No. 888,335. PATENTED MAY 19, 1908.

C. L. KRUM.

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APPLICATION FILED AUG. 22, 1903.

16 SHEETS—SHEET 1.

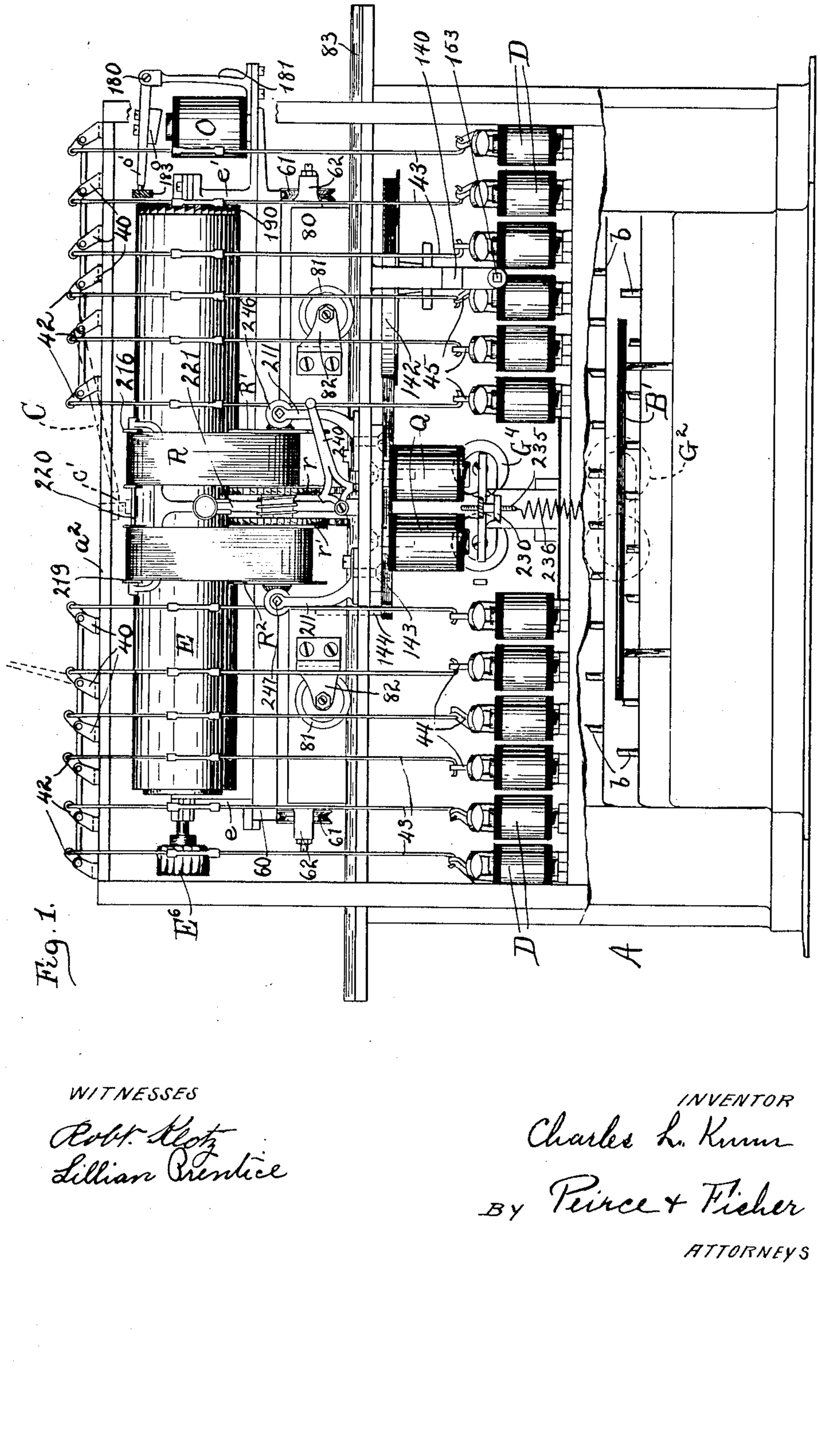

Fig. 1.

WITNESSES

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16 SHEETS—SHEET 2.

