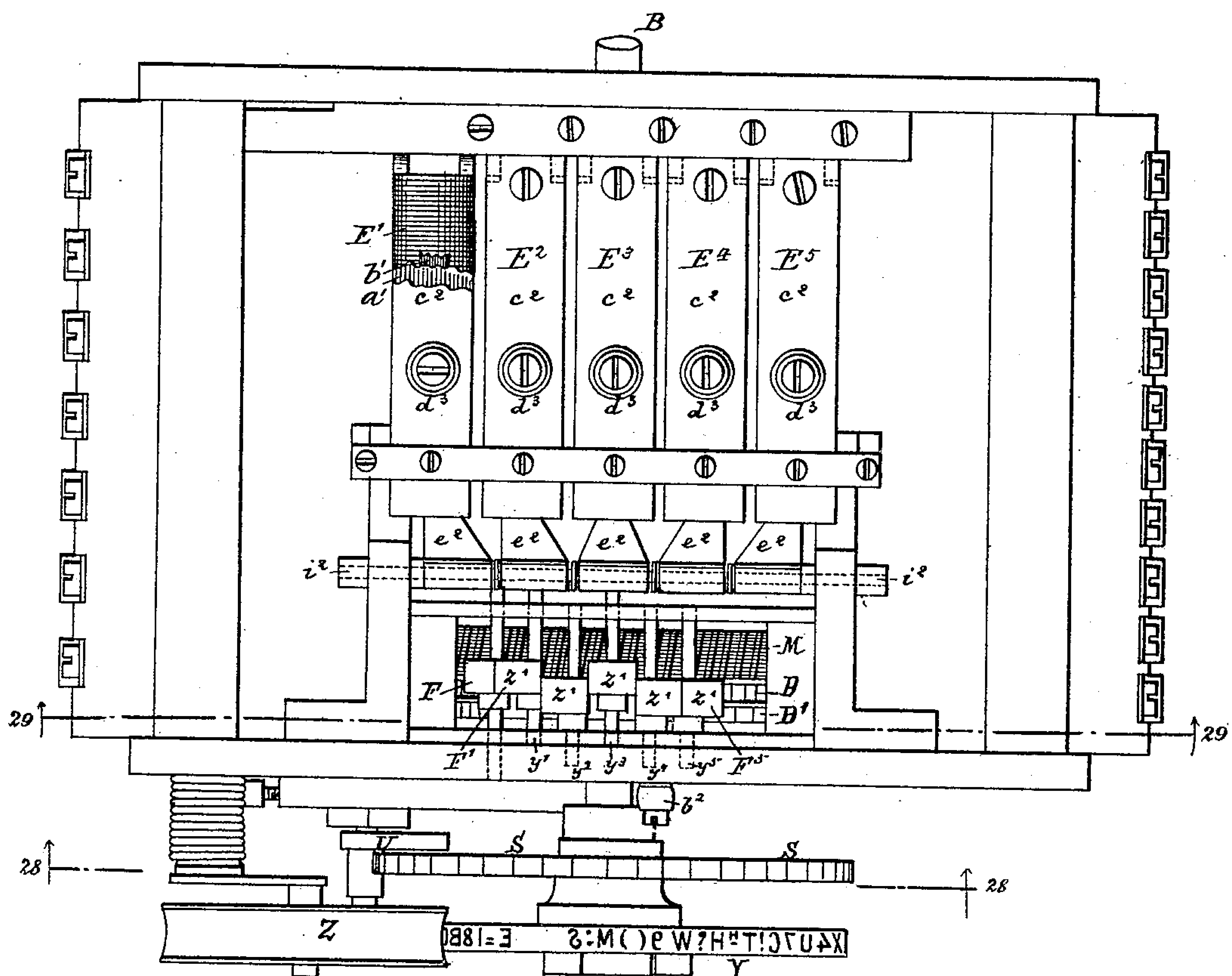
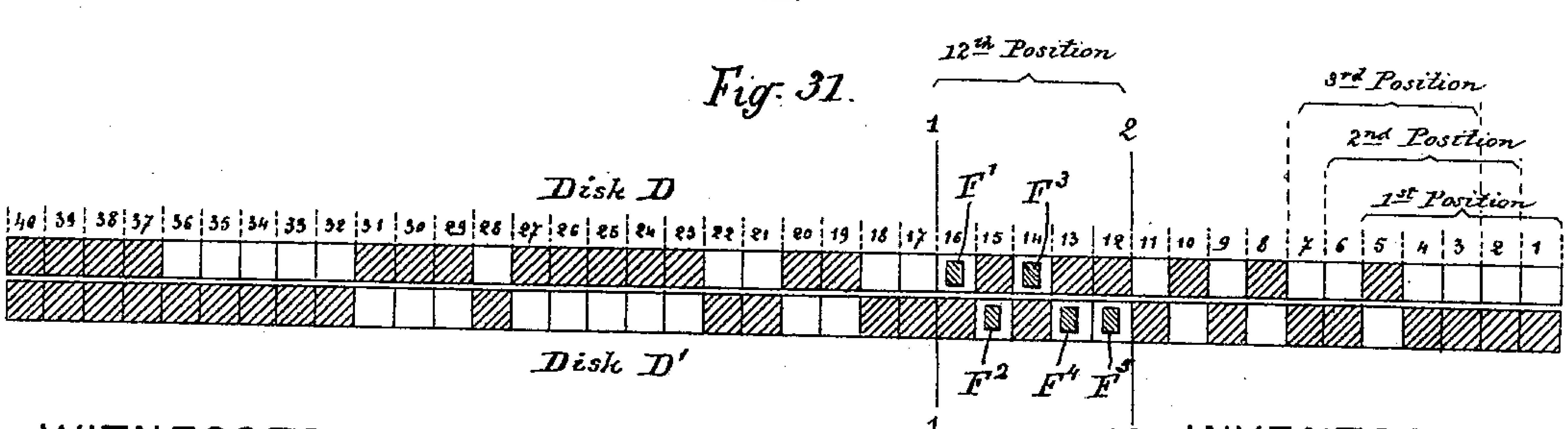


Fig. 31.



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No. 388,244. Patented Aug. 21, 1888.

Fig. 28.

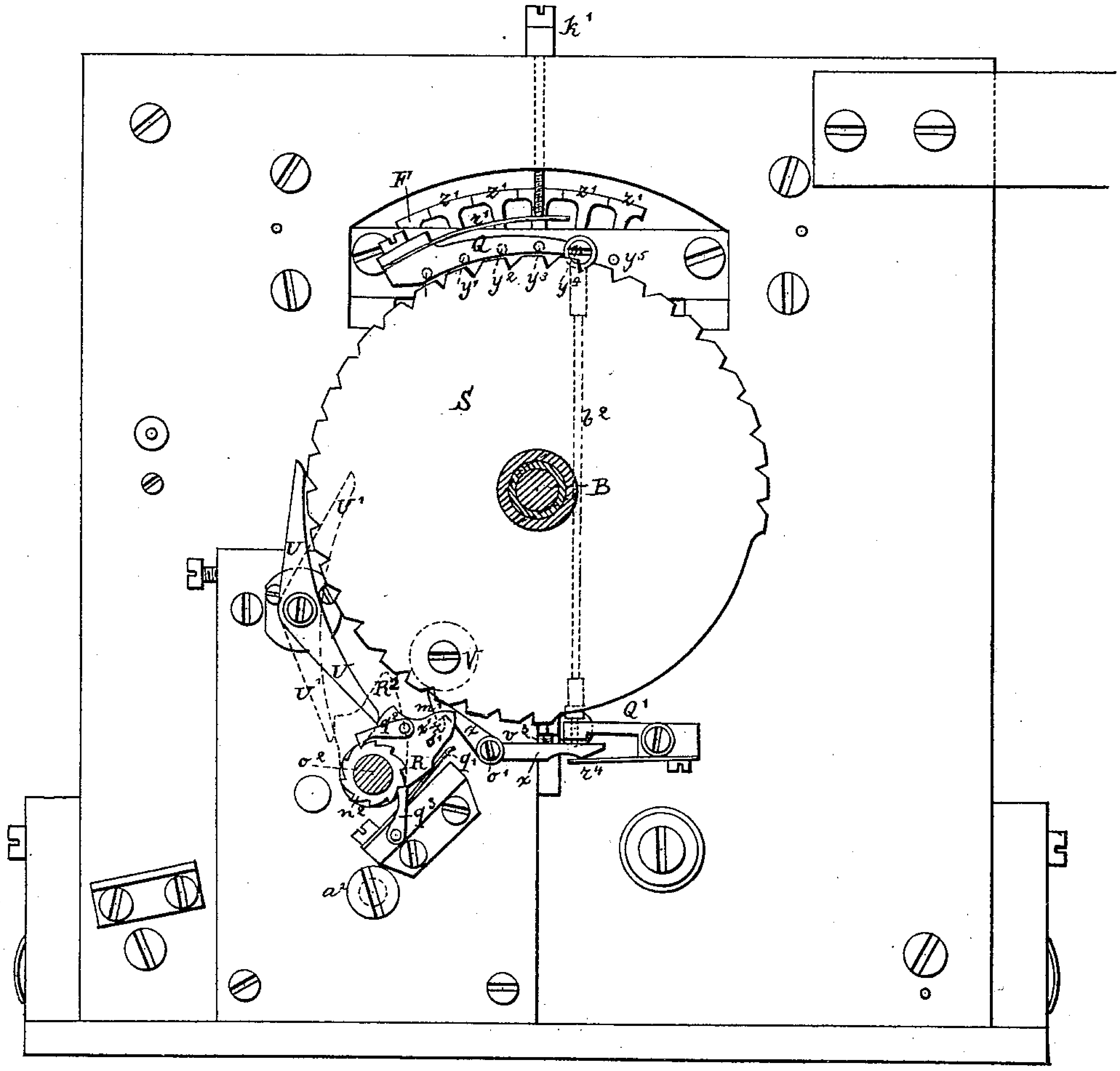

Fig. 30.

