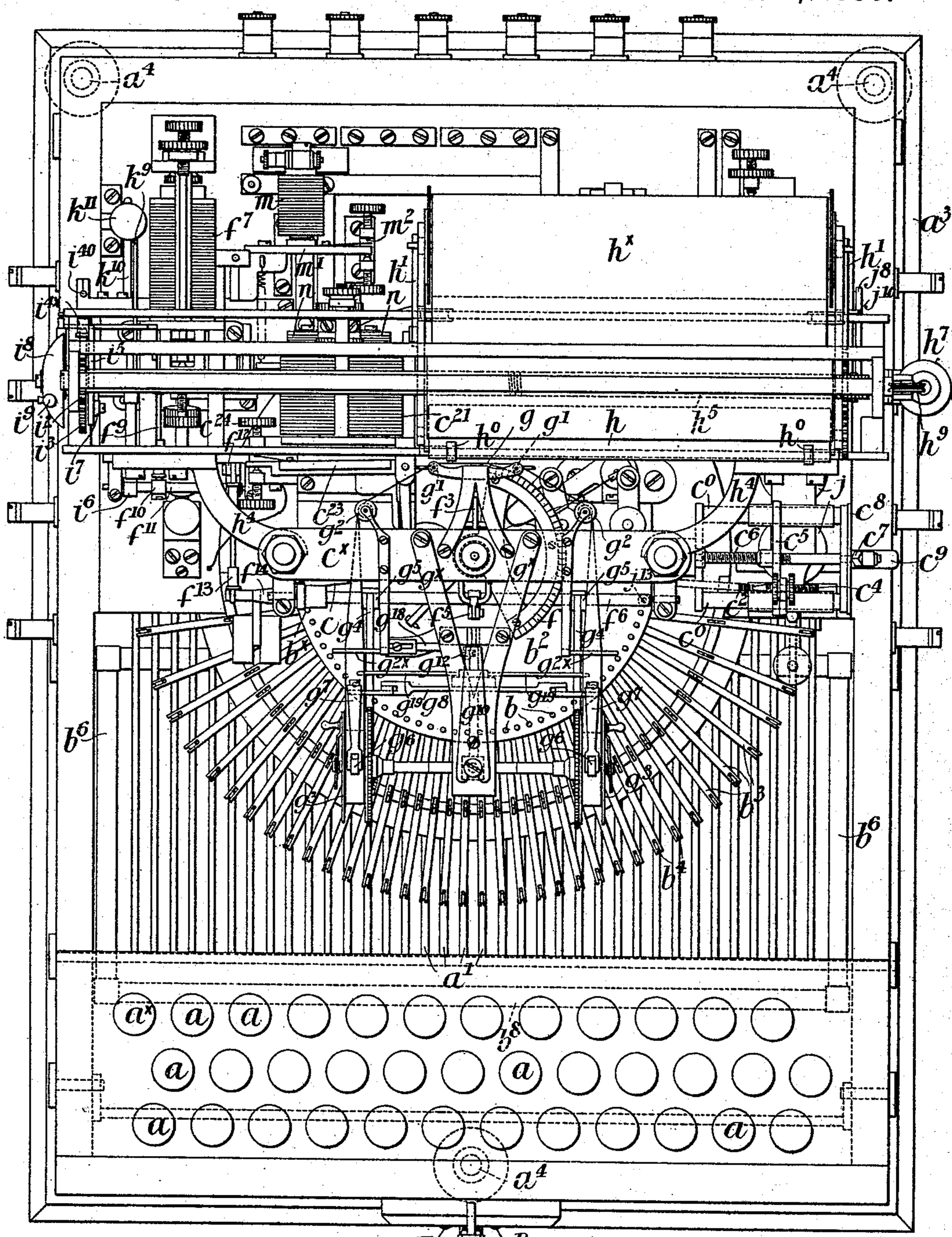
(No Model.) 9 Sheets—Sheet 1.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.



Witnesses.
C. G. Redfern
A. F. Stuart

Fig. 1.

Inventor
Leo Kamm

(No Model.) 9 Sheets—Sheet 2.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

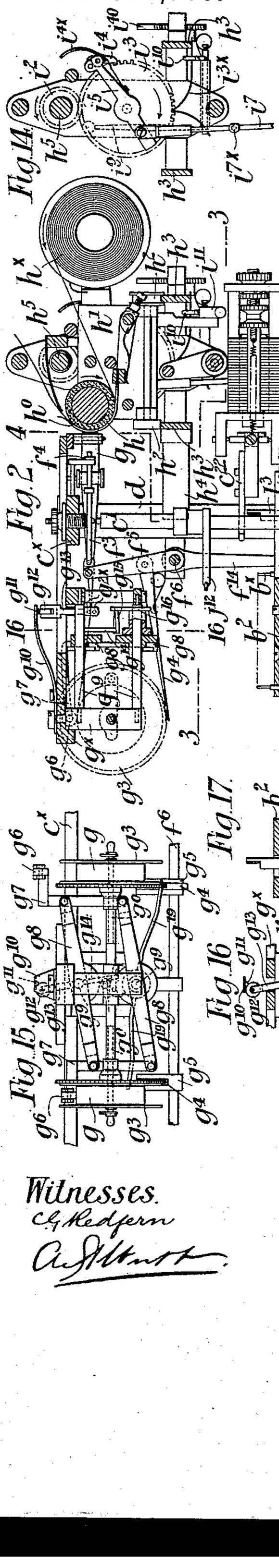


Fig. 14.

Fig. 2.

Fig. 15.

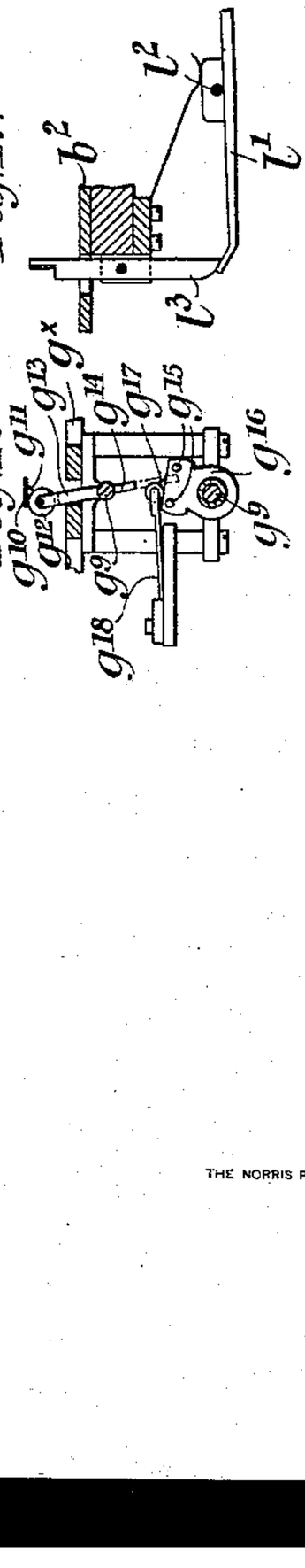


Fig. 16

Fig. 17.

Fig. 18

Witnesses.
C. G. Redfern
A. J. Abbott.

Inventor:
Leo Kamm

(No Model.) 9 Sheets—Sheet 3.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

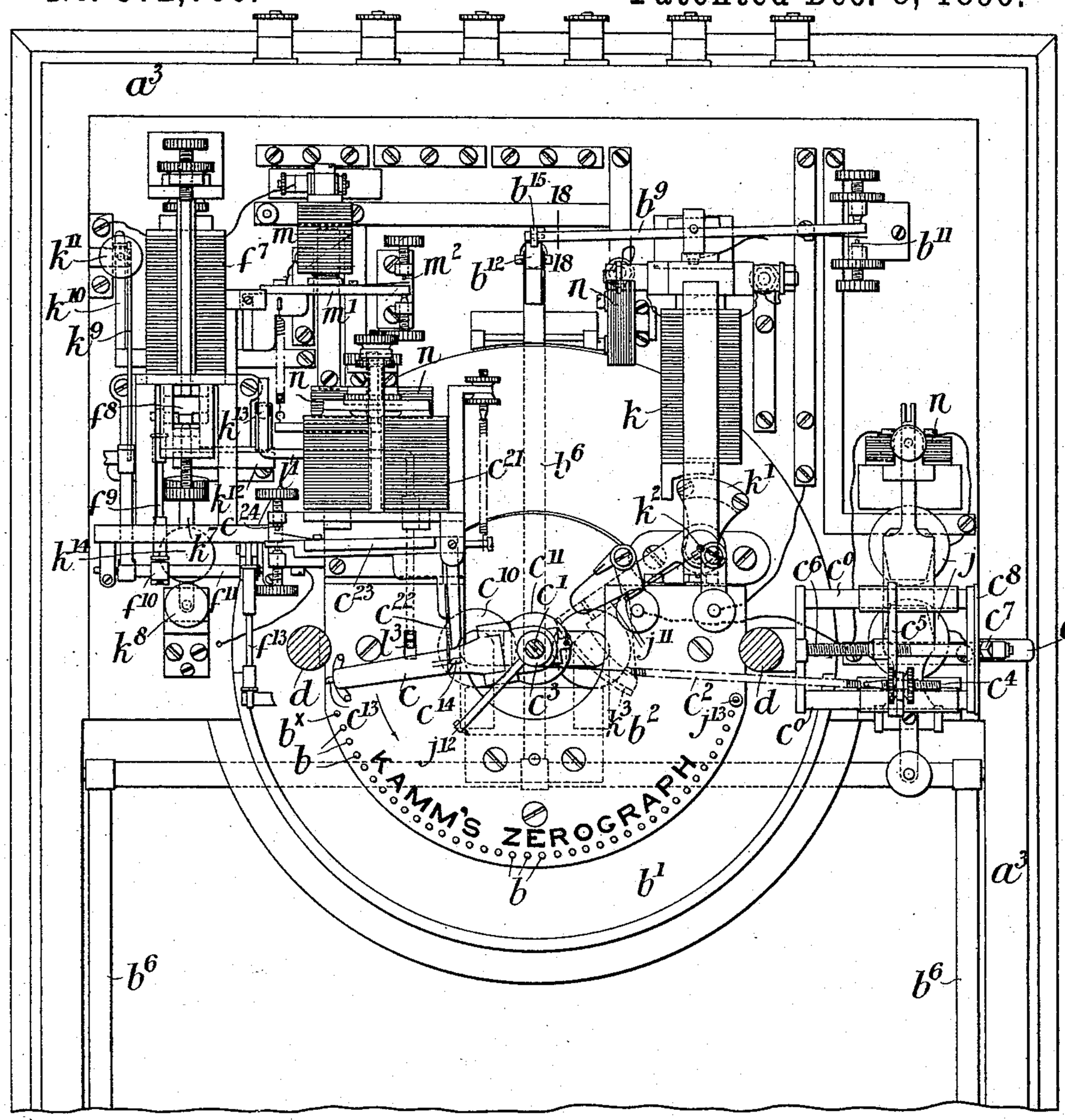
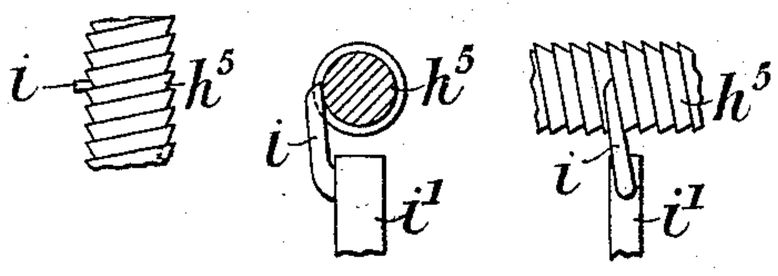