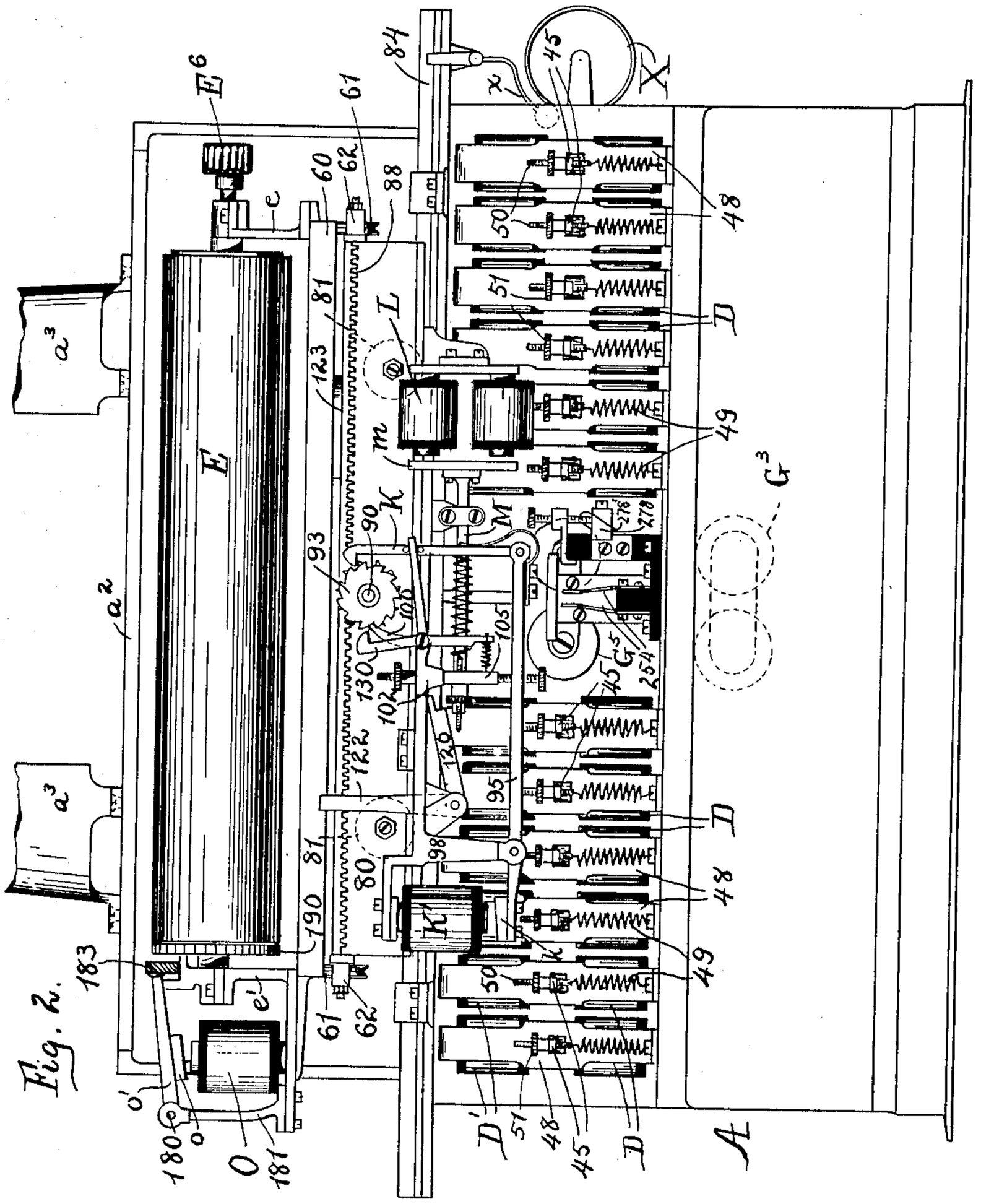

Fig. 2.

WITNESSES

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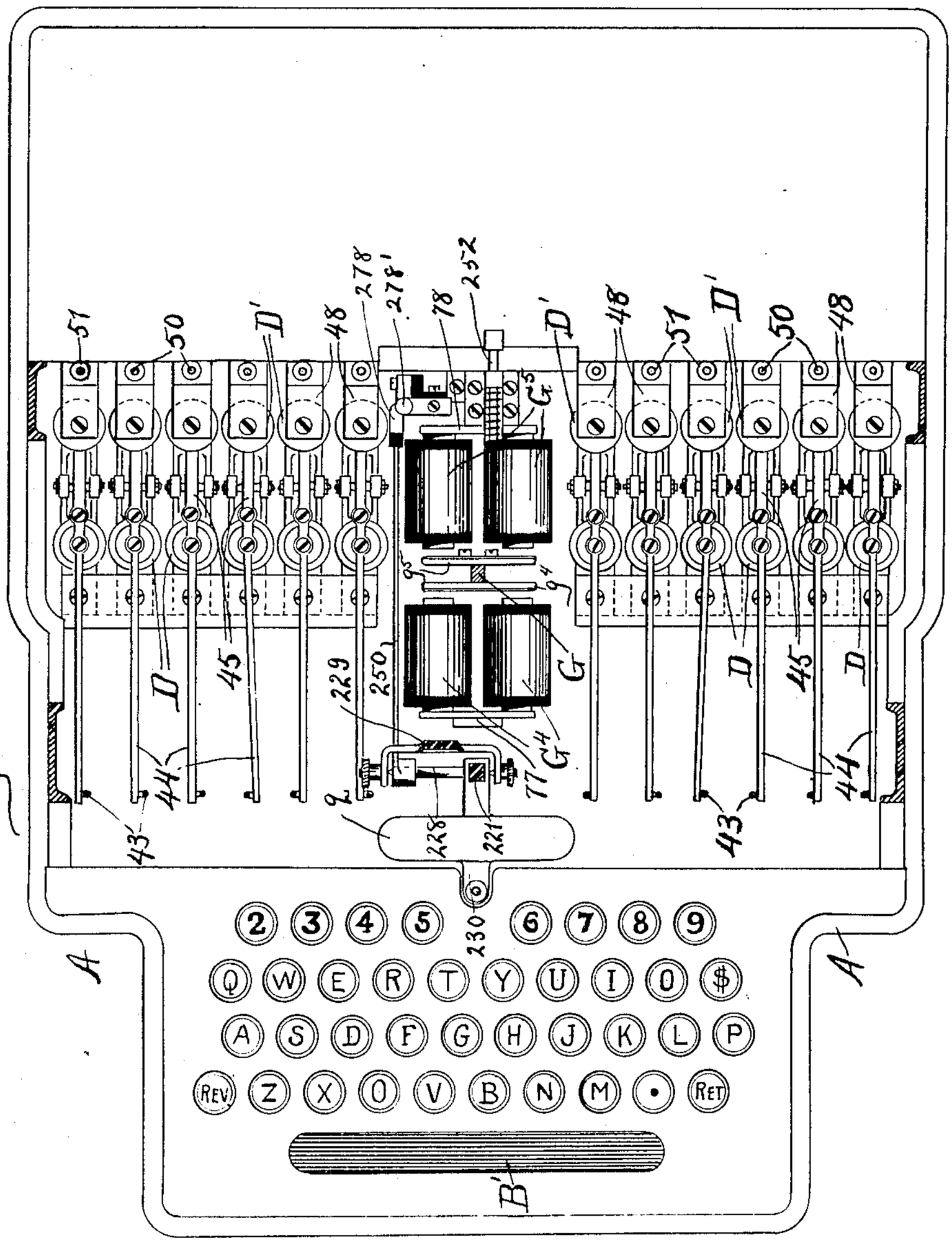
16 SHEETS—SHEET 3.

Fig. 3.



WITNESSES

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Fig. 4.