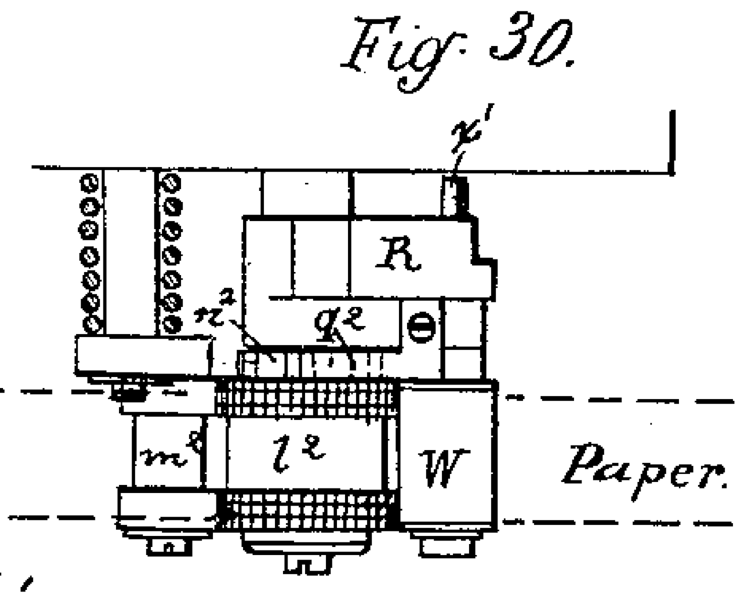

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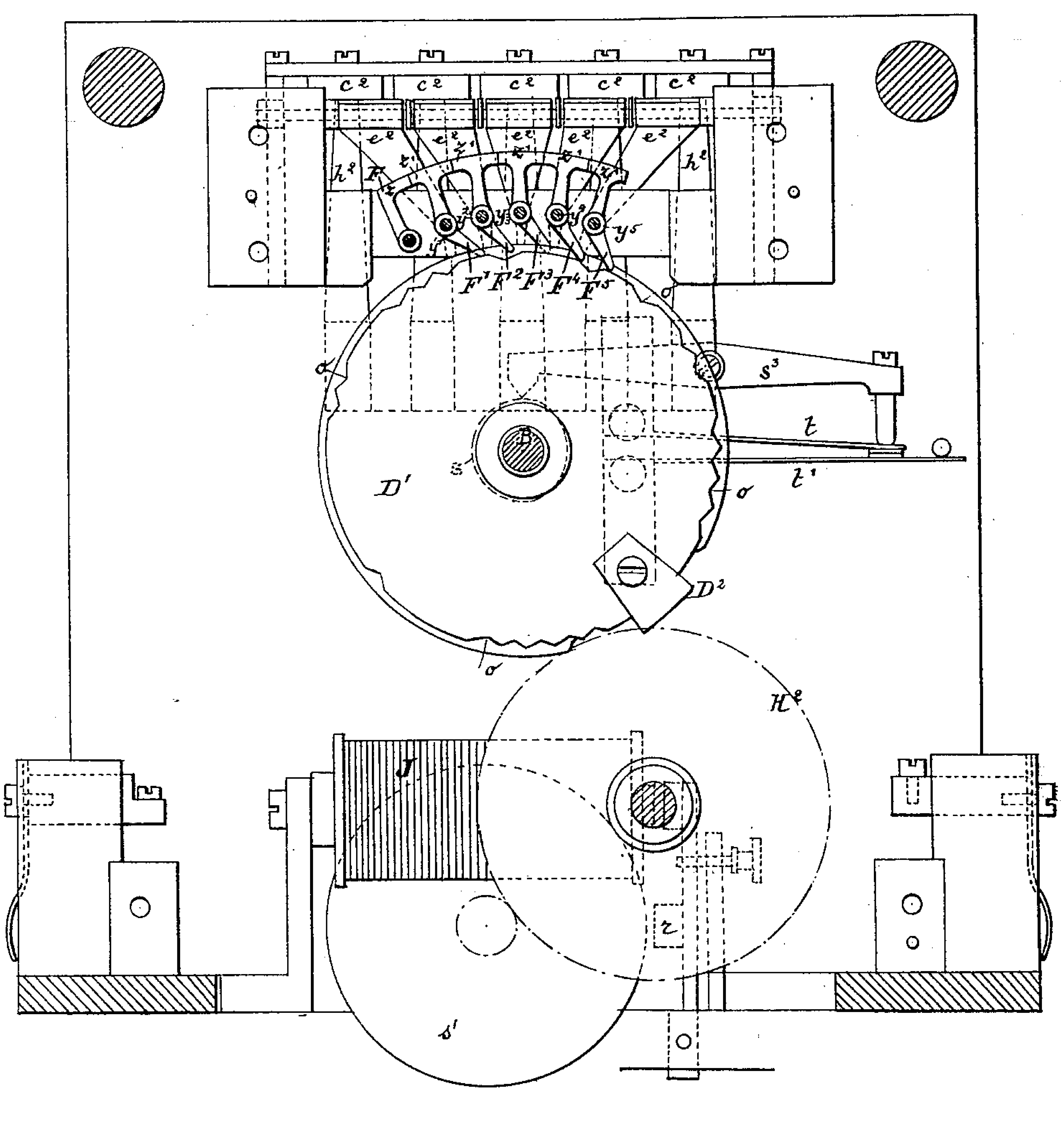
Fig. 29.



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UNITED STATES PATENT OFFICE.

JEAN MAURICE EMILE BAUDOT, OF PARIS, FRANCE.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 388,244, dated August 21, 1888.

Application filed April 4, 1883. Serial No. 90,549. (No model.) Patented in France January 6, 1882, No. 146,716; in Belgium January 25, 1882, No. 56,883; in England January 28, 1882, No. 436, and in Germany February 4, 1882, No. 20,826.

To all whom it may concern:

Be it known that I, JEAN MAURICE EMILE BAUDOT, a citizen of the French Republic, and a resident of Paris, France, have invented certain new and useful Improvements in Electric Telegraph-Printing Apparatus, of which the following is a specification.

My invention is the subject of patents in France dated January 6, 1882, No. 146,716; in England, dated January 28, 1882, No. 436; in Germany, dated February 4, 1882, No. 20,826, and in Belgium, dated January 25, 1882, No. 56,883.

In some of the printing-telegraph systems already existing the signals which represent the letters are formed by means of the multiple combinations that it is possible to make with simple signs. The systems of this class admit of the employment either of a single line-wire or several line-wires. In the first case the simple signs the combination of which represents a letter reach the receiving-station successively. In the second case the same signs arrive simultaneously. When these signs are received complete at the receiving-station, the translation of this combination of signs into a letter of the usual alphabet has to be made. This is done by an employé or by a mechanism. Various arrangements of automatic translators have already been invented for those systems admitting of several line-wires—that is to say, the systems in which the signs the combinations of which form the letters manifest themselves simultaneously; but no one has yet invented an automatic translation applicable to those systems having only one line-wire—that is to say, in which the signs the combinations of which form the letters manifest themselves successively. It is this result that is realized by the system which constitutes my invention.

My improved system of only one line-wire comprises, first, at the sending-station *a* a manipulator or instrument to be manipulated by the operator for preparing the combination of signals to be transmitted; and *b*, a distributer, which effects automatically the transmission to the line of the electric currents, the direction and order of which depend on the combination prepared by the manipulator. This distributer in its rotative movement picks up at each turn the successive signals that have been prepared by the manipulator; and, second, at the receiving-station *a* a distributer which gives out again the currents received by the receiving instruments or relays; and *b*, a translating-receiver which, after taking up the signals which are given to it by the relays, translates them into typographic signs printed on a strip of paper. The two stations in communication being identically installed, each of them includes a manipulator, a distributer, and a translating-receiver. The same distributer is used for transmitting the signals that are furnished by the manipulator and for the distributing of the signals arriving from the opposite station to the respective receiving instruments or relays which precede the translator.