Fig. 3

Fig. 19. Fig. 20. Fig. 21.



Witnesses.
C. G. Redfern
A. S. Hewett

Inventor.
Leo Kamm

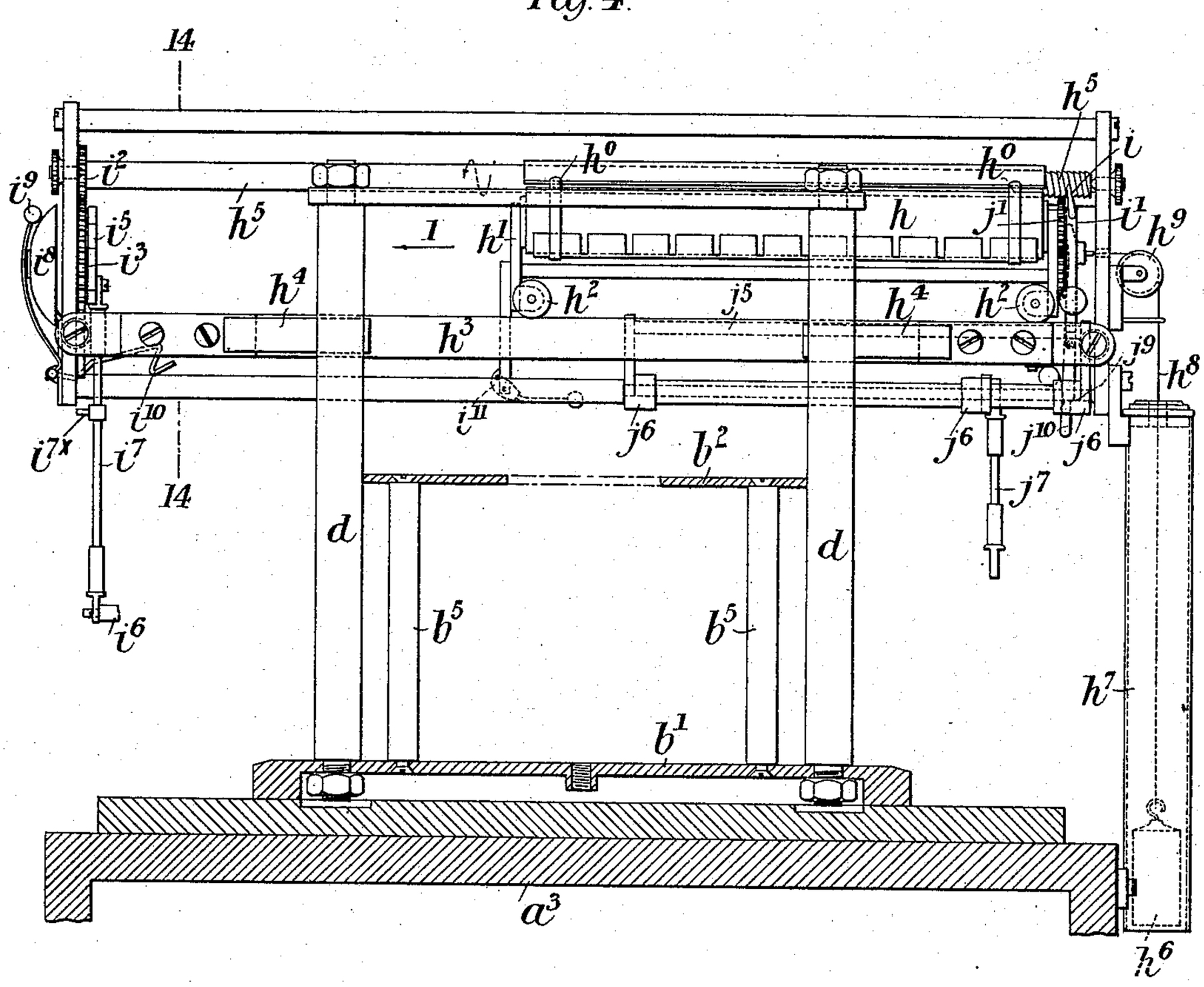
(No Model.) 9 Sheets—Sheet 4.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

Fig. 4.



Witnesses.
C. G. Redfern
A. Abbott

Inventor.
L. Kamm

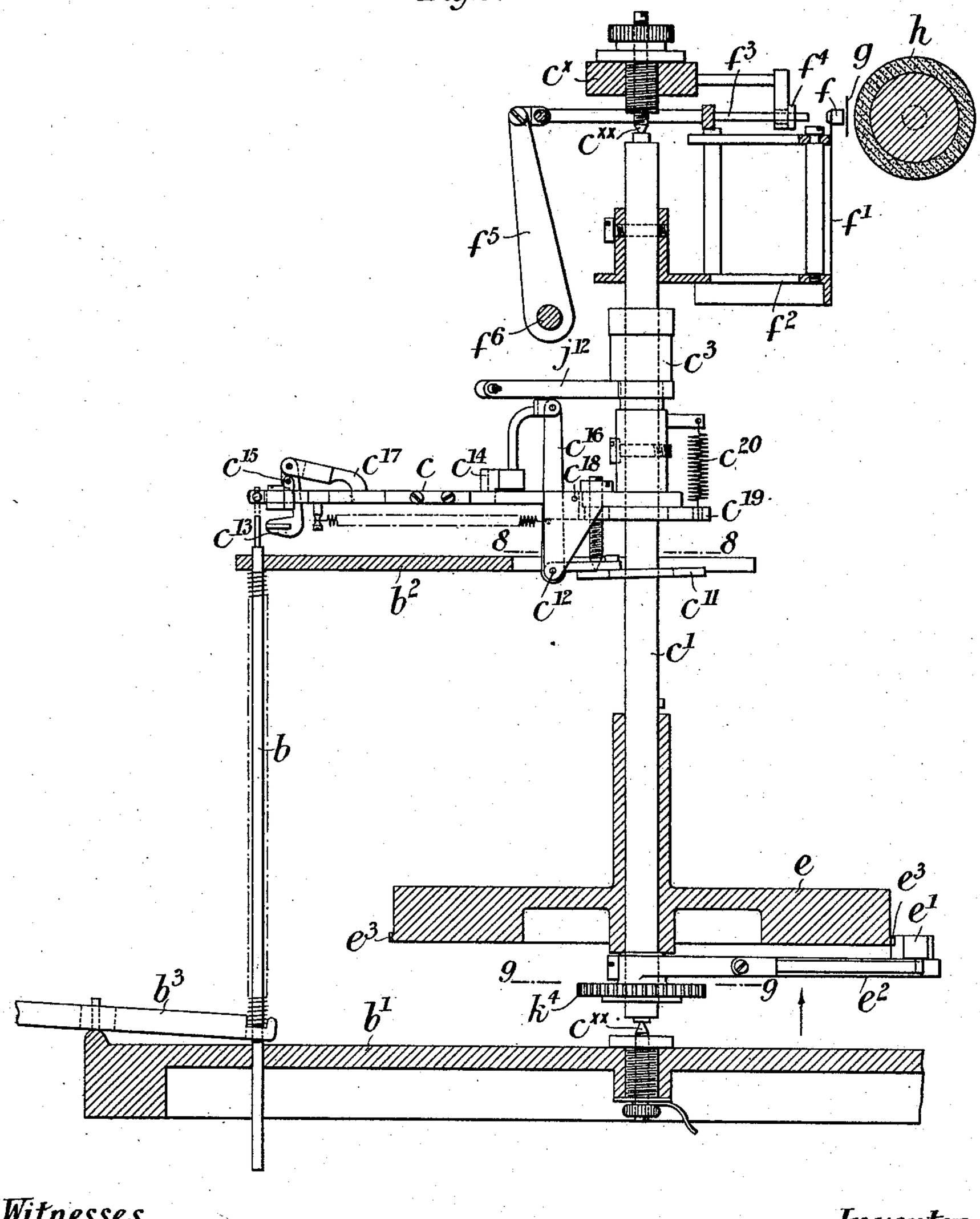
(No Model.) 9 Sheets—Sheet 5.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

Fig 5.