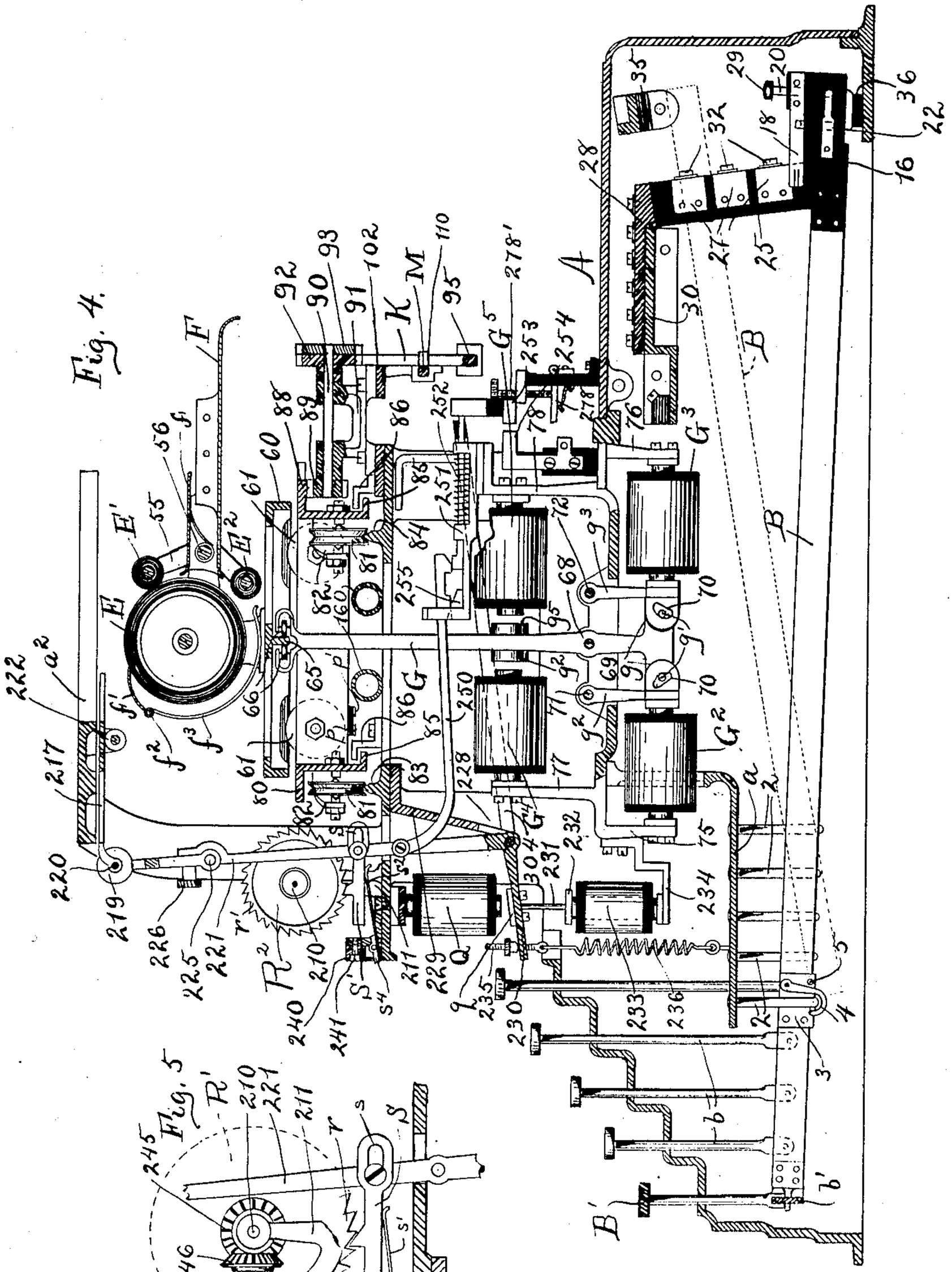

Fig. 5.

WITNESSES

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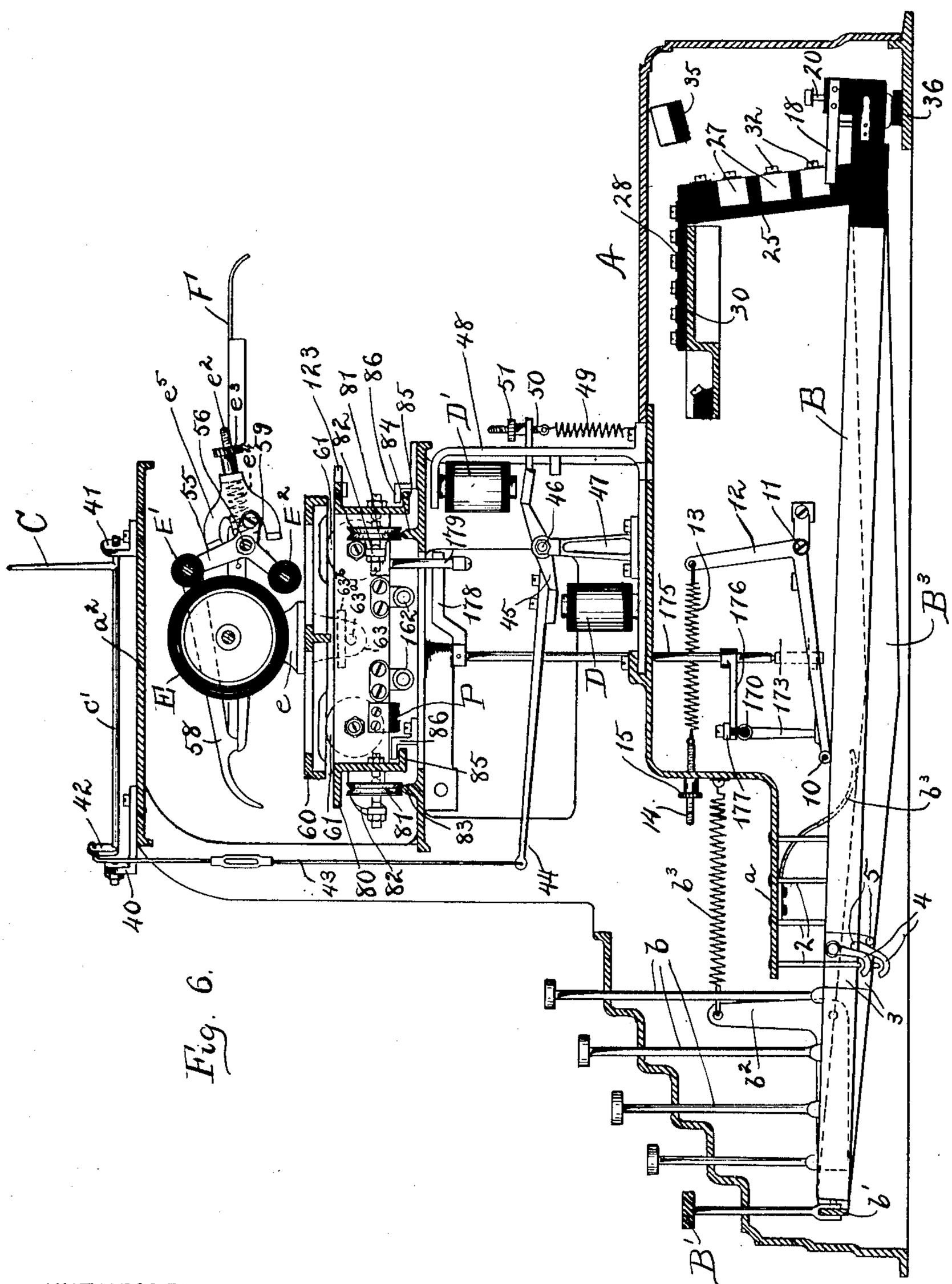

Fig. 6.