In order that my invention may be well understood, I will describe the new principle which it introduces with reference to some elementary forms, which will serve to elucidate that principle, before proceeding to describe the complete apparatus that I have devised for practical use. In so doing I shall refer to Figures 1 to 15 of the accompanying drawings, wherein—

Fig. 1 is a diagram showing the connection between the transmitting and receiving stations. Fig. 2 is a chart or diagram illustrating the different combinations which may be used in transmitting. Figs. 3 and 4 are elevations of an electric "combiner," an instrument employed at the receiving-station. Fig. 5 is a diagram or chart showing a development of the periphery of the combiner. Fig. 6 is a fragmentary side elevation of the combiner, showing a modified construction. Fig. 7 is a fragmentary front view thereof. Fig. 8 is a plan of a modified form of combiner, its operation being mechanical. Fig. 9 is a plan of a fragment thereof. Fig. 10 is a fragmentary view showing a modification of Fig. 9. Fig. 11 is a fragmentary section showing a further modification. Fig. 12 is a similar view to Fig. 3, illustrating a modification. Fig. 13 is a similar view to Fig. 4, showing a modified construction. Figs. 14 and 15 are diagrams showing modifications of Figs. 2 and

3. Fig. 16, which is a diagram illustrating the complete installation at one station, will be described after the description in detail of the several apparatus practically employed. Figs. 17 to 31, inclusive, will be explained subsequently.

In all these figures like letters of reference designate like or corresponding parts.

For transmitting by this system over a single wire the circuit is divided at the sending and receiving stations into an equal number of branches—five, for example—all of these branches being connected to earth on the one hand and to the line-wire on the other. Their connection with the line is made through the medium of the distributer, by which the five branches are put successively into communication with the line and the two distributers are caused to revolve synchronously to such effect that when the distributer connects either branch at the sending-station with the line the corresponding branch at the receiving-station is also put in connection with the line. Thus, if a transmitting-key or circuit-breaker is included in each of the branches at the transmitting-station and an electro-magnet or relay in each of the branches at the receiving-station, the key in the first branch at the transmitting-station will control the magnet in the first branch at the receiving-station, the key in the second branch will control the second magnet, and so on.

Fig. 1 illustrates the simplest arrangement of this character. At the sending-station there are five branches, in which are arranged five keys, C' to C^5, (constituting a "manipulator,") and the branches terminate in metal contacts a' to a^5, which are swept by a conducting-brush, A. The five branches at the receiving-station contain electro-magnets E' to E^5, and terminate likewise is five contacts, which are swept by a brush, B. The brushes A and B are connected together through the medium of the line-wire and move synchronously, thereby putting key C' into momentary communication with magnet E', then C^2 with E^2, and so on successively. If, therefore, several keys are depressed, the several corresponding magnets are excited, so that the positions of the armatures of the magnets will correspond with the positions of the keys. As the keys can be depressed separately or in any desired groupings, there are altogether thirty-two different combinations of the five movements, as is shown by the chart or diagram, Fig. 2. Each of these combinations will represent a different letter or character to be printed. If the armatures of the receiving-magnets are polarized, they remain in the position in which they are set by the currents that actuate them, and thus the signal is, as it were, stored; or they may be made to act on mechanism which stores the signal, so that there is sufficient time to translate and print the signals received.

The translation is effected by an instrument which I call the "translator," and which consists of a series of feeling fingers or brushes moving relatively to a "combiner," so called from its including in itself all the combinations to be translated. The translator may be constructed in various ways, one of which is shown in Figs. 3, 4, and 5. Although the translating mechanism will now be described as applicable to the thirty-two combinations resulting from five movements, it is to be understood that similar mechanism is applicable to other numbers of movements and their combinations by merely altering the number of parts; also, where circular rows of contacts are described it is to be understood that they might be concentric or parallel. The rubbers or brushes may move over the contacts or they may be stationary while the contacts move.

Fig. 3 shows a combiner-cylinder consisting of five pairs of peripherally-indented metal disks, D D, their indentations being arranged as shown in Fig. 5, which is a development of the periphery of the cylinder, the tinted parts representing the indentations, (which may be filled with insulating material.) The disks are swept by ten conducting brushes or fingers, F F, which revolve around the cylinder, and which are electrically connected to ten contacts, c c, arranged in five pairs, between which play the five armatures b b of the receiving-magnets E' to E^5. (Shown in Fig. 1.) These armatures are connected to the positive pole of a local battery, P, while the disks D are connected to its negative pole. The two disks D of each pair are reciprocals, each having an indentation coinciding with an adjoining plain conducting-surface on the other. When the armatures b b are in repose or resting on the left-hand contacts c c, the circuit of the battery P is closed whatever be the position of the fingers or brushes on the projecting parts of the cylinder, since at every position at least one of the brushes is in contact with a conducting portion of the disks; but if one of the armatures, or several of them, be moved to the dotted position the circuit is broken when the fingers or brushes reach a point on the cylinder determined by the combination of the displaced armatures, since at that point all the five fingers or brushes find themselves on the insulated indentations, whereas at every other point in the revolution at least one of the brushes is in contact with a projecting or conducting portion of the disks, and so serves to maintain the circuit closed.

As there are thirty-two different combinations that can be made by the displacement of the armatures, there are thirty-two different points around the combiner-cylinder at which the circuit will be broken. Hence the exact point in the revolution at which this circuit shall be broken may be determined by the transmitting-operator, who has only to depress the manipulator-keys in the particular combination corresponding to this point.

A type-wheel, y, Fig. 4, revolves with the fingers or brushes F F and has thirty-two peripheral types spaced in the same manner as the indented divisions of the disks D D, These types are presented toward a strip of paper, which is held off from contact with them by the armature of a magnet, e, so long as this magnet is excited by the current from battery P; but when this circuit is broken this armature is released and the paper is carried against the particular type, which corresponds to the combination of displacements of the receiving-armatures by which the circuit has been broken. Thus there will be a different character printed on the paper for each different combination effected by the armatures.

Such is the principle of my invention.

To enable successive characters to be printed, the paper must be fed forward a short distance after each impression. Fig. 4 shows a pin, j', on the type-wheel, which at the end of each revolution strikes a restoring-lever, j, which throws back the arm carrying the paper, while the latter is held by the feeding-rollers, so that a part of the paper one space in advance of the printed character is presented at the end of the arm ready to be brought against the type-wheel, in order that at the next revolution another character may be impressed on the paper just beyond the one last printed. If the sending-operator presses down a new combination of keys to each revolution of the fingers or brushes and type-wheel, a new character will be printed during each revolution. This will be explained in detail hereinafter. It will be seen from Fig. 5 that the position of an armature—such as b^2—determines by which of the two fingers or brushes F of either pair the circuit is closed. A single brush moved by the armature to contact with either the first or the second disk D would produce the same result.

The device thus far described is an electrical combiner. My invention may also be embodied in a mechanical combiner, wherein the simultaneous drop of feeler brushes or fingers into notches or indentations shall cause the paper to be pressed against the type-wheel. When the brushes or fingers are moved by the armatures, it is better to make the cylinder revolve relatively to them. As it may be desirable to have the brushes or fingers displaced at the proper moment without necessarily exciting the magnet at the same time, the arrangement shown in Figs. 6 and 7 may be adopted, this giving a margin almost equivalent to a whole revolution of the cylinder for preparing the signal by the armatures. In Fig. 7 only two disks are shown with one finger or brush, it being understood that this is repeated throughout and that the disks are peripherally indented, as shown in Fig. 5. On the face of these disks is jointed a kind of fan or wedge, d, which is kept out by a spring, but which by the rotation of the disks is brought against the end of a pin, g, if this pin has been pushed by the armature b of the magnet E, Fig. 6. In passing the pin the piece d is moved to the dotted position and the finger F, which, being pressed by the incline f, would otherwise bear on the right-hand disk, D^2, is thus made to bear on the left, D'. A cam, d', pushes back the pin g and the armature. As the pin g has very little mass or friction, the working of the fingers by the armatures can thus be effected with very small magnetic power.

Instead of parallel combiner-disks, concentric indented rings may be employed, these being stationary, while the fingers revolve. This arrangement is shown in Figs. 8, 9, 10, and 11 combined with a switch mechanism for effecting the movement of the fingers by the armature.