Witnesses.
C. Redfern
A. Abbott

Inventor.
L. Kamm

(No Model.)

9 Sheets—Sheet 6.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

Fig. 6.

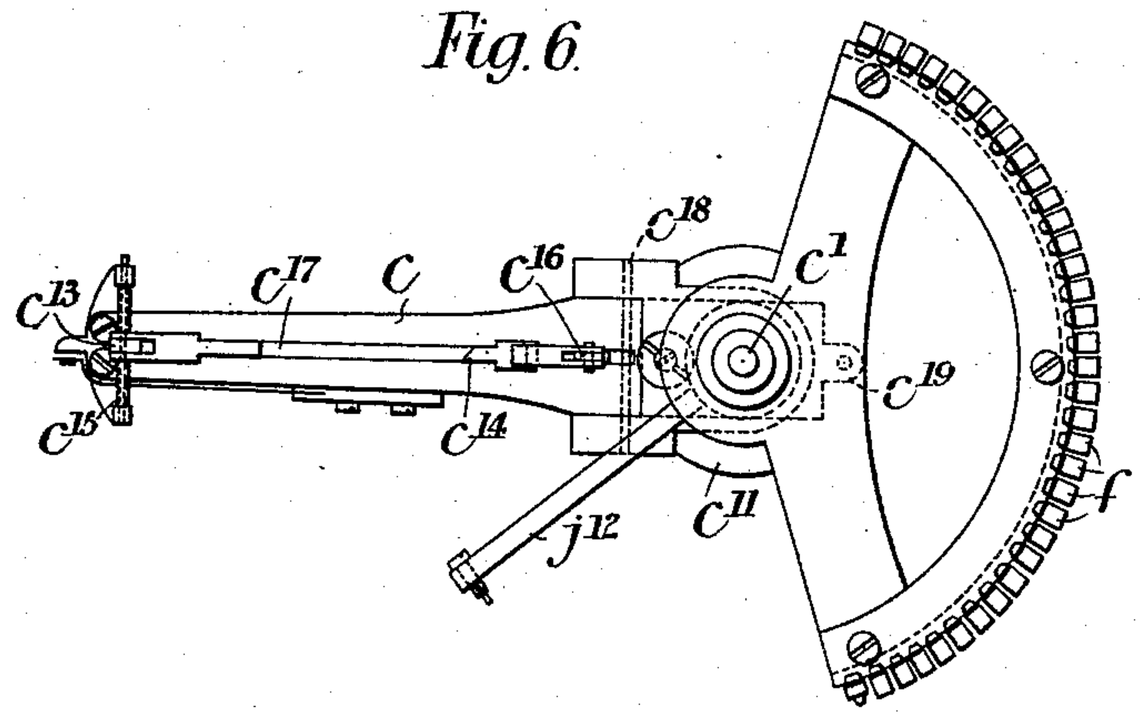


Fig. 7.

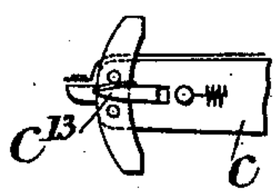


Fig. 8.

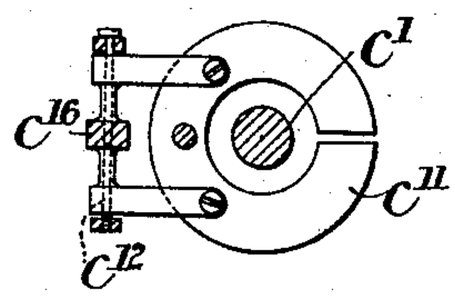
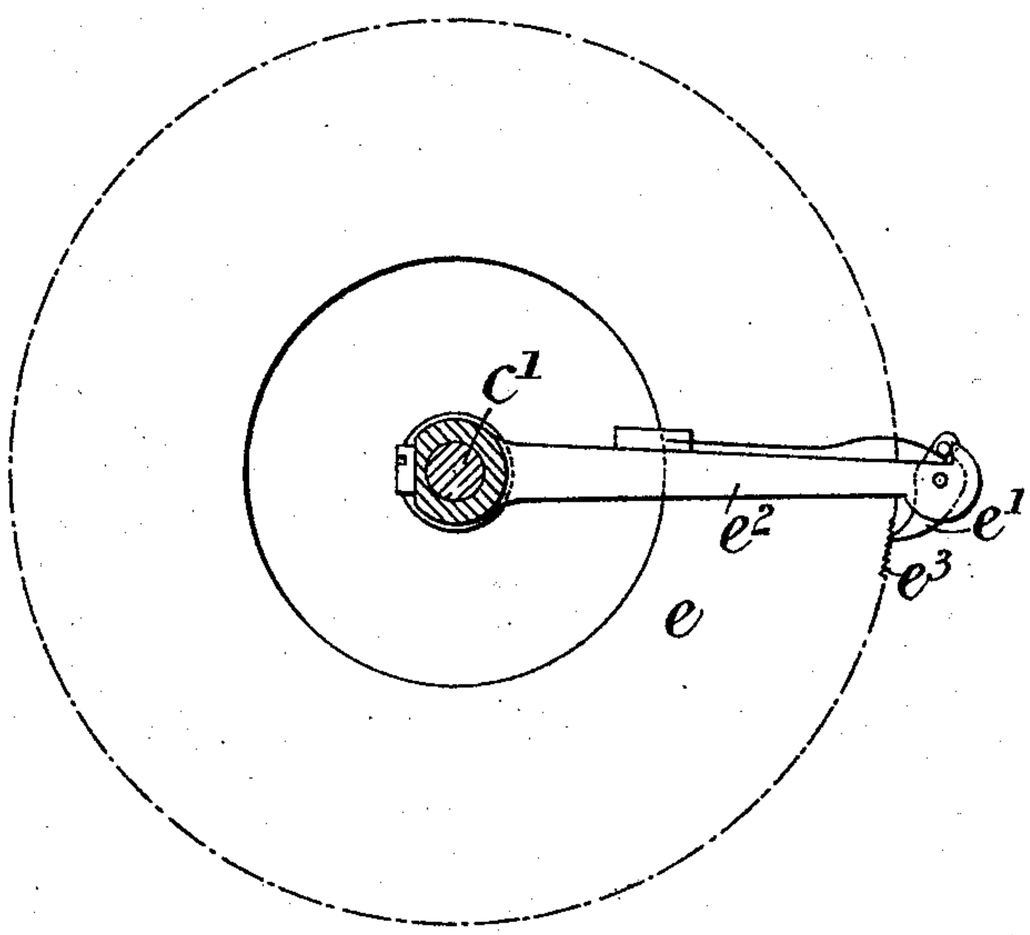


Fig. 9.



Witnesses.
C. G. Redfern
A. F. Stahl

Inventor.
L. Kamm

(No Model.)

9 Sheets—Sheet 7.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

Fig. 13.

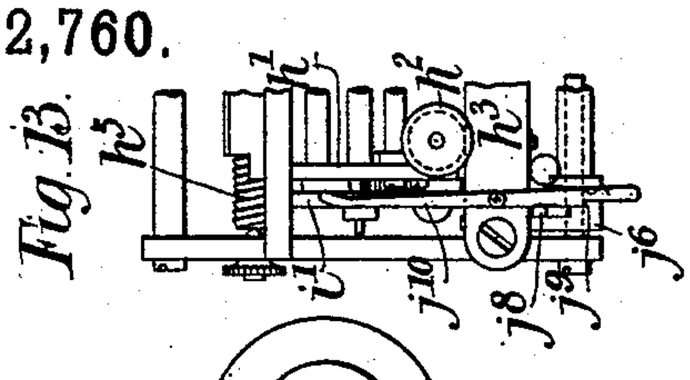


Fig. 12.