WITNESSES

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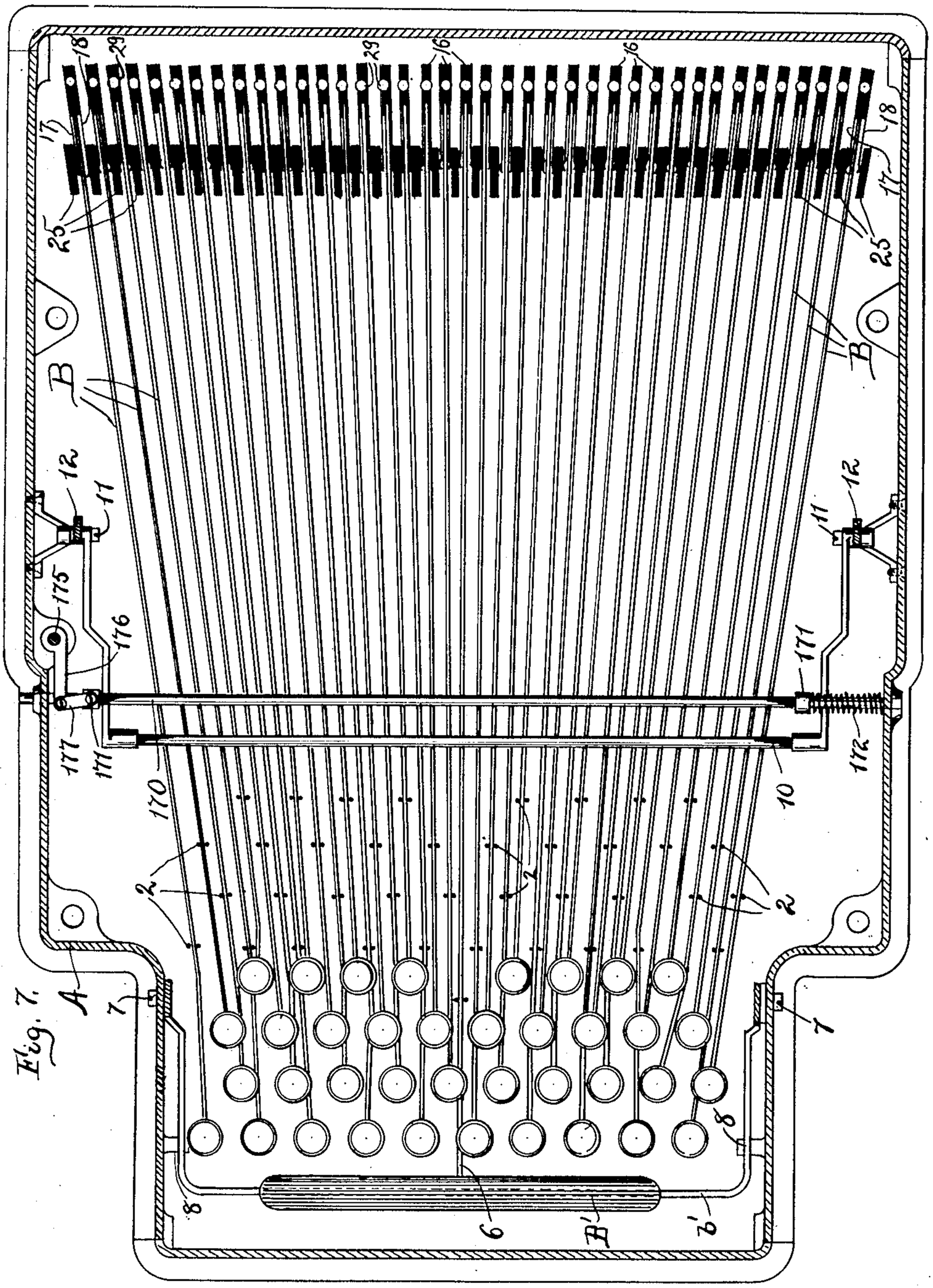

Fig. 7.

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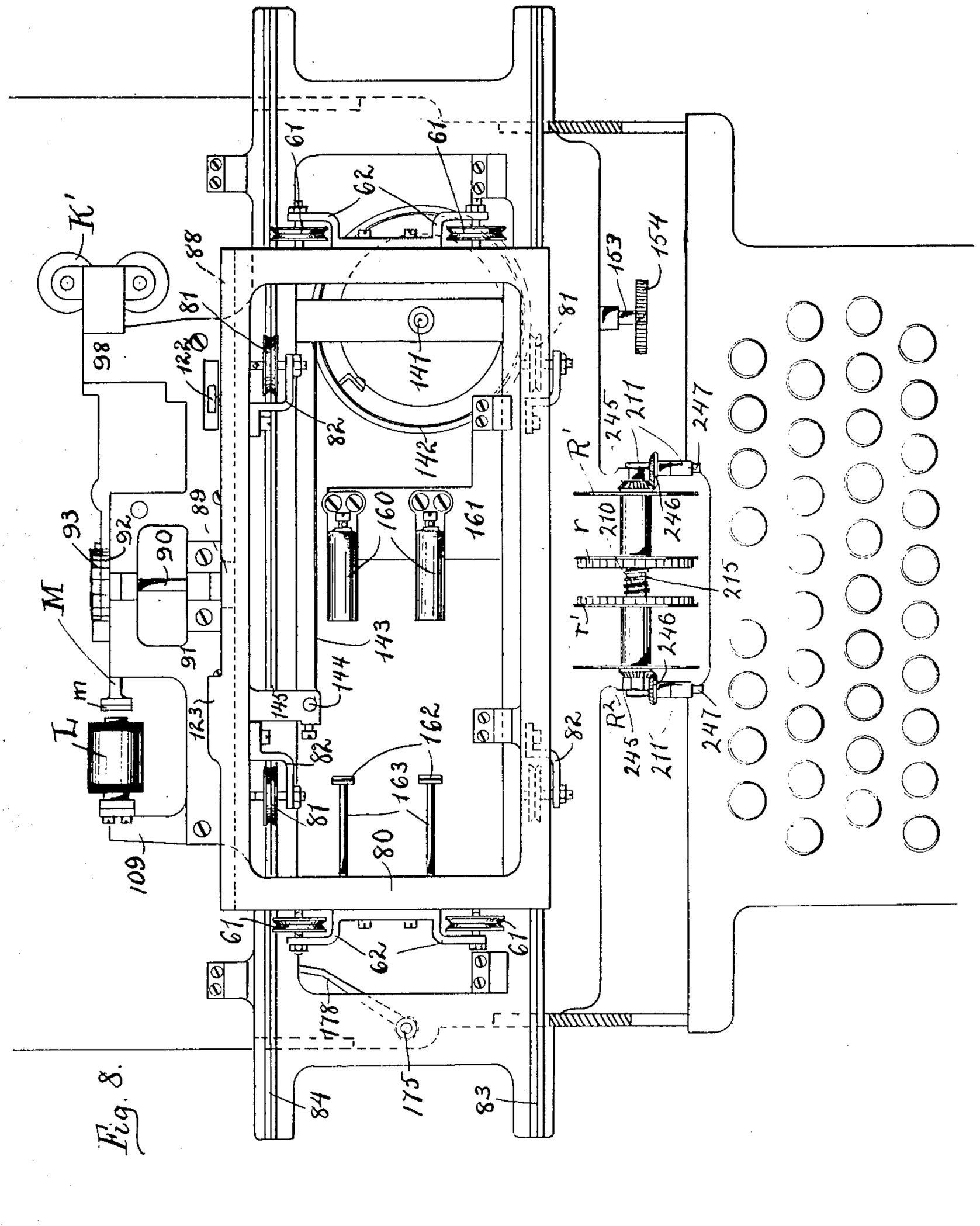

Fig. 8.