Referring to Fig. 8, the five fingers are mounted on the frame G by pivot-screws and the frame itself is pivoted at its ends to a frame or arm, H, which is mounted on a vertical tubular spindle in the center by which the fingers are carried around. An arm, G', projects from the frame G and is pressed down upon by a spring, d^2, fixed to the arm H, thereby causing the fingers F F to press down upon the indented rings D D. Whenever all the fingers F F drop simultaneously into indentations in the rings D D, the frame G is permitted to rock and the arm G^2 presses down on a pin which slides in the vertical bore in the central spindle, and this pin communicates the motion to the paper strip, either directly or through a lever, and effects the printing of the character corresponding to the combination of indentations into which the five fingers have fallen.

Fig. 9 shows how each finger is guided by a switch, d, worked by an armature, b, either to right or left, according as the switch is in the position shown by the full or the dotted lines. The switch-lever after operating is restored to its normal position by a cam.

Fig. 10 shows a modified arrangement of this apparatus. A stationary incline, f, guides the finger to the left and the switch d is moved parallel to itself by the armature b, as in Fig. 10, or by an arm of the armature lever, as shown in Fig. 11.

Fig. 12 shows a simplified construction of electric combiner, being a development of a cylinder consisting of five indented metal disks D D which revolve in front of five fingers or brushes, F F, connected, respectively, to the five armatures, b b, which merely act as interrupters of the current. These armatures b b are the armatures of the magnets E E, Fig. 1. They are connected through the coil of an electro-magnet, e, to one pole of a local battery, P, the other pole of which is connected to the cylinder. For every different combination of the armature movements the circuit is broken in the first instance at a different point in the revolution of the cylinder, and the first break is made to effect the printing by the arrangement shown in Fig. 4, where the printing-arm on being brought against the type-wheel is not returned until the end of the revolution thereof, as will be fully explained hereinafter with reference to Figs. 25 and 28, so that meanwhile the magnet is impotent.

Another arrangement is shown in Fig. 13. A lever, h, rests against a pin, h'. When the armature b is caused to rise by the interruption of the current, it pushes the paper against the type-wheel, but at the same time rocks the lever h, which falls on a contact, h^2. The circuit of the local battery and electro-magnet is then closed through $e\ h\ h^2$, and the armature b cannot again rise. As the type-wheel completes its revolution, a restoring-lever, j, is struck by a pin, h', and moves h back and advances the paper by the ratchet i.

In the combiner shown in Fig. 14 the five double rows are alike and are merely advanced by steps, so that each finger traverses the same succession of indentations, the effect being the same as though only one double row were used and the five fingers were arranged in succession. This latter plan is the one which I use in practice, and which is shown in Fig. 15, where D D′ show the development of two disks indented oppositely, and F′ to F^5 show the ends of the five fingers, illustrating their relative spacing.

Having thus described in general the system which forms the basis of my invention, I will now proceed to describe the several complete apparatus and their electrical connections for carrying my invention into practice. In so doing I shall make reference to the remaining figures of the accompanying drawings, of which—

Figs. 17 and 18 show the transmitting key board or manipulator, the former figure being a section on the line 17 17 in the latter, and the latter figure being a plan with the five finger-keys omitted, these being indicated in dotted lines. Fig. 19 is a diagram showing the electrical connections at the sending and receiving stations. Figs. 20, 21, and 22 show the "distributer." Fig. 20 is a front elevation; Fig. 21, a side elevation, and Fig. 22 a diametrical transverse section. Fig. 23 is a simplified diagram showing the principle of the electrical connection of the sending and receiving stations through the distributers. Fig. 24 is a chart showing the various combinations of the manipulator corresponding to the different letters or characters to be printed. Fig. 25 is a front elevation of the translating-receiver. Fig. 26 is a side elevation thereof, viewed from the left in Fig. 25, and partly in section, cut in the plane of the line 26 26 therein. Fig. 27 is a plan thereof. Fig. 28 is a front elevation thereof, partly in section, cut in the plane of the lines 28 28 in Fig. 26. Fig. 29 is a front view, in vertical section, cut in the plane of the lines 29 29 in Fig. 26. Fig. 30 is a plan of a fragment of the printing mechanism; and Fig. 31 is a development of the combiner-disks, showing the arrangement of their indentations.

In all these figures like letters of reference designate like or corresponding parts. It is to be observed, however, that the system of reference-letters used in these figures is not quite the same as that used in the first sixteen figures.

Manipulator.—I will first describe the manipulator. As shown in Figs. 17 and 18, this is composed of a box in which are mounted five finger-keys, C C, (shown in dotted lines in Fig. 18 and numbered C′ to C^5,) all being pivoted on a rod, a. They should be made of wood, faced with ivory, like the keys of a piano. The two keys on the left are separated from the three on the right, and a commutator hand-lever, b, is arranged between. On turning this lever to make contact with c the manipulator is arranged for the transmission of a message. For receiving, it is turned to make contact with c'. (See the diagram, Fig. 19.) Under each finger-key C are two springs or circuit-closers, $d\ d'$, fixed to the bottom of the box at one of their ends. The depression of the key C makes their free ends move between buttons $e\ e'$, of silver. The springs $d\ d$ serve for the transmission, properly called, while the others, $d'\ d'$, serve to actuate the receiving-instrument at the transmitting-station, in order that it shall duplicate the message. In the position of rest of the keys the springs press against the upper buttons, $e\ e$, of which those for the springs $d\ d$ are all connected to the negative pole of a battery, the other pole of which goes to the earth; but when the finger of the operator depresses one or more of the keys the corresponding springs are caused to press against the lower buttons, $e'\ e'$, each of which is joined to the positive pole of a battery, the negative pole of which goes to the earth. The upper buttons, e, of the five springs d are formed by plugs of silver embedded in one plate of brass, f. The upper buttons of the five springs d' are embedded in a second plate, f'. The lower buttons, e', of the five springs d are embedded in a plate, f^2, and the lower buttons of the five springs d' are embedded in the plate f^3. The four plates $f\ f'\ f^2\ f^3$ are insulated from one another by means of plates of ebonite or ivory.

Principle of the distributer.—The distributing apparatus may best be understood from the diagram, Fig. 23, which shows the distributers at the transmitting and receiving stations and their principal connections. The distributer consists of a double brush, A, mounted on a shaft, B, which is revolved by any kind of motor mechanism. This brush A sweeps in a uniform circular movement over five contacts, which are respectively connected to the five springs $d\ d$ of the keys of the manipulator at the sending-station, and to the five receiving-magnets E′ to E^5 at the receiving-station. In Fig. 23 these contacts are lettered g' to g^6 in the transmitting-distributer, and G′ to G^5 in the receiving-distributer. The double brush A of the former sweeps over the contacts g and a long contact, h, which is connected to the line, and at the receiving-station the current enters from the line to a similar long contact, H, and passes by the double brush A′ to the successive contacts G. The five receiving electro-magnets, Fig. 23, are polarized, the armature of each being arranged in such manner as to be pressed toward the button *i* at the left or the button *i'* at the right, according as the current in its coils is positive or negative. Each armature is so regulated as to remain permanently in contact with the button against which it has been moved by a momentary current in either direction traversing its coils. Let us suppose, now, that the brushes A A', driven at the same speed, are started at the same moment from a point on the circumference of the disk or plate. They will touch necessarily and coincidently the contacts g' G', g^2 G^2, g^3 G^3, g^4 G^4, and g^5 G^5. Let us suppose, also, that the five keys of the manipulator, Fig. 23, are some of them depressed, the others raised, while the brush A makes one turn. These positive and negative currents are sent successively to the receiving electro-magnets, and the five armatures reproduce the positions of the combination of keys pressed down at the transmitting-station.

Construction of the distributer.—Referring, now, to Figs. 20 to 22, the double brush A, shaft B, and contacts H and G' to G^5 are easily recognizable. These contacts are fixed immovably to the base of insulating material. There are also five other fixed contacts, K' to K^5, and five exterior contacts, I' to I^5, which are swept by a double brush A^2, by which they are connected together in successive pairs K' to I', &c. The five exterior contacts are mounted on a circle of ebonite, s^2, which slides in an annular groove, t^2. By means of the tangent-screw V' and of the toothed sector s', which is fixed to the ring s^2, one may displace the five contacts I' to I^5 around their common center, (which is the shaft B,) thereby permitting the regulation of the distributers of the two communicating stations in such manner that the brushes pass at the same moment over the contacts of the same order. These contacts I' to I^5 have each a groove, *u*, Fig. 22, in which communication with the bars *v*, which connect with the wires, is established through the medium of spring *w*, which assures the passage of the current, while permitting of free displacement of the contacts. The five contacts I' to I^5, in combination with the contacts K' to K^5 and the double brush A^2, serve to direct the dispatches to the receiving-instrument of the sending-station. If we now refer to the diagram, Fig. 19, we may easily understand the operation of the system. Let us suppose that the station on the left is the transmitting-station and that on the right the receiving-station. In the first the commutator hand-lever *b* is turned to make contact with *c*. Thus the upper buttons, *e*, of the springs *d* of the manipulator are connected to the negative pole of a battery, p^2, by the common plate, *f*, (referring back to Figs. 17 and 18). As for the lower buttons, *e'*, of the same springs, *d*, they are connected through the plate f^2 to the positive pole of a battery, P^3.