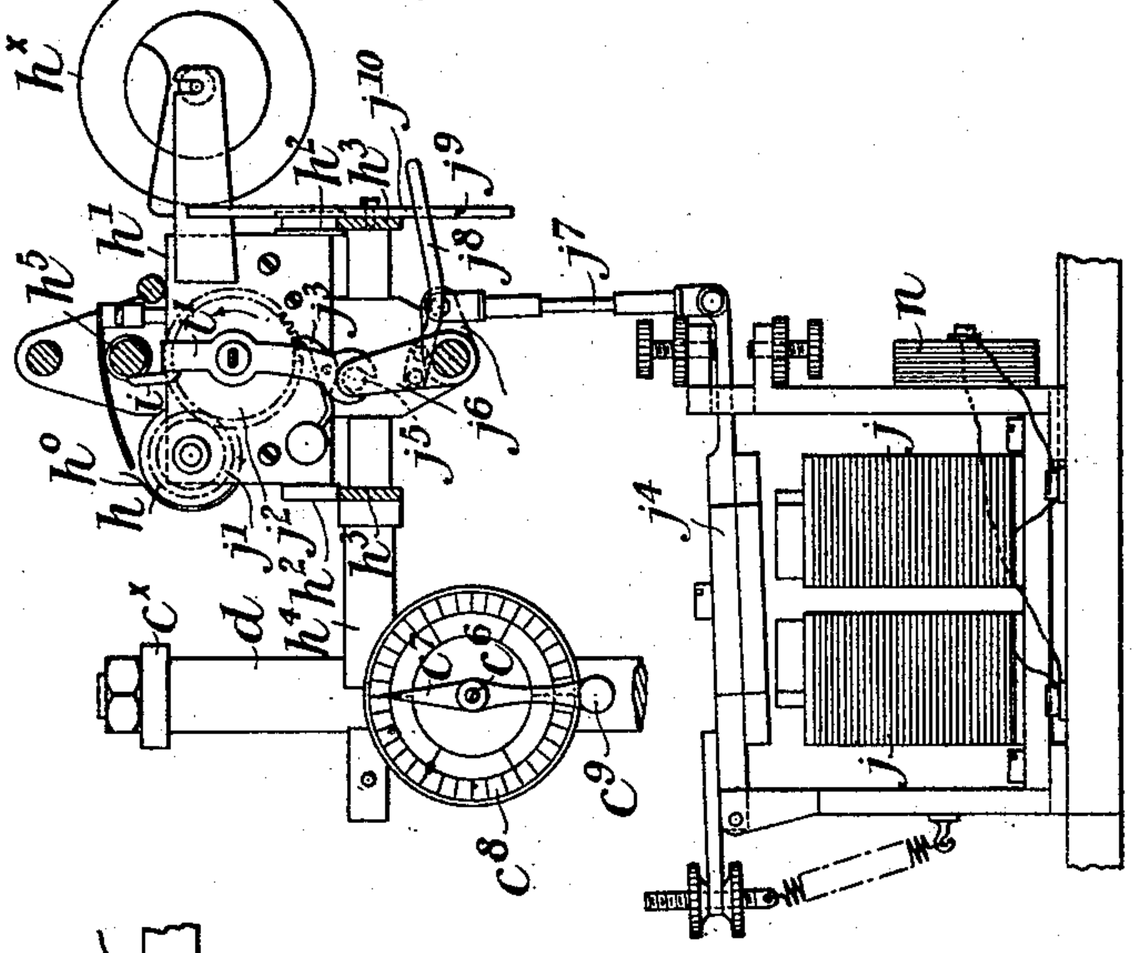


Fig. 10

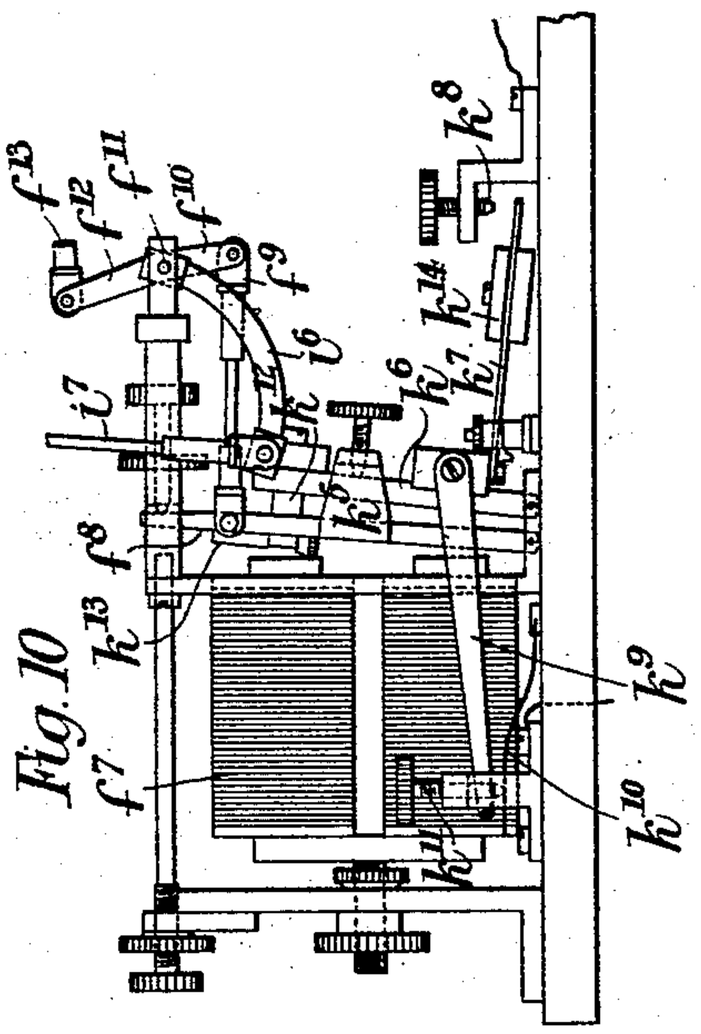
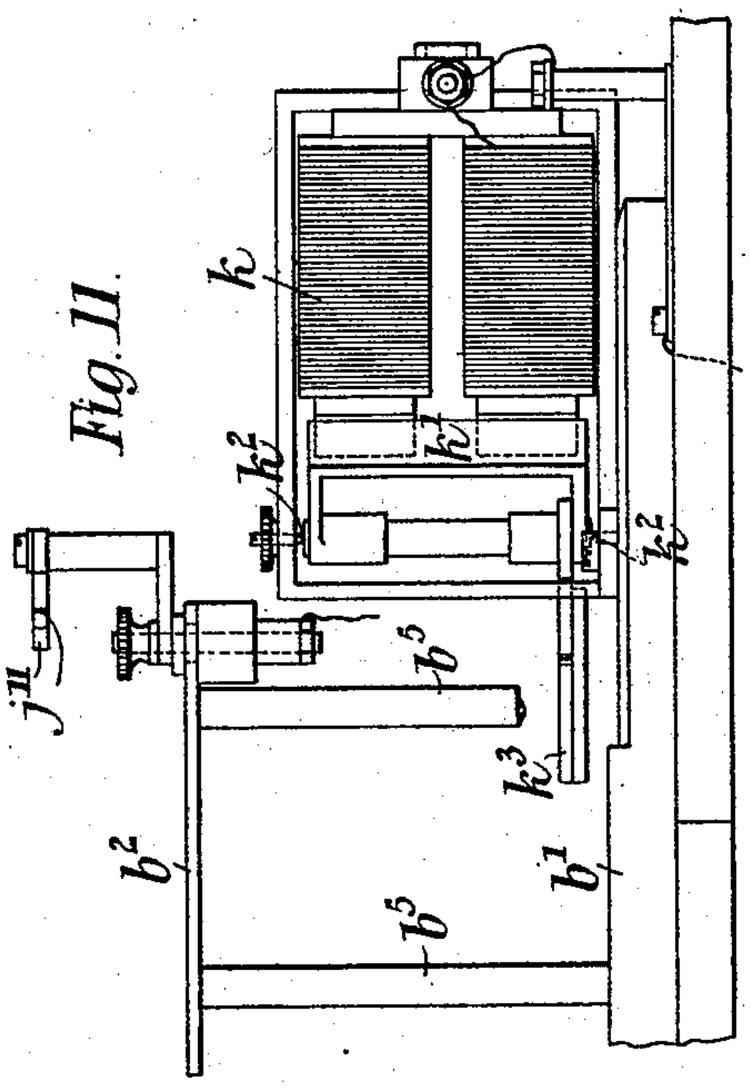


Fig. 11.



Witnesses.
C. G. Redfern
A. S. Hunt.