WITNESSES

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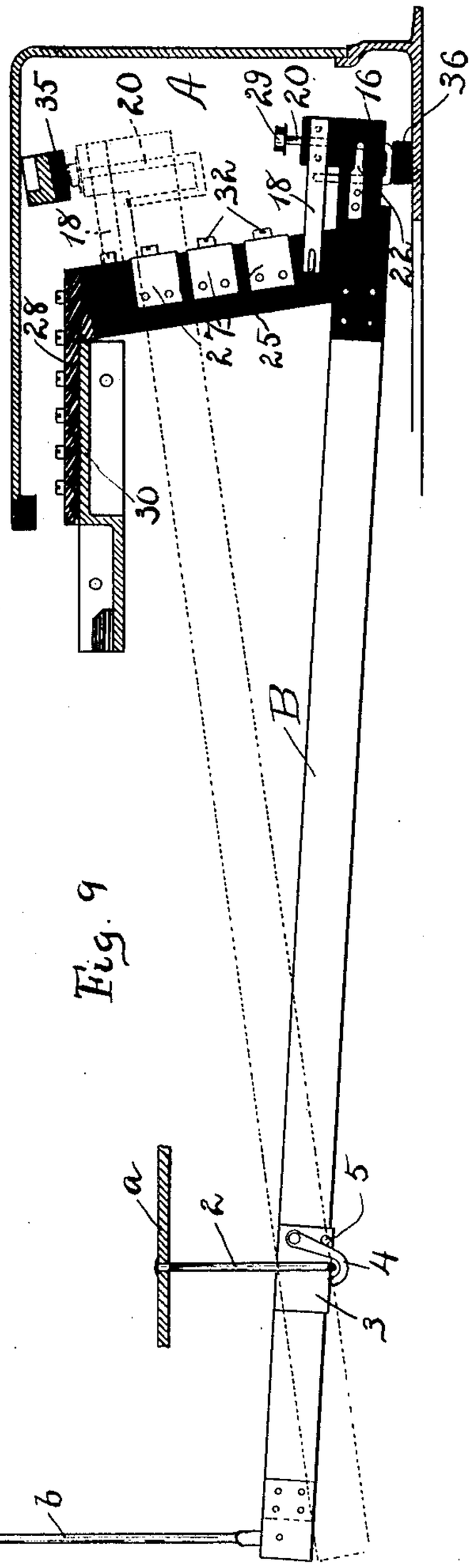


Fig. 9

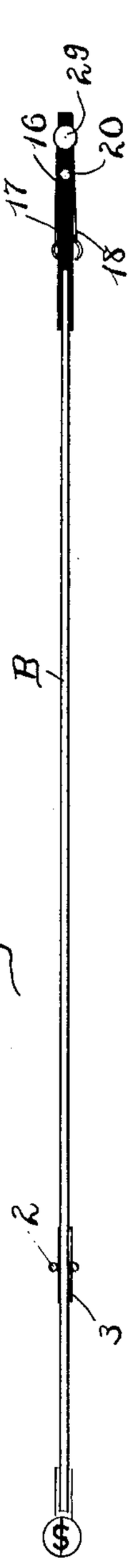


Fig. 10.

Fig. 11.

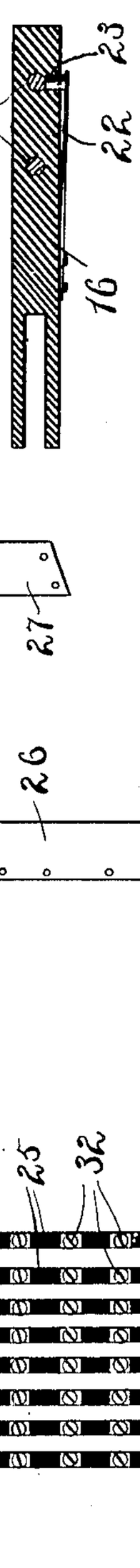


Fig. 14.

Fig. 13.

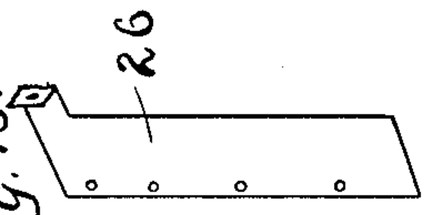
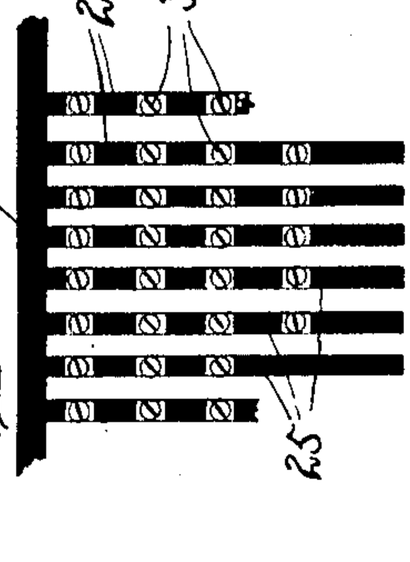


Fig. 12



WITNESSES

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Fig. 15.