P^4 is a local battery, the positive pole of which is connected to the plate f^3 of the lower buttons of the springs *d'*, and also to the vibrator b^3 of a polarized relay, R'. The contact c^3 of this relay is connected to the plate *f'* of the upper buttons of the springs *d'*.

To clearly perceive the action of the system, let us suppose that the operator has pressed the keys 2, 4, and 5 in order to transmit the signals, the combination of which should form the letter M, as shown by the chart, Fig. 24. The brush of the distributer being in the position shown in the drawings and turning according to the arrow, the double brush A arrives first in contact with the contacts H and G', which correspond with the first key-spring *d*, whereupon the negative current from P^2 passes by *c b f*, the first spring *d*, the wire which goes to G', or the distributer, the contact, and the line. At the same time that the brush A touches G' and H the brush A^2 touches the contact I', which is connected to the electro-magnet E' of the receiver at the sending-station, and the contact K', which is connected to the first spring *d'*. No circuit being thus formed, the magnet E' is not affected. At the receiving station the negative current arriving by the line passes by H, the double brush A G', the wire which goes to the first key-spring *d* of the manipulator, the commutator *b c'*, the relay R', and the earth. The relay R', being polarized in such way as not to be affected by negative currents, remains immovable, and no current can reach the electro-magnet E' of the receiving-station. When the double brush of the distributer at the transmitting-station passes onto the contact G^2, a positive current from the battery P^3 passes by the second spring *d*, which is depressed, the wire which connects it to G^2, the double brush A, contact H, and the line. At the same time the double brush A^2 makes communication between I^2, which is connected with the electro-magnet E^2 of the receiver at the transmitting-station, and K^2, which is connected to the second key-spring *d'*. This key being in the depressed position, a positive current from the local battery P^4 passes by said spring K^2 I^2 and the electro-magnet E^2 of the receiver. At the receiving-station the positive current which arrives by the line passes by H, the brush A, which has advanced synchronously, G^2 the wire which goes to the second key-spring *d*, this spring, its contact *e*, the plate *f b c'*, the relay R', and the earth. The relay is acted upon by this positive current and its vibrator b^3 touches the contact c^3. Then a positive current from the local battery P^4 at the receiving-station passes by b^3 c^3, the plate *f'*, the second spring *d'* K^2, the brush A^2 I^2, and the electro-magnet E^2 of the receiver. When the brushes pass onto the third contacts, the third key not being depressed, the electro-magnets E^3 of the receivers are not excited. On the contrary, when the brushes pass onto the fourth and fifth contacts, the fourth and fifth keys of the manipulator at the sending-station being depressed, the electro-magnets E^4 and E^5 of both stations are actuated.

I will now proceed to explain how the movements of the armatures of the electro-magnets E of the receivers are utilized for translating the signals into typographic signs.

Translator.—The apparatus which translates the received signals into a letter printed typographically is shown in Figs. 25 to 31. To render this description more clear, I will divide it into five parts, corresponding to the five series of organs, the functions of which may be stated thus: first, means for driving the translator and governing its speed; second, devices for receiving from the sending-station the signals of which the combination should represent a letter; third, devices which transfer this group of received signals to a second series of devices which preserve them, thereby leaving the receiving devices above mentioned free for the reception of new signals; fourth, mechanism for automatically translating the signals, this translation having for its result to determine the particular letter resulting from the combination of the signals; fifth, finally, mechanism for printing.

It should be observed that in the most simple installation the translator apparatus may carry the distributer. The latter is placed vertically and in the rear—that is, at the left in Fig. 26, where the distributer is not shown, in order not to complicate the drawings. In this construction it is the same motor which turns both the distributer and the translator. The shaft B in Figs. 20 and 21 is in such case identical with the shaft B in Figs. 25 to 29.

I. *Driving and synchronizing.*—The translator is driven by any motor whatever, which imparts a uniform rotary movement to the shaft B, or to the gear-wheel H^2, which gears with the wheel M, fixed on said shaft. Unison is maintained between the apparatus of the two corresponding stations by means of an "electric brake," which is composed of an electro-magnet, J, the armature of which carries a pad, *r*, of cork, which, upon the excitation of the magnet, is pressed against the periphery of a fly-wheel which is driven by the gear-wheel H^2, and serves thus to retard it. To effect the necessary regulation by this means, the motor of one of the two translators is set to travel at a speed slightly in excess of the other. The slower one thus becomes the governing-translator and the faster one the governed. The electric brake of the governing-translator thus becomes inactive, while that of the governed translator is used to retard the speed of the latter, and thereby to hold it back to the same speed of rotation as that of the governing-translator. To this end a current is sent during a certain fraction of each revolution from the governing to the governed translator, and serves to excite the electric brake of the latter, during its passage. The duration of this current is proportioned to the advance that the faster translator has acquired over the governing one, so that the farther in advance it is the longer time is the brake applied to it during each revolution, and consequently the more is it retarded. By this means it is held back to a position uniformly and very slightly in advance of that of the governing-translator. The current is sent to the electric brake-magnet during the simultaneous closure of the circuit at both the governing and governed translators by means of two contact-springs, *t t'*, which are brought together at each revolution by a lever, s^3, actuated by a cam, *s*, on the shaft B, as shown in Figs. 26 and 29. This cam may be set to different positions on the shaft in order to give the proper adjustment to render the electric brake effective to keep the two apparatus in unison. The adjustment should be such that when both are in unison the springs of the governing-translator will be first closed, and upon their being separated those of the governed translator are closed, so that no current passes; but as the governed translator gains upon the other its springs close together before those of the governing-translator are opened, thus causing a current to pass during the period of overlapping, so to speak, of the two closures.

II. *Receiving and storing devices.*—The receiving electro-magnets E' to E^5 are arranged in a row in the translator, as shown in Figs. 26 and 27. It has already been explained that their armatures, after a signal has been transmitted, occupy positions corresponding to those of the respective keys of the manipulator, and that these positions are retained in order to store up the signal until it is taken off from them and transferred to the translating mechanism. It is not essential that it shall be the armatures of these magnets which shall store the signals; but this may be done by other mechanical parts. In practice I do it by a series of little levers, which I call "switch-levers," and which are moved one after another by the armatures of the magnets as the latter are successively excited. On their being thus moved the respective armatures may fall back as soon as the excitation of their magnets ceases. The electro-magnets E' to E^5 operate the switch-levers. The latter are lettered e^2 e^2. They are elbow-levers pivoted at i^2 and retained in their normal positions (shown in full lines in Fig. 26) by the engagement of the ends of their horizontal arms with notches in vertical springs h^2 h^2. The armature *a'* of each electro-magnet E is pivoted to one of the poles, p^2, and attracted by the other pole, p^3. It has fixed beneath it a retracting-spring, *b'*, and above it is an arm, c^2, in the form of a strip, the free end of which is turned down at a right angle. This arm, which is slightly flexible, is adjustable by means of a screw, d^3, by which it may be pressed down more or less. When the armature *a'* of a receiving-magnet, E, is attracted, the turned-down end of its arm c^2 strikes the horizontal arm of the corresponding elbow-lever e^2, and, disengaging it from the notch in spring h^2, makes it take the position e^3, (shown in dotted lines in Fig. 26.) The stability of this second position of the switch-lever is assured by means of its vertical arm striking the margin j^2 of a disk, I, which is joined solidly to the wheel M. It will now be understood that those armatures of the electro-magnets E′ to E^5 which have been attracted have displaced the corresponding switch-levers. The transmitted signals are thus stored and manifest themselves by the positions of the five switch-levers.

III. *Transfer devices.*—In their turn the switch-levers transmit their respective positions of rest or of displacement to some horizontal rods, y′ to y^5, Figs. 26 and 27. This transfer takes place under the action of the double cam N N′, which is carried by the disk L in a part of its circumference, and in the following manner: When the levers e^2 are in the position of rest, (full lines,) the cam N N′ cannot touch them; but those levers which occupy the position e^3 are encountered by the part N of the cam and are thrown over to the position e^4, (shown in dotted lines,) after which the part N′ of the cam throws them back to the position of rest. In the movement of displacement from the position e^3 to the position e^4 the levers have acted on the corresponding rods *y* in such manner that the signals produced by the five keys of the transmitter at the sending-station are now reproduced exactly by the relatively advanced or undisturbed positions of the five rods y′ to y^5 of the receiver.