Inventor.
L. Kamm

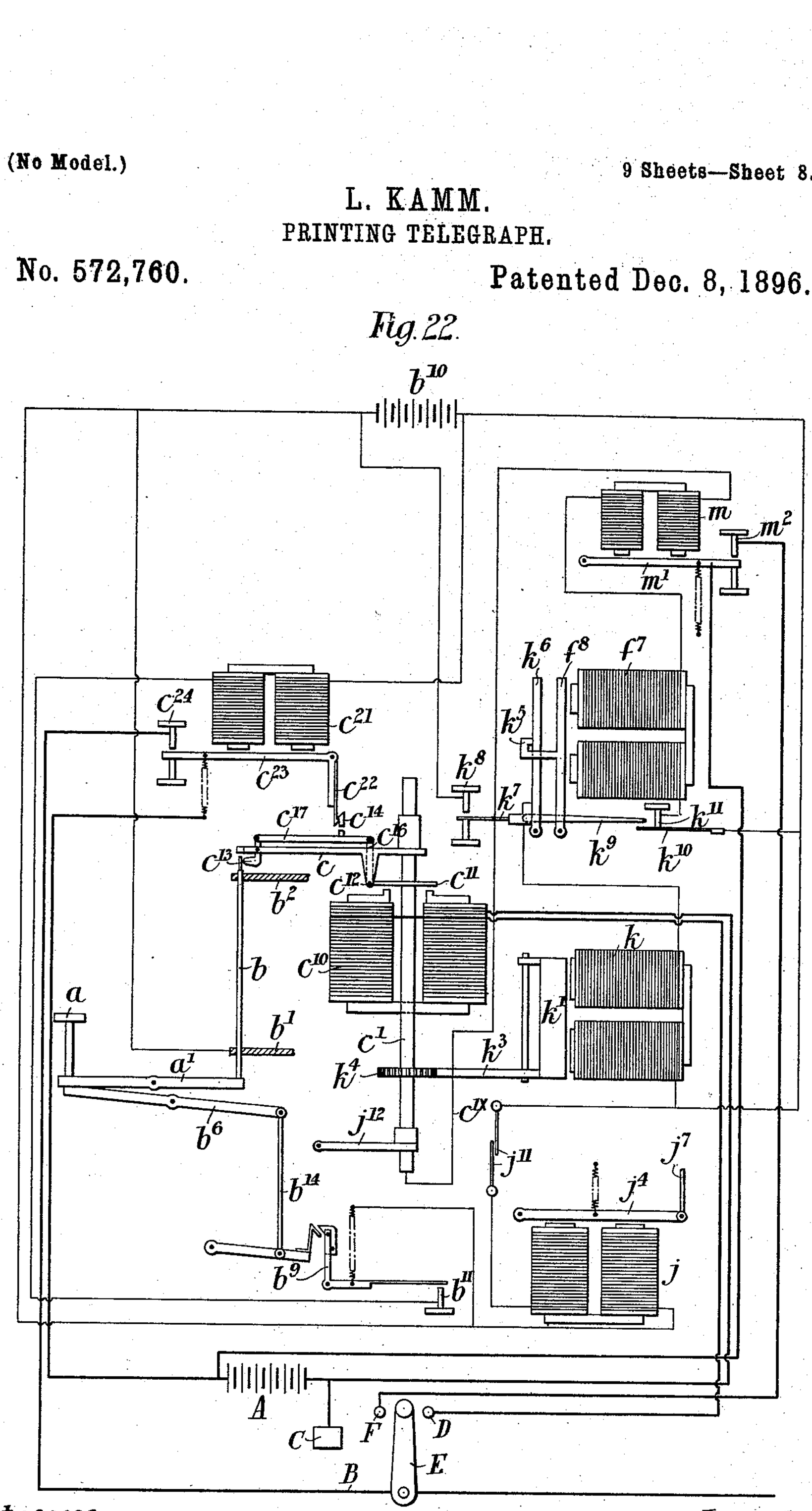
(No Model.) 9 Sheets—Sheet 8.

L. KAMM.

PRINTING TELEGRAPH.

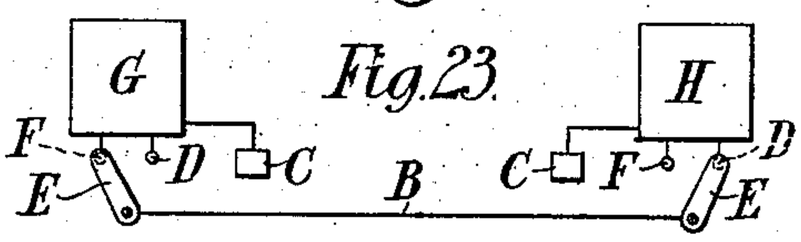
No. 572,760. Patented Dec. 8, 1896.

Fig. 22.



Witnesses.
C. G. Redfern
A. S. Abbott

Fig. 23.



Inventor.
Leo Kamm

(No Model.) 9 Sheets—Sheet 9.

L. KAMM.

PRINTING TELEGRAPH.

No. 572,760. Patented Dec. 8, 1896.

Fig. 24.

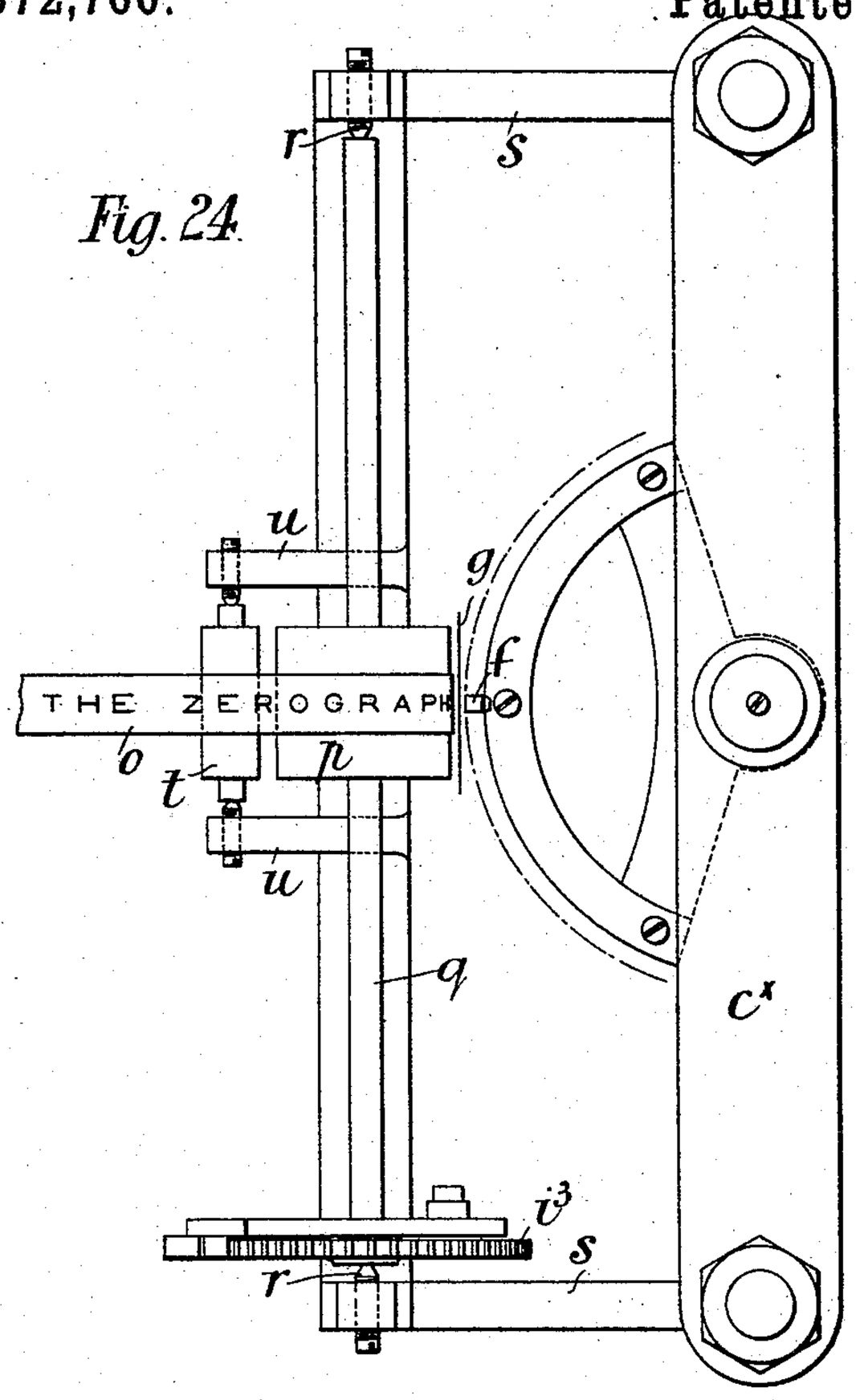
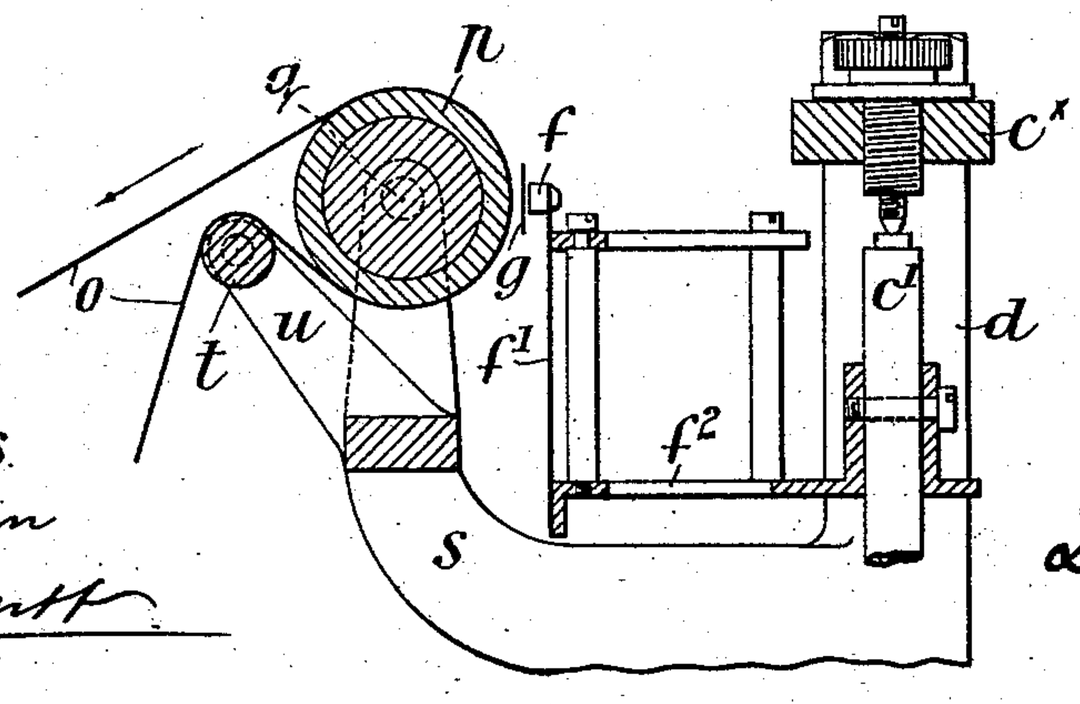


Fig. 25.



Witnesses.
C. G. Redfern
A. Abbott

Inventor.
L. Kamm

UNITED STATES PATENT OFFICE.