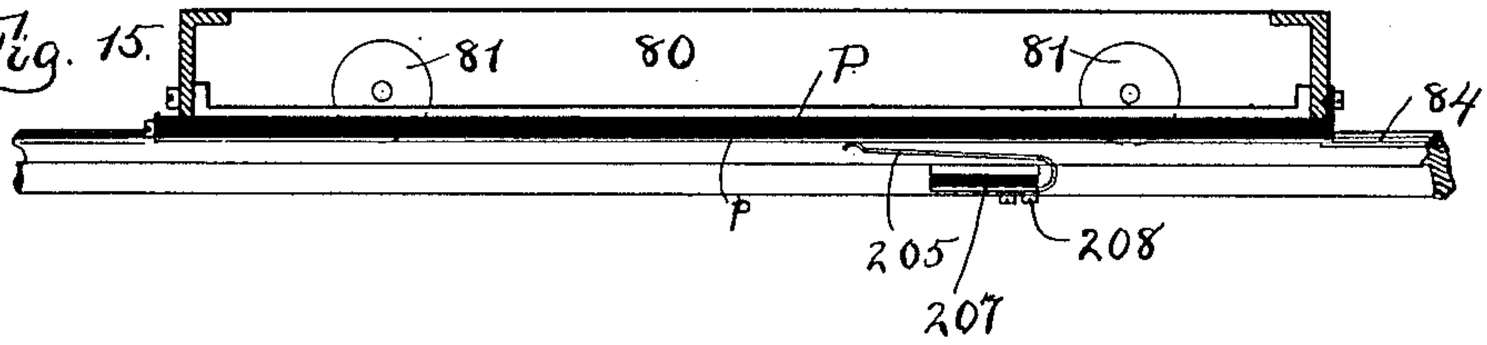

Fig. 16

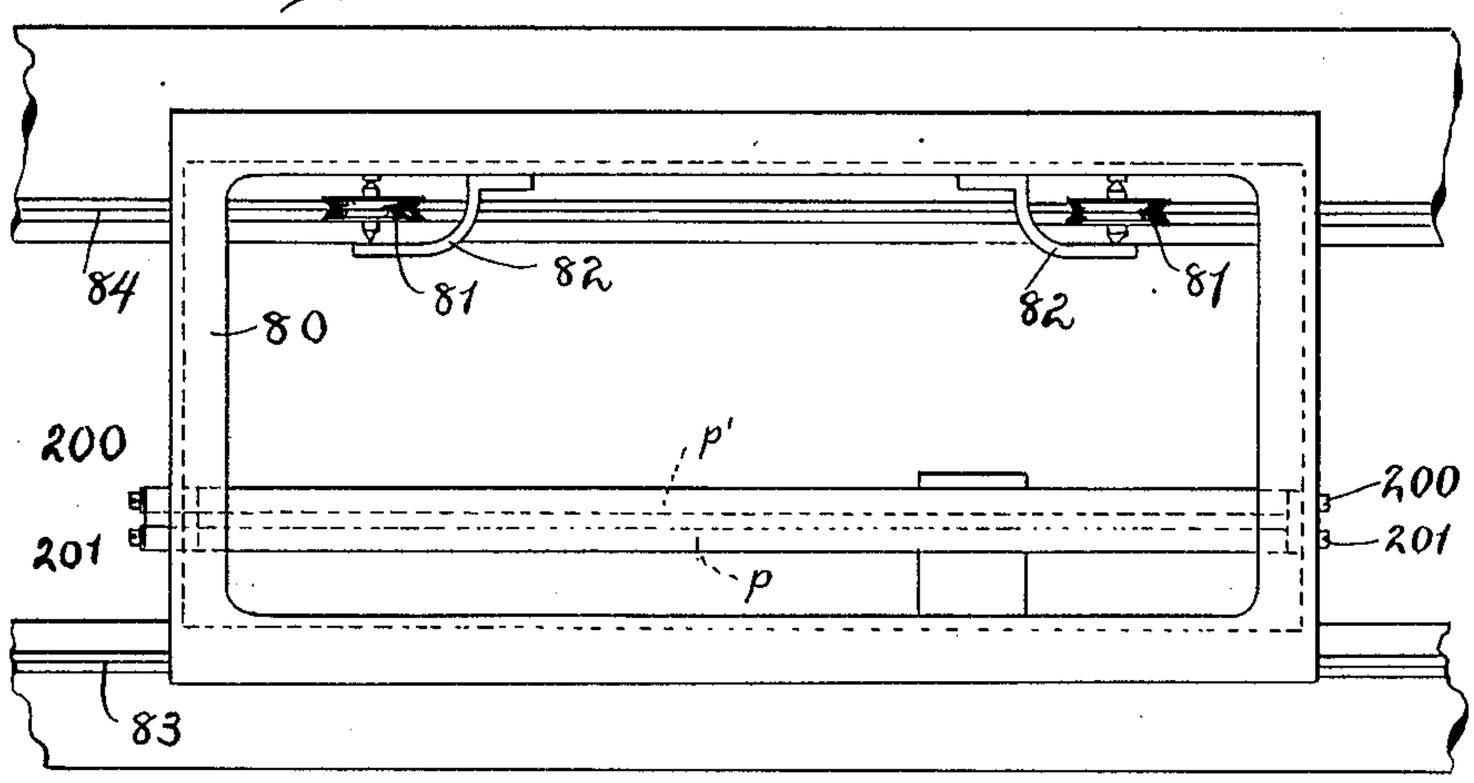

Fig. 17

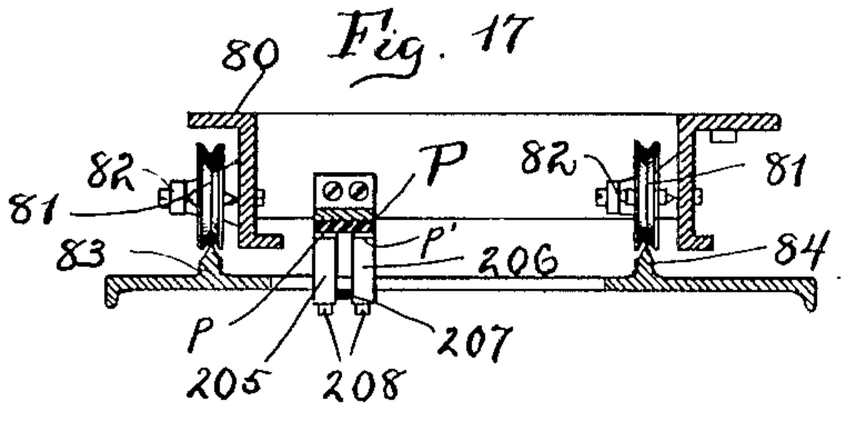

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Fig. 18.