IV. *Translating mechanism.*—The translation of the stored-up signals into a typographical letter is effected by a combiner and a series of "fingers," the principle of which has already been described with reference to Figs. 2 to 15, especially Fig. 15. The combiner consists of two peripherally-indented disks, D and D′, arranged side by side, and the indentations in each being alongside of plain or projecting spaces on the other, the arrangement of indentations being shown in Fig. 31. In this figure the section-shaded squares designate the plain or projecting portions and the white squares the indentations. Over these disks are five fingers or tumbler-levers, F′ to F^5, the lower ends of which are in contact with their peripheries. These fingers are normally all over the disk D, but may be shifted so as to come over the disk D′. This shifting is accomplished by the rods y′ to y^5, on which the fingers are fixed and with which they move forward or backward, the rods serving also as their pivots. Each finger F′ to F^5 is formed with a square head, z′, on its upper arm, so that the heads of all the fingers touch one another, even when some of the fingers are displaced over the disk D′, as shown in Fig. 27. At the left is a lever, F, having a head, *z*, which bears against the head z′ of the left-hand finger. This lever is pressed toward the right by a spring, but can be tilted over only in case all the fingers may be tilted. This can happen only when all five of the fingers drop simultaneously into indentations in the combiner-disks as, if any one of the fingers is not over an indentation it alone will serve to resist the tilting of the lever F and any of the fingers that may intervene.

Now the order in which the indentations are formed in the disk D is such that in each of the successive positions in which this disk presents itself beneath the five fingers the plain parts of the disk uphold a greater or less number of fingers, so that if all of the latter remain over this disk at no time in the revolution can they be tilted. This will be more clear from an examination of Fig. 31. In the first position of the disk in its rotation it presents its divisions numbered 5, 4, 3, 2, 1 beneath the respective fingers F′ F^2 F^3 F^4 F^5. As No. 5 is a plain surface, it upholds the finger F′. On reaching its second position the disk presents divisions Nos. 6, 5, 4, 3, 2 beneath the respective fingers and the plain space 5 upholds finger F^2. In the third position Nos. 7, 6, 5, 4, 3 are presented and No. 5 upholds F^3. In the fourth position Nos. 8, 7, 6, 5, 4 are presented and the plain spaces Nos. 8 and 5 uphold fingers F′ and F^4, and so on during the entire revolution of the disk; hence it is evident that the tilting of the five fingers can only be rendered possible by shifting one or more of the fingers over onto the conversely-indented disk D′. This is done through the shifting of the rods *y*, on which the fingers are mounted, as has already been described. It will be understood that each different combination, according to which the fingers are displaced, will enable them to drop simultaneously into indentations in the disks at a different point in the rotation of the latter and corresponding to a different character to be printed.

Now, to enable the complete cycle of operations in receiving a signal to be followed, let us suppose that the operator shall have transmitted from the sending-station the signals which should form the letter M. The sending-operator has, conformably to the indications of the table, Fig. 24, pressed down the keys C^2, C^4, and C^5. It results from this that positive currents have been sent to the receiving-magnets E^2, E^4, and E^5, Figs. 26 and 27, the switch-levers e^2 corresponding have been tilted to e^3, and the rods y^2 y^4 y^5 have been pushed forward, as well as the fingers F^2 F^4 F^5 that they carry. On the other hand, we may ascertain from Fig. 31 that when the disks D D′ reach their twelfth position the fingers F^2, F^4, and F^5 find bearings on the plain parts of the disk D; but as these three fingers have been shifted forward over the conversely-indented disk D′ they find themselves, when this twelfth position is reached, as shown by the lines 1 1 2 2 in Fig. 31, over indentations in that disk, whereupon, as neither of the five fingers is upheld, all of them are tilted under the influence of the pressure of the lever F. We shall soon see how this tilting movement of the fingers has for its result the printing of the character (in the example the letter M) on the band of paper.

I will terminate the description of these organs of translation by saying that a restoring-cam, D^2, Figs. 26 and 29, fixed in the disk D′, pushes back over the disk D the fingers which have been displaced over the disk D′, thus effacing the conventional signal, which has played its part, since at this moment, as we have seen, it is translated, and, as we shall now proceed to understand, it is even already printed.

Printing.—Fig. 28 shows at r′ the spring which acts on the lever F for pressing the latter against the heads of the fingers. This spring presses against an arm, Q, which is fixed on the same axis as the lever F, and its tension may be made greater or less by means of the regulating screw k′. This arm Q is connected by a rod, b^2, to a lever, Q′, beneath which is a catch-lever, x, which abuts against a screw, v^3, and is held by a spring, r^4. This lever, which turns on an axial screw, o′, is called the "catch-lever," because it carries a hook, m′, which catches over a steel pin, x′, on an arm, R, in order to hold this arm at rest against the tension of a spring, q′, which tends to turn it to the left around its axis o^2.

It will be understood that when the five fingers oscillate the lever Q′ will tilt the catch-lever x, which will release the arm R, and the latter will then be thrown to the left by its spring q′. In this movement the upper end of the arm R, which is in the form of a gear-tooth, comes into mesh with one of the teeth of a wheel, S, Fig. 28, which is mounted on the shaft B. The wheel S in turning carries the arm R with it until this arm assumes the position R^2, moving in its turn a restoring lever, U, to U′.

It is the movement of the arm R from right to left which effects the printing. To this end the shaft B carries in front of the wheel S a type-wheel, Y, having printing-types engraved in relief on its periphery. A band of paper, P, passes between this wheel Y and an impression-roller, W, mounted on the arm R. A cylindrical inking pad, Z, previously inked, deposits a thin coating of ink on the types on the wheel Y. Fig. 25 shows clearly how the displacement of the arm R from right to left results in bringing the band of paper, P, into contact with the type which is passing at this instant in coincidence with the roller W, so that an impression of this type is made on the paper band.

The combiner-disks D D′ and the type-wheel Y are arranged in such manner that the type which finds itself in coincidence with the roller W corresponds to the combination formed by the indentations in D D′ which are at the same instant in coincidence with the fingers. When the arm R reaches the position R^2, the type has been printed and the roller W has moved far enough to carry the paper out of contact with the type-wheel. The parts remain in this position until the roller V, which is carried by the wheel S, comes against the upper part of the lever U at U′. By this movement this restoring-lever is brought back to U, and in so moving pushes back the arm R to where it will be caught by the catch-lever x. This movement of the arm R in the opposite direction to the movement of the wheel S is made without interruption, since the wheel has no teeth on the part of its circumference which is presented to the arm R at the time when the roller V encounters the lever U. The type-wheel Y is also devoid of type on the portion which is presented to the roller W during this return movement.

The movement of the arm R from right to left effects also the advance of the band of paper, as shown in Fig. 25. The band passes first through a guide, a^2, ascends along the arm R, passes around the guide-pin k^2, thence over the wheel W, then between the serrated wheel l^2 and the compressor-roller m^2, and finally passes out toward the left of the apparatus. Fig. 30 is a plan of the part of the mechanism including the arm R and its rollers and the compressor-roller m^2. By referring to this figure and to Fig. 28 it will be seen that the positive part n^2 of the roller l^2, which turns on the same axis as the arm R, is notched like a ratchet-wheel and its teeth are engaged by a propelling-pawl, q^2, and a retaining-pawl, q^3. In the movement of the arm R from right to left the pawl q^2 engages the toothed roller l^2 and advances the paper a few millimeters toward the left. It will be understood that during this feeding movement the part of the band of paper which has passed the roller m^2 and the portion to the right of the guide a^2 are advanced from right to left, while the part which touches the type-wheel Y is not displaced with reference to this cylinder. Thus a clean impression of the type is assured. The return movement of the arm R from left to right produces a contrary effect. The retaining-pawl q^3 opposes the backward movement of the roller l^2, and the printing-roller W, sliding under the band of paper, comes beneath a white part of the paper a few millimeters beyond the last character printed and ready for the printing of the next succeeding character.

It should be noted that the several successive manipulations take place in a certain order during each revolution. During the greater part of the revolution the signals are passing over the line, the receiving-magnets E are accordingly excited and the switch-levers e^2 are shifted, and during the same portion of the revolution the combiner is translating the signal received during the preceding revolution and the printing mechanism is printing it. When this portion of the revolution is completed, the parts are in this condition, viz: The switch-levers e^2 are all set for the new signal, the fingers have oscillated and righted themselves and are waiting for the displaced ones to be restored over the disk D again, and the printing-arm R has moved to the left and is waiting to be restored. During the remaining portion of the revolution no signals are transmitted, but the line-wire is utilized for the transmission of a current to the electric brake J, and the following mechanical manipulations are performed: First, such of the fingers F' to F^5 as are standing over the disk D' are restored by the cam D^2, so that for an instant all the fingers are over the disk D in readiness to have the new signal transferred to them. Immediately thereafter the cam N throws forward such of the switch-levers as have been displaced, and thus displaces the corresponding fingers in the image of the newly-received signal, and then the cam N' restores all the switch-levers to their original positions ready to receive the next signal. To facilitate the movement of the fingers across from one disk D D' to the other, the flange between the disks is interrupted on the inert portion thereof which is passing the fingers during this part of the revolution. During the time that these operations are taking place the printing-arm R is restored to the right-hand position. Thus by my system during the time employed in translating and printing each signal the line is utilized for transmitting other signals. The division of the work between several different apparatus reduces correspondingly the work of each and renders their action very sure without requiring delicate regulation. The succession of the operations allows of the constant use of the line, so that it is capable of considerable work.