LEO KAMM, OF LONDON, ENGLAND.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 572,760, dated December 8, 1896.

Application filed December 30, 1895. Serial No. 573,761. (No model.)

To all whom it may concern:

Be it known that I, LEO KAMM, a subject of the Queen of Great Britain, residing at London, England, have invented new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

This invention relates to printing telegraphic apparatus, and has for its object to produce an apparatus which acts both as a transmitter and receiver, which is more certain and rapid in its action than instruments at present in use, and which does not require any special skill in its operation.

According to my invention I make use of two electric impulses or currents produced by the transmitting apparatus to produce each letter or character on the receiving apparatus.

In carrying out my invention I employ in each apparatus a series of finger-keys, as in a type-writer, with which keys are connected spring-pins arranged in the arc of a circle. The center of this circle is the axis of an arm which I term the "synchronizing" arm and which is adapted to be swung by an adjustable spring (or weight) above the spring-pins until arrested by any one pin moved into its path by a finger-key. The spindle on which the synchronizing arm is mounted carries a governor or loose weight actuated in one direction only by a pawl connected to the spindle, which weight, according to the pull of the adjustable spring, (or weight,) determines the speed of the arm. The spindle also carries a series of spring-type arranged in the arc of a circle and corresponding with the finger-keys, a plunger being employed to move each type when in position against a roll of paper upon a carriage, a suitable inking device, such as an ink-ribbon, being employed for the type. The synchronizing arm also carries two projections adapted to be moved by the armature of an electromagnet, which I term the "synchronizing" magnet, one of which projections is adapted to be projected between the spring-pins hereinbefore described, while the other is engaged by a hook upon the armature of an electromagnet, so as to hold the arm in its initial or zero position. This magnet, which I term the "starting-magnet," is energized by the first electric impulse or current hereinbefore mentioned, produced by the closing of a local electric circuit when a finger-key is depressed, the said armature in its movement also closing the line-circuit connected with the synchronizing magnet of a distant or receiving apparatus, which magnet attracts its armature and withdraws the projection on the synchronizing arm engaged with the hook of its starting-magnet. Both synchronizing arms are thus released simultaneously and, being similarly constructed and adjusted, move at the same speed. The synchronizing arm of the transmitting apparatus then makes contact with the projecting spring-pin operated by the finger-key, thus closing another local circuit and energizing an electromagnet, which I term the "second" contact-magnet, the armature of which in its movement again closes the line-circuit and produces the second electric impulse or current hereinbefore mentioned. This current again energizes the synchronizing magnet of the distant or receiving apparatus, the armature of which moves the other projection so as to stop the synchronizing arm against the spring-pin corresponding with that operated by the finger-key in the transmitting apparatus, and thus closes a local circuit, as in the transmitting apparatuses. These local circuits in both apparatuses then each simultaneously operates an electromagnet, which I term the "printing-magnet," which operates the plunger hereinbefore described to cause the type to print, to feed the carriage along carrying the paper roll, and close another local circuit in which is an electromagnet (or solenoid) which I term the "zero-magnet" and which is energized to return the synchronizing arms to the zero position.

To feed the paper on its roller so as to start a fresh line or column, I provide an electromagnet which I term a "column-magnet," which is energized by allowing the synchronizing arm to travel farther than the row of spring-pins extend, when it is stopped by a fixed pin, (which is in the same local circuit as the spring-pins,) and also causes two contacts to close the circuit containing the said magnet.

To enable my invention to be fully understood, I will describe how it can be carried into practice by reference to the accompanying drawings, in which—

Figure 1 is a plan view of a printing tele-

graphic apparatus constructed according to my invention. Fig. 2 is a central longitudinal section of the same with certain parts removed. Fig. 3 is a sectional plan, the section being taken on the line 3 3, Fig. 2. Fig. 4 is a front sectional elevation with certain parts removed, the section being taken on the line 4 4, Fig. 2. Fig. 5 is a sectional view showing the synchronizing arm, its governor, the type, and other connected parts drawn to an enlarged scale. Fig. 6 is a plan of the type and the synchronizing arm. Fig. 7 is an under side view of the outer end of the synchronizing arm. Fig. 8 is a section on the line 8 8, Fig. 5. Fig. 9 is a section on the line 9 9, Fig. 5, looking in the direction of the arrow. Figs. 10, 11, and 12 are respectively views of the printing-magnet, the zero-magnet, and the column-magnet with connected parts. Fig. 13 is a rear view showing one end of the paper-carriage and its supporting-rails. Fig. 14 is a section on the line 14 14, Fig. 4. Fig. 15 is a front view of the mechanism for operating the inking-ribbon. Fig. 16 is a section on the line 16 16, Fig. 2. Fig. 17 is a section showing mechanism for locking the armature of the printing-magnet. Fig. 18 is a section on the line 18 18 of Fig. 3 drawn to an enlarged scale. Figs. 19, 20, and 21 are respectively a plan, a section, and a side view showing the feed-screw for operating the paper-carriage. Fig. 22 is a diagrammatic view showing the arrangement of the various circuits in connection with the apparatus. Fig. 23 is a diagrammatic view showing two connected apparatuses. Figs. 24 and 25 are respectively a plan and a sectional elevation showing the apparatus adapted to print on a paper tape.

Similar reference-letters indicate corresponding parts throughout the drawings.

$a^{\times}$ a a, Figs. 1 and 2, are the finger-keys jointed to levers a', pivoted at a^2 in a box or case a^3, the lower part of which is provided with adjustable feet a^4.

$b^{\times}$ b b are the spring-pins, arranged in the arc of a circle, as shown in Fig. 3, the ends of which pins are guided in plates b' b^2 and which are connected to the levers a' through the medium of links b^3, fulcrumed on the plate b', and levers b^4. The plate b^2 is connected to the plate b' by pillars b^5.

b^6 is a spring-frame pivoted at b^7 beneath the levers a' and having a bar b^8 in contact with the under sides of the said levers, so that when any one of the levers a' is depressed it moves, through the medium of the said frame, a spring-lever b^9, which forms one of the terminals of a circuit, including a local battery b^{10}, Fig. 22, and the starting-magnet, hereinafter described, the said lever when moved making contact with the other terminal, b^{11}. The lever b^9 is moved by a projection b^{12} on a pivoted arm b^{13}, connected to the frame b^6 by a link b^{14}, the movement being effected on the upward movement of the arm b^{13} only by coming into contact with a projection on a block b^{15}, pivoted on the end of the lever b^9, the block being prevented from turning on the said lever during such upward movement by a pin b^{16}, Fig. 18, but turning freely when impinged against by the projection b^{12} in its downward movement without moving the lever b^9.

c is the synchronizing arm, (shown most clearly in Figs. 5 and 6,) and c' is the spindle thereof, the axis of which coincides with the center of the circle in which the pins b are arranged, as shown, so that its free end can swing in the direction of the arrow, Fig. 3, above the upper ends of the pins b. By this arrangement if one of the pins b be raised by the depression of one of the keys a the synchronizing arm will come in contact therewith and be arrested in its movement. The spindle c' turns upon centers $c^{\times\times}$ in the plate b' and in a cross-bar $c^{\times}$, but insulated therefrom, the cross-bar being carried by pillars d d.

c^2, Figs. 1 and 3, is the adjustable spring, one end of which is attached by a cord or the like to an insulated drum c^3 on the spindle c', while the other end is connected to a screw c^4, carried by a sliding frame c^5, working on guide-rods c^0, attached to one of the two pillars d d. With the screw-threaded boss of the frame c^5 a screw c^6 engages, so that by rotating the said screw the frame c^5 can be moved backward or forward to adjust the tension of the spring c^3, and consequently the pull on the arm c. The end of the screw c^6 is provided with a pointer c^7, working over a dial c^8, the pointer being operated by a handle c^9, as shown clearly in Fig. 12.

Each of the pins b b forms one terminal of a local circuit, including the plate b', the battery b^{10}, Fig. 22, and the second contact-magnet and printing-magnet hereinafter described, the other terminal being the arm c, connected to the battery through the spindle c' and conductor $c'^{\times}$.

c^{10}, Figs. 2 and 3, is the synchronizing magnet in circuit with the line-battery A, Fig. 22, and with a contact-piece D, forming a terminal, the other terminal being a switch-lever E, connected to the line-wire B. The spring-armature c^{11} of the said magnet is pivoted at c^{12} to downward extensions on the arm c, the said armature encircling the spindle c', so as to be operated by the magnet in any position of the arm c.

c^{13} and c^{14} are the projections carried by the arm c, the projections c^{13} being in the form of a lever pivoted at c^{15}, so that it can be projected between the pins b and connected to an upward extension c^{16} of the armature c^{10} by a link c^{17}, the projection c^{14} forming part of the said link.