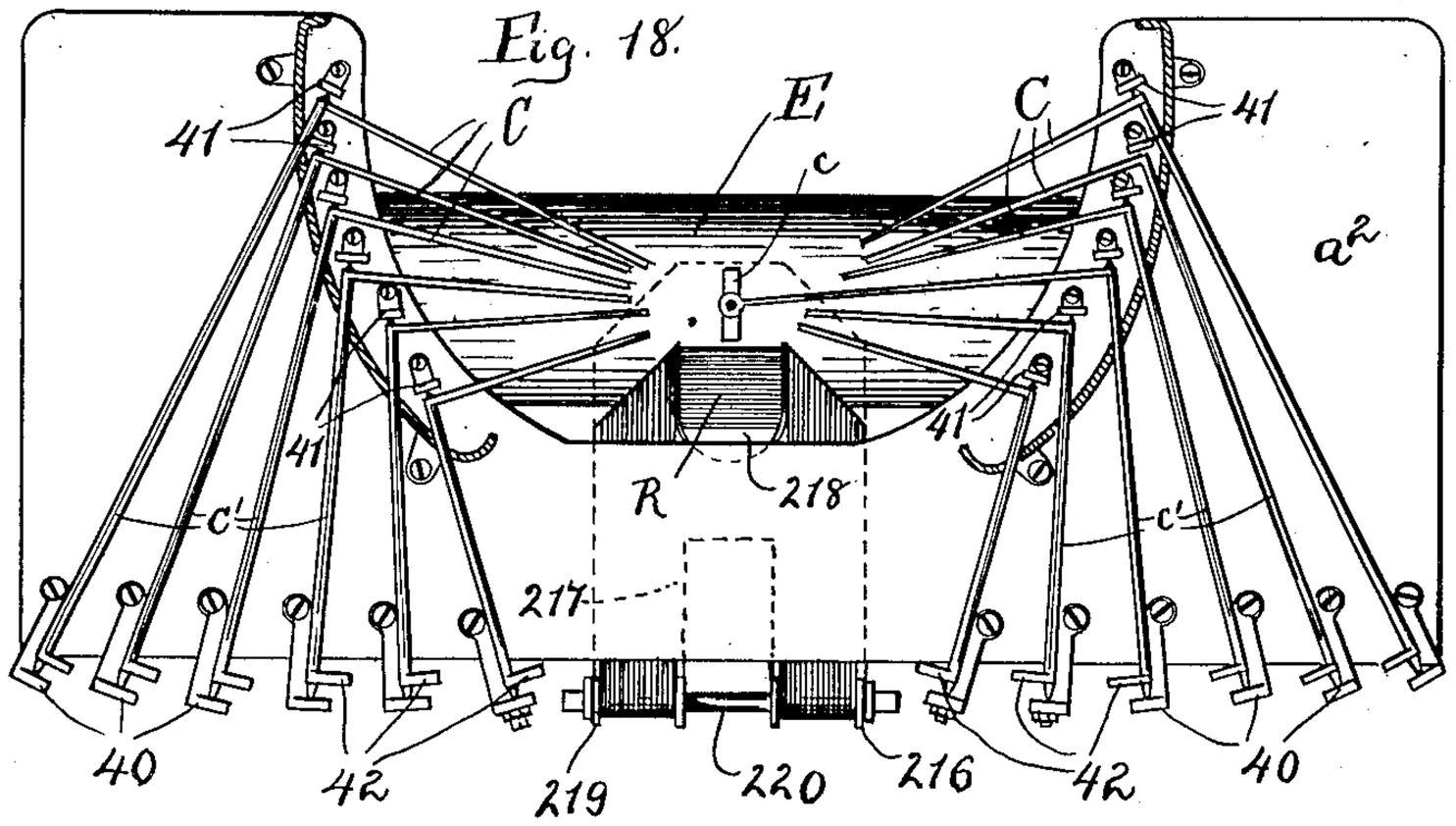
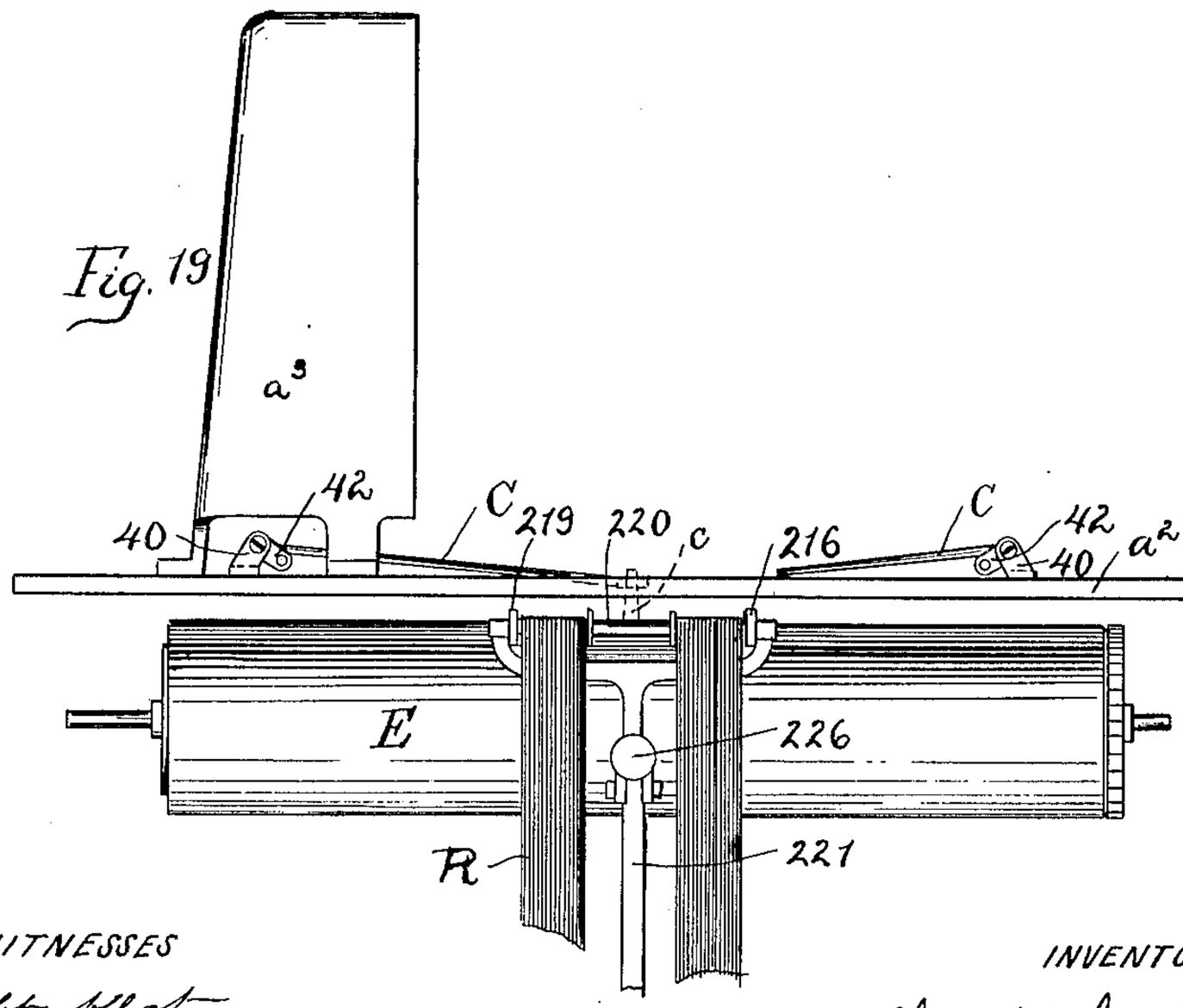