Fig. 16 (which is lettered to correspond with Figs. 1 to 15) shows a more complicated installation. The distributer carries four double brushes, numbered 1 2, 3 4, 5 6, and 7 8. They sweep over contacts in rows A, B, C, D, E, G^2, and G'. There are five relays, R' to R^5, controlling the respective receiving-magnets E' to E^5. L is the manipulator-switch, and J is the electric brake-magnet.

The operation is as follows: The distributers at the two stations having been set in motion and brought to accord with one another, the sending-operator sets his switch L to Tr. The distributer having reached the position shown, the circuit of the local battery P is first closed by brushes 1 2 through the magnet I' of a metronome. Suppose the letter M is to be transmitted. The operator depresses keys C^2, C^4, and C^5. Thus the positive pole of battery T' is put in communication with the contacts a^2, a^4, and a^5, while the negative pole of battery T^2 is in communication with contacts a' and a^3. As the brushes 7 8 sweep over these contacts, the respective contacts send positive or negative currents over the line through contact-strip B and switch L. At the receiving-station the switch L is set to Rc. The respective positive and negative currents pass from the switch to the spring d' of the successive keys, and thence successively to the contacts s' to s^5, which are coincidently swept by the brushes 3 4, through which the five successive currents pass into the contacts r' to r^5, which conduct them to the successive polarized relays R' to R^5, after which they pass to earth. In this instance the relays R' R^3 are traversed by negative currents and the others by positive currents. Their polarization is such that the armatures of those receiving negative currents remain in the position shown in full lines, while the armatures of those receiving positive currents are thrown over to the right, and thus close the circuits to the respective receiving-magnets E' to E^5 of the translator. The magnets E^2 E^4 E^5 thus put in circuit are then traversed by a current from the local battery P'. The armatures of the relays R^2, R^4, and R^5 remain thus deflected until the new revolution of the distributer-arm, when the brushes 5 and 6 (which travel in advance of the receiving-brushes 3 and 4) form a bridge between the long contact C and the contacts r^4 to r^5 successively, thus causing a negative current from local battery P' to traverse all the relays R' to R^6 in succession, which throws back to the full-line position those armatures that were before deflected. During these operations the translator turns at the same speed as the distributer, being corrected at each revolution by the electro-magnetic brake, which is operated by the passing of a current through the magnet J upon the closure of the two contact-springs f f' by the cam s on the translator. This current comes from the battery P, and can pass only when the contacts G' and G^2 are connected by the brushes 1 and 2 on the distributer, so that the relative position of the two instruments determines the duration of this current.

The metronome-magnet M' receives a current during the entire time of the transmission of the signals, its connection being broken during that part of the revolution during which the displaced organs of the translator are being restored. It is placed in the case of the manipulator, and its function is to mark time for the operator, in order that he may know when to depress the keys and how long to hold them down. He should depress them an instant before the distributer puts the manipulator in connection with the line, and should keep them depressed as long as this connection lasts. In order to avoid the trouble of keeping them so depressed, I utililize the local current which actuates the metronome-magnet for holding down the keys. For this purpose each key is, as shown in Fig. 17, prolonged backward by an iron plate, T, which, when the key is depressed, comes in contact with the poles of the electro-magnet M', which acts as the metronome, and which remains excited as long a time as is necessary to send currents to the line.

Since in my system the received currents have a relatively great duration, the contacts designed to distribute them may be shortened, which effects a double advantage. The synchronic deviation does not produce false effects, and the breakings of the local circuit take place at the distributer and not at the contact of the relay-armature, which avoids sparking at this last point, where it would be more troublesome than at the distributer.

On long lines compensation has to be made for duration of currents. The electro-magnet C P, Fig. 16, effects this. Its armature being very light with a strong spring and the cores and base of the magnet being very large, a certain time is occupied before the armature can be moved. Should this happen owing to a prolonged current, the armature shunts the current through an adjustable rheostat, R; hence it follows that brief currents go entirely to line; but when long currents or a succession of like currents are sent only the beginning goes fully to line, the rest being weakened. This result might be attained by making the movement of the armature introduce a resistance.

My system may be readily adapted for automatic transmission by a prepared strip of perforated paper such as has been utilized for working printing-telegraph transmitters according to other systems.

It will be understood that in applying the principle of my invention it is immaterial whether the fingers are mechanically-tilting levers which fall into the notches or indentations in the combiner, in which case the translator works mechanically, or are circuit-closing brushes through which an electric current flows when they are in contact with the projecting or metallic portions of the combiner, the current being broken whenever the brushes encounter indentations in the combiner, in which case the translator works electrically. In the latter case it is immaterial whether the "indentations" in the combiner are open notches or are filled with insulating material. In the case of a mechanical translator the printing mechanism is actuated by the mechanical movement of the fingers, whereas in the case of an electrical translator it is actuated through the medium of an electro-magnet upon the the breaking or closing of the circuit through the fingers. In either case the construction may be reversed, as will be obvious.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is the following-defined improvements in printing-telegraphs, substantially as hereinbefore specified—namely:

1. The combination, in a receiving-instrument, of a series of fingers with a combiner moving relatively to them and formed with rows of indentations (or equivalents) traversed by the fingers and arranged to be engaged by the latter according to as many different combinations as there are characters to be transmitted.

2. The combination, in a receiving-instrument, of a series of fingers, a combiner moving past them and formed with rows of indentations (or equivalents) traversed by the fingers and arranged relatively to the latter according to as many different combinations as there are characters to be transmitted, and electro-magnetic means for bringing the respective fingers into operative connection with the rows of indentations according to any desired combination, whereby when the combiner reaches the position corresponding to the particular combination for which the fingers are prepared it presents an indentation to each one of the series of fingers.

3. The combination, in a receiving-instrument, of a series of fingers, a combiner moving past them and formed with rows of indentations (or equivalents) traversed by the fingers and arranged relatively to the latter according to as many different combinations as there are characters to be transmitted, electro-magnets for actuating the respective fingers to bring them into operative connection with the rows of indentations, and a distributer for connecting said magnets successively with the line-circuit, whereby the combination, according to which said fingers are prepared for the combiner, is determined by the successive electric impulses acting upon said magnets.

4. The combination, in a receiving-instrument, of a combiner consisting of rows of indentations, a series of fingers traversed by said combiner and capable of being displaced to different positions relatively thereto according to as many different combinations as are to be transmitted, and electro magnetic means for so displacing them.

5. The combination, in a receiving-instrument, of a combiner consisting of inversely-indented disks, a series of fingers traversed by said disks and each capable of being displaced from one disk to the other, having inversely-arranged indentations, and electro-magnetic means for so displacing them.

6. The combination, in a receiving-instrument, of a combiner consisting of two inversely-indented disks, a series of fingers traversed thereby normally in contact with one of said disks and capable of being displaced into contact with the other, electro-magnetic means for so displacing one or more of them according to any one of the different combinations for which the combiner is adapted, and mechanical means for restoring the displaced fingers to their normal position after the prepared combination has been translated.

7. The combination, in a receiving-instrument, of a combiner consisting of two inversely-indented disks, a series of tilting fingers traversed thereby normally in contact with one of said disks, but capable of being displaced into contact with the other, and the several fingers arranged to bear laterally upon one another in either position, whereby the first of the series cannot tilt upon encountering an indentation until all the others simultaneously encounter indentations, whereupon all the fingers tilt together, and electro-magnetic means for displacing the fingers according to different combinations.

8. The combination of electro-magnets for receiving the successive electric impulses constituting a signal, mechanical parts moved thereby, by which said signal is stored, and

the relative positions of which constitute an image of the transmitted signal, a series of fingers, mechanism for transferring the impress of the signal from said storing parts to said fingers by displacing the latter according to the combination indicated by the positions of said parts, and a combiner consisting of inversely-indented disks traversing said fingers, one of them in contact with the fingers in their normal positions and the other in contact with the displaced fingers.