In order to prevent damage when the arm c is moving above the pins b b and one of the said pins is accidentally raised by a key a and strikes it, I joint the said arm to its boss, as at c^{18}, Fig. 5, and provide it with an extension c^{19}, which normally is kept in contact

with the under side of the boss by a spring c^{20}, the said spring allowing the arm to yield when struck, as described.

c^{21}, Figs. 1, 2, and 3, is the starting-magnet and c^{22} is the hook on the spring-armature c^{23} of the same, but insulated therefrom for holding the arm c in its initial or zero position. This magnet is energized by the contact of the terminals b^9 b^{11} each time a key a is depressed, whereby the arm c is released from the hook c^{22}. This armature forms one of the terminals of the main-line circuit, including the battery A, Fig. 22, and when attracted by the magnet c^{21} comes into contact with the other terminal, c^{24}, and completes the circuit, sending a current to line B through the distant or receiving apparatus and earth-plate C.

e, Fig. 5, is the loose weight or governor on the spindle c', and e' is the pawl, connected to the spindle c' by the arm e^2 and engaging with ratchet-teeth e^3 on the periphery of the said weight. By arranging the weight loose, as described, its momentum allows it to turn when the synchronizing arm is arrested by one of the pins b, thereby preventing any damage to the said pins by the impact, and it also allows the arm c to be moved back quickly by the zero-magnet, hereinafter described.

f f are the type, which are arranged in the arc of a circle, as shown clearly in Fig. 6, and attached to springs f', carried on a sector f^2, attached to the spindle c'. Each of these type corresponds with one of the spring-pins, (except the first pin $b^\times$, which has no corresponding type,) that is to say, when one of the pins b is raised by depressing its corresponding finger-key the synchronizing arm when in contact with the said pin brings a type, the character of which corresponds with the character marked on the finger-key depressed, into position to be moved forward to imprint the paper. The first pin $b^\times$ serves to form the spaces between words when printing and is connected to the key $a^\times$. f^3 is the plunger, working through an insulated guide f^4 and adapted when moved by a lever f^5 upon a shaft f^6 to press the type f against the ink-ribbon g, which in turn is pressed against the paper which passes around the roller h from the paper roll $h^\times$. The paper is pressed against the roller h by springs h^0.

f^7, Figs. 1, 2, 3, and 10, is the printing-magnet in circuit with the local battery b^{10}, Fig. 22, and the armature f^8 of which operates the shaft f^6 through the medium of the rod f^9, lever f^{10}, shaft f^{11}, lever f^{12}, rod f^{13}, and weighted lever f^{14}.

The ink-ribbon g is arranged to pass round rollers g' g' g^2 g^2 and between guides $g^{2\times}$ $g^{2\times}$, Figs. 1 and 2, and has its ends wound upon drums g^3 g^3, which are advantageously adapted to be automatically alternately rotated through the medium of spring-pawls g^4 g^4, actuated from the shaft f^6 by levers g^5, Fig. 15. The drums rotate upon spindles g^0, carried by a frame $g^\times$, attached to the bar $c^\times$. This alternate rotation allows of the ink-ribbon being wound upon the drums alternately, and in order that it may be effected automatically I provide rollers g^6, carried by arms g^7, the said rollers being caused to work in vertical lines by being jointed to the ends of the levers g^8, fulcrumed on shafts g^9, and forming a parallel motion. One of the said rollers is designed to run upon the ribbon being wound upon one of the drums. This ribbon as it increases in size in the form of a coil upon the drum causes the roller upon it to be moved upwardly, and when it has reached a certain point the roller is caused to move off the ribbon and the other roller into contact with the ribbon on the other drum. These movements, which are instantaneous, are effected by a spring g^{10}, having a tooth g^{11} and bearing upon a roller g^{12} upon the upper end of an arm g^{13}, as shown clearly in Fig. 16, which roller as the roller g^6 is moved up is caused through the medium of the arm g^7 of the latter roller and one of the levers g^8 and shaft g^9 to move beneath the tooth of the spring g^{10}, and when it has reached a point just beyond the center of the tooth the spring g^{10} causes it to suddenly complete the rest of its movement in the same direction by pressing down upon the other side of the roller g^{13}, as will be understood. In order also that the pawl g^4, which has been actuating the drum on which the ribbon has just been wound, shall be instantaneously disengaged at the same time that the roller g^6 is moved from off the ribbon and the other pawl thrown into engagement with its drum, I provide the arm g^{13} with a downward extension g^{14}, which engages with a fork g^{15} (having considerable space between its prongs) above an arm g^{16}, loose upon the lower shaft g^9, the upper part of the arm g^{16} having a tooth g^{17} similar to the tooth g^{11} and borne upon by a roller at the end of a spring g^{18}, similar to the spring g^{10}. The arm g^{16} is also provided with a boss carrying arms g^{19}, each of which bears upon the upper side of the pawl g^4 beneath it alternately. By this construction it will be seen that when the arm g^{13} is instantaneously moved when the roller g^6 is disengaged from the coil of ribbon, as described, it will come into contact with one of the prongs of the fork g^{15} and move the arm g^{16} beneath the roller of the spring g^{18}, thereby moving the arms g^3 to disengage one pawl from and engage the other pawl with its respective drum. With the described arrangement of springs g^{10} g^{18}, operating in conjunction with the rollers and teeth, the movements of the parts are effected instantaneously and the parts are maintained in position when so moved.

The roller h and paper-roll $h^\times$ are carried in a carriage h', supported by wheels h^2 upon rails h^3, connected to the pillars d d by brackets h^4. The carriage h' is moved in the direction of the arrow 1, Fig. 4, by a screw h^5 and in the opposite direction by means of a weight h^6, (or spring,) the weight being protected by a tube h^7 and connected to a cord

h^8, which passes over a pulley h^9 and is attached to one end of the carriage. The carriage is connected to the screw h^5 by a tooth i, which engages with the screw-thread, the latter being of a shape in section similar to a ratchet-tooth, as shown clearly in Figs. 19 and 21, so that when the screw is revolved in the direction of the arrow, Fig. 4, the carriage will be caused to move upon the rails h^3. The shape of the screw-thread also allows the carriage to be moved by hand in the direction of the arrow 1 independently of the screw h^5, the tooth i, which is attached to a pivoted arm i', riding over the convolutions of the screw. The screw h^5 is revolved by gear-wheels i^2 i^3, Fig. 14, the latter of which is actuated by a pawl i^4, carried at one end of a lever i^5, the other end being connected to and actuated from a lever i^6 on the shaft f^{11} through the medium of a rod i^7. $i^{3\times}$ is a spring-detent engaging with the wheel i^3. The pawl i^4 is provided with a tail $i^{4\times}$, which, just before the lever i^5 completes its movement when rotating the wheel i^3, comes into contact with an adjustable pin i^{40} and is disengaged from the wheel. This arrangement allows of the wheel i^3 and consequently the carriage h' being stationary when the plunger f^3 is pressed against the ink-ribbon to print on the paper. In order to insure that the wheel i^3 does not move owing to any momentum after the pawl i^4 is disengaged, I arrange a stop $i^{7\times}$ upon the rod i^7, which comes into contact with the end of the detent $i^{3\times}$ and holds it tightly in gear with the wheel i^3. By adjusting the screw i^{40} higher or lower the pawl i^4 is disengaged from the wheel i^3 earlier or later during the movement of the lever i^5, whereby the movement of the screw h^5 and consequently the spacing between the letters printed by the type are varied.

i^8 is the gong for signaling when the carriage has almost reached the farthest point of its travel, the hammer i^9 of the gong (which is a spring-hammer) being pivoted and provided with an arm i^{10}, which will be moved up and allowed to fall to cause the hammer to strike the gong by the passage under the outer end of the said arm of a weighted arm i^{11} on the carriage, the arm i^{11} being pivoted so that as the carriage moves back it will turn upon its pivot without affecting the arm i^{10} in a similar way to the block b^{15}.

j, Figs. 3 and 12, is the column-magnet in circuit with the local battery b^{10}, Fig. 22, which magnet serves to rotate the roller h to feed the paper when it is necessary to start a new line. This is effected through the medium of a gear-wheel j' on one end of the shaft of the roller h and a gear-wheel j^2 in gear with the wheel j' and operated by a weighted pawl j^3, carried on one end of the lever i', the said lever being operated from the spring-armature j^4 of the magnet j through the medium of the rod j^5, the bell-crank lever j^6, and rod j^7. By this construction it will be seen that when the armature j^4 is attracted by the magnet j the lever i' will be moved and cause the pawl j^3 to rotate the wheels j^2 and j' and roller h and consequently move the paper surrounding the same, and at the same time it disengages the tooth i from the screw h^5, whereby the carriage will automatically move back from a position into which it may have been moved into its original or starting position (shown in Fig. 4) under the influence of the weight h^6. The rod j^5 extends longitudinally between the rails h^3, so that the lever i' can always be in engagement notwithstanding the movement of the carriage h'.

In order that the tooth i shall not reëngage with the screw h^5 until the carriage has arrived at its initial position, I provide one of the levers of the bell-crank j^6 with an arm j^8, which, when the armature j^4 is attracted by the magnet j, will be caused to engage beneath a shoulder j^9 on a spring-lever j^{10}, pivoted to one of the rails h^3, whereby the tooth i will be held out of engagement with the screw h^5 until the carriage, reaching its initial position, strikes the upper end of the lever j^{10} and releases the arm j^8, when the parts resume their normal position. The lever j^{10} is shown clearly in Figs. 12 and 13.

j^{11} j^{11}, Figs. 3 and 22, are the terminals of the circuit containing the column-magnet, one of which terminals is moved into contact with the other by an arm j^{12} on but insulated from the spindle c'. By allowing the arm c to move over the pins $b^{\times}$ b without making contact therewith it will bring the arm j^{12} into contact with one of the terminals j^{11} and cause the latter to move into contact with the other terminal, thereby closing the circuit and operating the magnet, the arm c being stopped in its movement by contact with a pin j^{13} on the plate b^2, which pin acts as a terminal to the circuit, including the starting and printing magnets, similarly to each of the pins $b^{\times}$ and b.

k, Figs. 3 and 11, is the zero-magnet (or solenoid) in circuit with the local battery b^{10}, Fig. 22. The armature k' of this magnet is pivoted at k^2 and provided with, but insulated from, an arm or toothed quadrant k^3 in gear with a toothed wheel k^4 on the spindle c', so that after the arm c has been moved by the spring c^2 it can be returned to its initial position by the armature k' being attracted by the magnet k. This magnet is energized by the operation of the printing-magnet f^7, the armature f^8 of which is provided with an extension k^5, which, as the said armature is moved, comes in contact with a pivoted bar k^6, having an insulated arm k^7, which forms one of the terminals of the circuit including the zero-magnet, the said terminal being moved into contact with the other terminal, k^8, to complete the circuit and energize the zero-magnet. The bar k^6 is also provided with an arm k^9, which during the movement of the said bar will move away a terminal contact-piece k^{10} from contact with a terminal k^{11} in the circuit of the printing-magnet,

thereby breaking the said circuit. In order that the backward movement of the armature f^8 in consequence of the breaking of this circuit shall not allow the bar k^6 to move back also and separate the terminals k^7 and k^8, the bar k^6 is provided with another arm k^{12}, having an upward projection k^{13}, which, when the bar k^6 is moved forward by the armature f^8, moves behind a shoulder or catch l on a spring-lever l', pivoted at l^2 beneath the starting-magnet c^{21}.

In order that the terminals k^8 and k^7 shall not be separated until the synchronizing arm has been drawn back to its initial position by the zero-magnet, I provide that when the arm has reached this position it shall come into contact with the upper end of a pivoted bar l^3, Figs. 2, 3, and 17, which projects through the table b^2, the lower end of the said bar being in contact with the inclined end of the lever l', so that the movement of the bar l^3, caused by the impingement of the synchronizing arm c, will disengage the shoulder l from the projection k^{13} and allow the bar k^6 to fall back under the influence of the weight k^{14} and break the circuit.

m, Figs. 1, 2, and 3, is the second contact-magnet in the same circuit as the printing-magnet, the spring-armature m' of which forms one of the terminals of a circuit, including the line-battery A, Fig. 22, and is adapted when attracted by the magnet m to make contact with the other terminal, m^2, of this circuit, which includes a contact-piece forming a terminal F, the switch-lever E, and line-wire B.

Although I have described the second contact-magnet m as being used for operating the armature m', I may in some cases make use of the printing-magnet f^7 for this purpose. I do not, however, prefer this arrangement, as the printing-magnet, having several parts to operate, does not work so quickly as the magnet m.

n n are resistance-coils in connection with the circuits containing the various circuit-closing devices, the said coils serving to diminish sparking, as will be well understood. I also employ condensers for the same purpose carried in the base of each apparatus.

The operation is as follows: Assume that two apparatuses, as described, are at each end of the line B and having their parts in the positions shown in Figs. 1, 2, 3, and 4 of the drawings, the said apparatuses being termed, respectively, the "transmitting" apparatus and "receiving" apparatus. The transmitting apparatus must have the switch-lever E moved so as to be in contact with the terminal F, while that of the receiving apparatus must be in contact with the terminal D, as shown in Fig. 23. If now one of the finger-keys a of the transmitting apparatus be depressed, the frame b^6 will cause the terminal b^9 to come in contact with the terminal b^{11}, thereby completing the local circuit, including the starting-magnet c^{21}, and energizing the same, whereby the armature c^{23} will be attracted and release the synchronizing arm c from the hook c^{22}, which arm, under the influence of the spring c^2, will commence to move in the direction of the arrow, Fig. 2. The armature c^{23} at the same time will come into contact with the terminal c^{24} and send a current to line B, which will pass through the switch-lever E and terminal D of the receiving apparatus and energize the synchronizing magnet c^{10} of the same, whereby the armature c^{11} of the arm c of this apparatus will be attracted and disengage the projection c^{14} from the hook c^{22}. By this it will be seen that the synchronizing arms in each apparatus will commence to move simultaneously. The arm c of the transmitting apparatus will then come in contact with the upper end of the spring-pin, which has been lifted by the depressed finger-key, and present a type corresponding with the said finger-key opposite the plunger f^3, the contact completing the circuit through the pin b, plate b', battery b^{10}, terminal k^{10}, terminal k^{11}, printing-magnet f^7, second contact-magnet m, spindle c', and arm c, and energizing the said magnets f^7 and m. The armature m' is consequently attracted and comes in contact with the terminal m^2, thereby sending a current to line B through the terminal F and switch-lever E, which, entering the receiving apparatus through the switch-lever E and terminal D, again energizes the synchronizing magnet of this apparatus, so as to again attract the armature c^{11} and cause the projection c^{13} to be thrust forward, thereby stopping the synchronizing arm c of this apparatus in contact with the spring-pin corresponding with the spring-pin which has been raised in the transmitting apparatus. This contact of the arm c with the spring-pin in the receiving apparatus also closes a circuit including its printing and second contact magnets, as in the transmitting apparatus, but the switch-lever E, being in contact with the terminal D, the second contact-magnet is consequently not in the line-circuit. The printing-magnets of both apparatuses being therefore energized attract their armatures f^8, which cause the screws h^5 to feed carriages h' along the rails h^3, the plungers f^3 to move the type to print upon the paper, and the pawls g^4 to feed the ink-ribbon g. The said armatures in their movement also move the bars k^6, so as to make contact between the terminals k^7 and k^8 and break contact between the terminals k^{10} and k^{11}, the contact between the terminals k^7 and k^8 being maintained by the engagement of the shoulders l on the bars l' with the projections k^{13}, thereby completing the circuit embracing the zero-magnets k k, which consequently attract their armatures k' and return the arms c to their initial or zero positions, where they again engage with the hooks c^{22} and at the same time impinge against the bars l^3 and disengage the shoulders l from the projections k^{13} and allow the

bars k^6 to fall back and move the terminals k^7 out of contact with the terminals k^8 and the terminals k^{10} to move into contact with the terminals k^{11}. By the operation of several finger-keys identical lines of type in both apparatuses will be printed.

By depressing any one of the finger-keys of the transmitting apparatus and releasing it before the synchronizing arm *c* reaches the spring-pin connected to such finger-key the said arm will pass over all the spring-pins and come into contact with the pin j^{13}, thereby again energizing the printing and second contact magnets, the latter of which again sends a current to line, so as to release the synchronizing arm of the receiving apparatus. The arms j^{12} in both apparatuses will then come into contact with one of the terminals j^{11} and cause it to make contact with the other terminal j^{11} to complete the circuits containing the column-magnets, thereby energizing the same, so as to attract their armatures and release the teeth *i* from the feed-screws h^5, whereby the carriages h' will be allowed to return to their initial position, the rollers *h* being simultaneously rotated to commence a fresh line.

By my invention it will be seen that the message is printed in both apparatuses and that the receiving apparatus requires no attendant while receiving a message.

Instead of the paper roll and carriage, as hereinbefore described, I sometimes employ a paper tape, upon which the type print, as illustrated in Figs. 24 and 25. In these figures *o* indicates the tape, arranged in a roll *p* upon a spindle *q*, revolving on centers *r r*, carried by brackets *s s*, formed on or attached to the pillars *d d*. The spindle *q* carries and is rotated by a wheel i^3, similar to that hereinbefore described in connection with the paper roll and carriage and actuated by the printing-magnet in a similar manner, the proportions of the connections being slightly modified in order to impart the required amount of feed at each depression of a key $a^\times$ or *a*. *t* is a roller for guiding the tape onto the roll *o'*, the said roller being carried by arms *u u*, connected to the brackets *s s*. By this arrangement it will be understood that the column-magnet can be dispensed with.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In printing telegraphic transmitting or receiving apparatus the combination of a series of spring-pins arranged in the arc of a circle, finger-keys connected to the said pins, a circuit-closing device in connection with the said keys, an arm arranged to work over the pins and provided with a movable hook projection and armature operatively connected, a magnet the armature of which is adapted to engage with the said hook and close the line-circuit, a weight or spring for operating the arm in one direction, a magnet for operating it in the other direction, a magnet for operating the armature on the arm, a series of type arranged in the arc of a circle and connected with the said arm, and a magnet the armature of which is arranged to close the line-circuit, all substantially as described.

2. In a printing-telegraph the combination with the revolving spindle provided with a synchronizing arm, and a series of stop-pins adapted to be moved into the path of said arm, of a weight loosely mounted on said spindle and means connecting said spindle with the weight for movement in one direction only, substantially as described.

3. In a printing-telegraph the combination with the revolving spindle, synchronizing arm and series of stop-pins adapted to be moved into the path of said arm, of a weight loosely mounted on said spindle and having a part provided with ratchet-teeth and a part connected with said spindle having a pawl engaging said teeth, whereby said weight will move with said spindle in one direction only, substantially as described.

4. In a printing-telegraph, the combination with the spindle, the synchronizing arm, a series of stops adapted to be moved into the path of said arm, a series of movable type carried by said spindle, a stationary plunger for impressing said type, the paper-carriage and a screw for operating the same, of means for starting said synchronizing arm and moving one of said stops into its path, a printing-magnet for operating said plunger and the said screw, and means for returning the parts to their initial positions, substantially as described.

5. In a printing-telegraph the combination with the synchronizing arm, and a series of stops adapted to be moved into the path of said arm, of a magnet for returning said arm to its initial position, the printing-magnet a bar operated by the printing-magnet to close a circuit through the returning-magnet, and a part operated by said bar for breaking the circuit through the printing-magnet, substantially as described.

LEO KAMM.

Witnesses:
CHARLES G. REDFERN,
A. ALBUTT.