9. The combination of electro-magnets for receiving the successive electric impulses constituting a signal, a corresponding series of storing-switches capable each of occupying three positions and of being displaced from the first to the second position by the action of its corresponding magnet, a cam adapted to engage those of the switches that are in the second position and to move them to the third position, a series of fingers adapted to be displaced by the latter movement of the switches, and a combiner consisting of inversely-indented disks traversing said fingers, one of them in contact with the fingers in their normal positions and the other in contact with the displaced fingers.

10. The combination of two inversely-indented combiner-disks, a series of fingers arranged successively thereagainst, a cam on the front disk adapted as it passes said fingers to shift them all to the rear disk, a series of storage switches corresponding to said fingers and each capable of occupying three positions, a series of electro-magnets adapted each to shift the corresponding switch from its first to its second position, and a cam revolving with the disks and adapted to engage all the switches that are in the second position and throw them as it passes to the third position, thereby displacing the corresponding fingers to the front disk.

11. The combination of two inversely indented combiner-disks, a series of fingers arranged successively thereagainst, a series of storage-switches corresponding to said fingers and each capable of occupying three positions, a series of electro-magnets adapted each to shift the corresponding switch from its first to its second position, a cam revolving with the disks and adapted to engage all the switches that are in the second position and throw them as it passes to the third position, thereby displacing the corresponding fingers from the rear to the front combiner-disk, and another cam following the first and adapted to restore all the displaced switches to their first positions.

12. The combination of two inversely-indented combiner disks, a series of fingers arranged successively thereagainst, a series of storage switches in the form of elbow-levers, each capable of occupying three positions, a series of notched springs engaging said switches in their first positions, a series of electro-magnets adapted each to shift the corresponding switch from its first to its second position, and a cam adapted to engage those of the switches that are in the second position and to move them to the third position, thereby displacing the fingers from the rear to the front combiner-disk.

13. The combination, in a receiving-instrument, of a combiner consisting of two inversely-indented disks, a series of tilting fingers traversed thereby normally in contact with one of said disks, but capable of being displaced into contact with the other, and the several fingers arranged to bear laterally upon one another in either position, whereby the first of the series cannot tilt upon encountering an indentation until all the others simultaneously encounter indentations, whereupon all the fingers tilt together, a lever bearing against the series of fingers, and a spring pressing said lever against them and tending to tilt them.

14. The combination, to form a printing-telegraph receiver, of a series of fingers, a combiner moving past them and formed with rows of indentations (or equivalents) traversed by the fingers and arranged relatively to the latter according to as many different combinations as there are characters to be printed, a series of printing-types moving synchronously with said combiner, and a printing mechanism for bringing a band of paper against any of said types, actuated by the engagement of said fingers with said combiner, whereby when the combiner reaches the position corresponding to the particular combination for which the fingers are prepared the type for printing the character indicated by that combination is in the position to be printed, and the simultaneous engagement of the fingers with the combiner acts to effect the printing of said character.

15. The combination, to form a printing-telegraph receiver, of a series of tilting fingers, a rotary combiner formed with rows of indentations traversed by the fingers and arranged relatively to the latter according to as many different combinations as there are characters to be printed, electro-magnetic means for bringing the respective fingers into operative connection with the rows of indentations according to any desired combination, a type-wheel revolving synchronously with said combiner and having its types arranged so that as each different combination on the combiner comes into coincidence with the fingers the corresponding type reaches the printing position, and a printing mechanism actuated by the simultaneous engagement of the fingers with the combiner, and adapted thereupon to bring a band of paper against one of the types.

16. The combination, to form a printing-telegraph receiver, of a combiner consisting of inversely-indented disks, a series of fingers traversed by said disks and each capable of being displaced from one disk to the other, having inversely-arranged indentations, electro-magnetic means for so displacing them, a type-wheel revolving synchronously with said combiner, and a printing mechanism actuated by

the simultaneous engagement of the fingers with the combiner, and adapted thereupon to bring a band of paper against one of the types.

17. The combination, to form a printing-telegraph receiver, of a series of tilting fingers, a rotary combiner formed with rows of indentations traversed by the fingers and arranged relatively to the latter according to as many different combinations as there are characters to be printed, whereby for each different combination the simultaneous dropping of all the fingers into said indentations will take place at a different point in the revolution, electro-magnetic means for bringing the respective fingers into operative connection with the rows of indentations according to any desired combination, a type-wheel revolving synchronously with said combiner and having its types arranged so that as each different combination on the combiner comes into coincidence with the fingers the corresponding type reaches the printing position, and a printing mechanism connected mechanically to the fingers and actuated by the simultaneous dropping thereof into indentations in the combiner, and adapted thereupon to bring a band of paper against one of the types.

18. In a printing-telegraph receiver, the combination of a continuously-revolving type-wheel, an impression-arm adapted, when released, to move into engagement with the type-wheel, and thereby in passing to press a band of paper against one of the types thereof, a detent normally restraining said impression arm, automatic translating mechanism for determining the instant at which to release the impression-arm in order to print the proper type, connected to and actuating said detent, and a restoring mechanism consisting of a cam moving with the type-wheel and a lever engaged thereby, which moves back the impression-arm.

19. In a printing-telegraph receiver, the combination of a continuously-revolving type-wheel, a toothed wheel revolving therewith, an impression-arm adapted, when released, to move into engagement with the teeth of said toothed wheel and to be carried thereby past the type-wheel, thereby bringing a band of paper against one of the types thereof, a detent for normally restraining said impression-arm, and a restoring mechanism for moving back said arm.

20. In a printing-telegraph receiver, the combination of a continuously-revolving type-wheel, an impression-arm adapted, when released, to move into engagement with the type-wheel, and thereby in passing to press a band of paper against one of the types thereof, a detent normally restraining said impression-arm, a feeding-roller mounted on the axis around which said arm vibrates and formed with ratchet-teeth, a pawl engaging said teeth and carried by said arm, whereby the paper is advanced with said arm during the printing movement thereof, a second pawl engaging said teeth and preventing the backward movement of said roller during the return of said arm, and a restoring mechanism for moving back said arm.

21. The combination, with a printing-telegraph receiver, of a synchronizing mechanism consisting of a fly-wheel in connection with the revolving printing-shaft, an electro-magnetic brake acting against said fly-wheel, and a circuit-closer in the circuit traversing the coils of said magnet, operated to close the circuit at regular intervals.

22. The combination of a distributer at the transmitting-station, a distributer and printing-receiver at the receiving-station, and a synchronizing mechanism for the two sets of apparatus, consisting of circuit-closers on both apparatus for closing the circuit at each revolution and an electric brake applied to the governed apparatus, whereby the acceleration of speed acquired by the latter is neutralized by the action of said brake, and the brake is applied for a duration proportional to the advance of the governed over the governing apparatus.

23. The combination, to form a distributer, of a series of contacts arranged annularly, a second series of contacts, also arranged annularly and angularly adjustable relatively to the first series, a revolving arm moving over said contacts, and conducting-brushes mounted on said arm and sweeping said contacts.

24. A manipulator consisting of circuit-closing springs vibrating between two opposite contact-buttons, the buttons of one series being connected to the positive pole of a battery and those of the opposite series being connected to the negative pole of another battery, in combination with a distributer serving to connect the respective springs to the line successively, whereby the successive impulses transmitted are of one polarity or the other, according to the order in which the springs are depressed.

25. A manipulator consisting of a series of finger-keys, two circuit-closing springs under each key, connections between the first spring of each key and the line-circuit, whereby these springs serve for transmitting the signals to the distant station, a receiving-instrument at the sending-station, and connections between the second spring of each key and this instrument, whereby these springs serve to reproduce the transmitted signal in this instrument.

26. The combination of a manipulator consisting of a series of finger-keys and two circuit-closing springs under each key, a receiving-instrument, and a distributer consisting of a revolving arm carrying contact-brushes, a series of successive contacts connected to the first springs of the respective keys and swept by the first brush, whereby the currents from these keys are sent to line successively, and two series of successive contacts arranged in pairs and swept by the other brush, the contacts of one series being connected with the second springs of the respective keys and the contacts of the other series being connected to

the electro-magnets of the receiving-instrument.

27. The combination, with the distributer, of a series of keys, each consisting of a circuit closing or breaking spring or springs, a finger key or lever for operating it or them, a metronome electro-magnet, and an armature mounted on said key and arranged to make contact with said magnet when the key is depressed, and thereby to hold the key depressed as long as the magnet remains active.

28. The combination of a manipulator consisting of five keys assembled in one instrument, a distributer for connecting said keys successively to line, a receiving-instrument having five magnets for receiving the five successive currents, and a distributer at the receiving-station for distributing the five successive currents to the respective magnets, whereby thirty-two different signals may be transmitted by depressing the manipulator-keys in different combinations.

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

JEAN MAURICE EMILE BAUDOT.

Witnesses:

JULES ARMENGAUD, Jr.,

E. P. MACLEAN.