Fig. 19



WITNESSES

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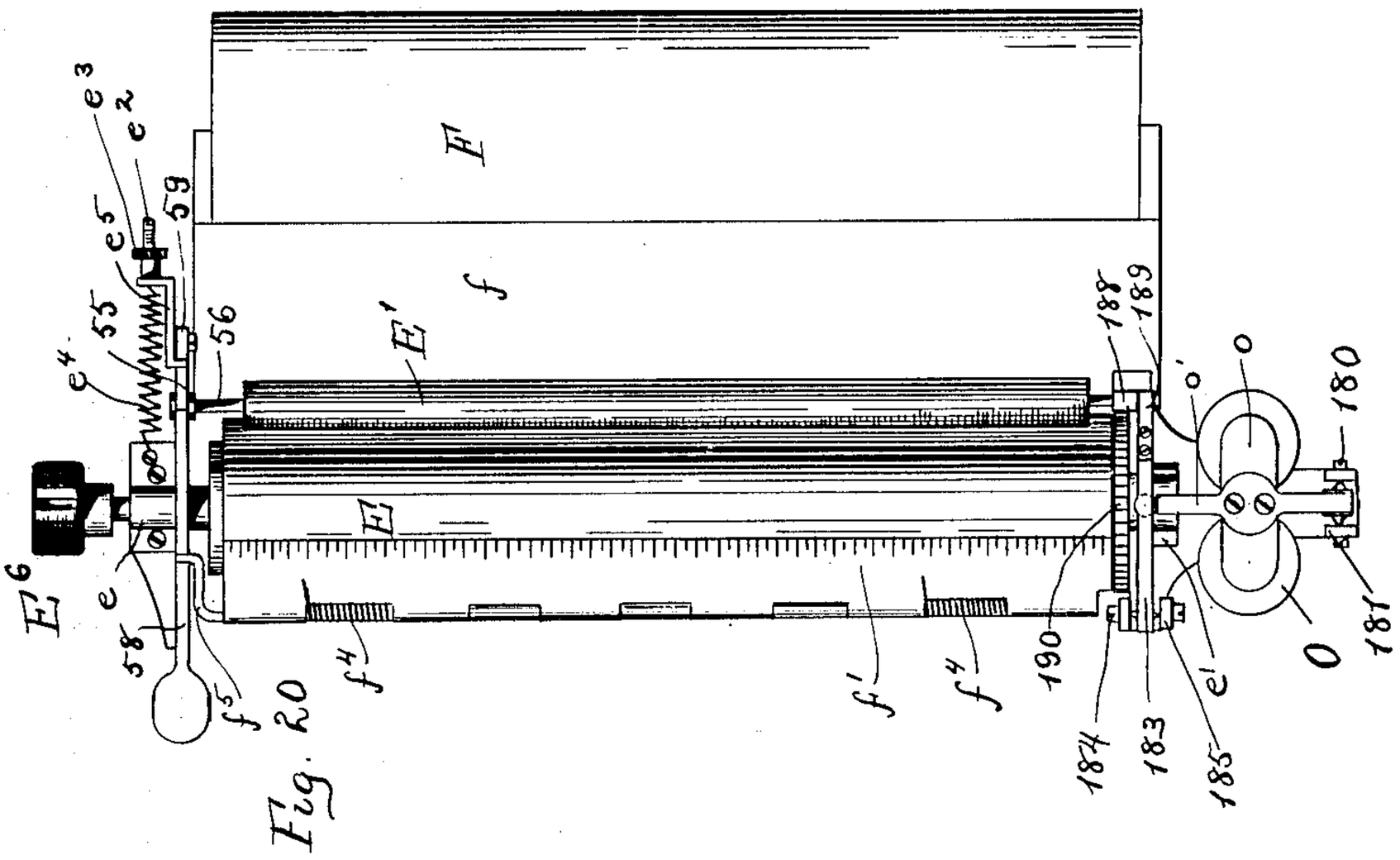

Fig. 20

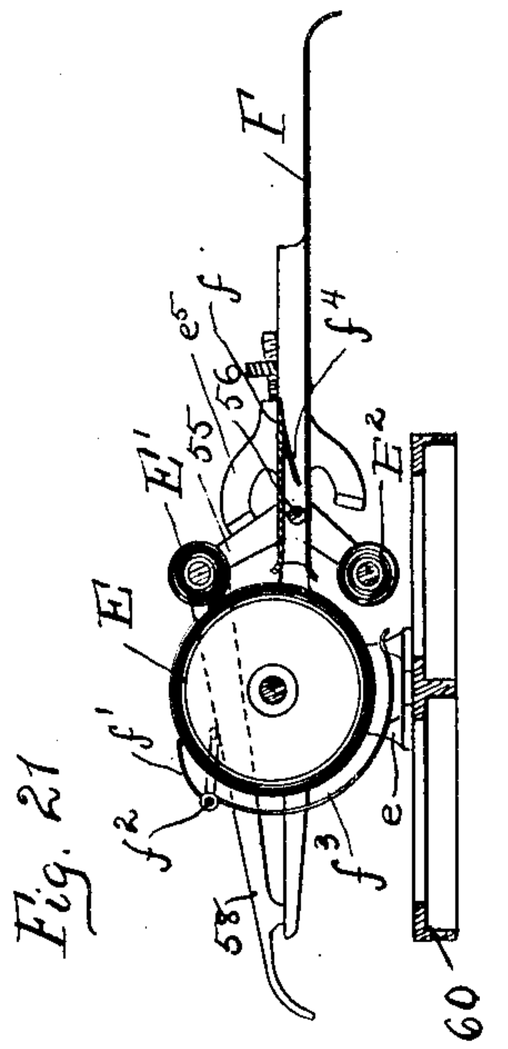

Fig. 21

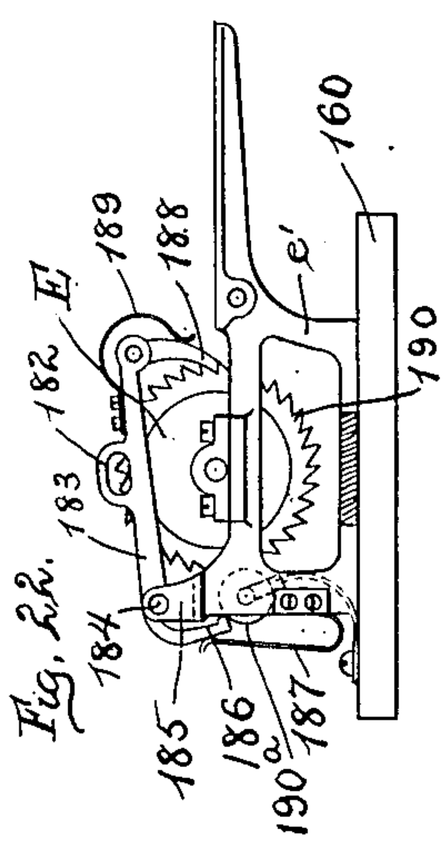

Fig. 22.

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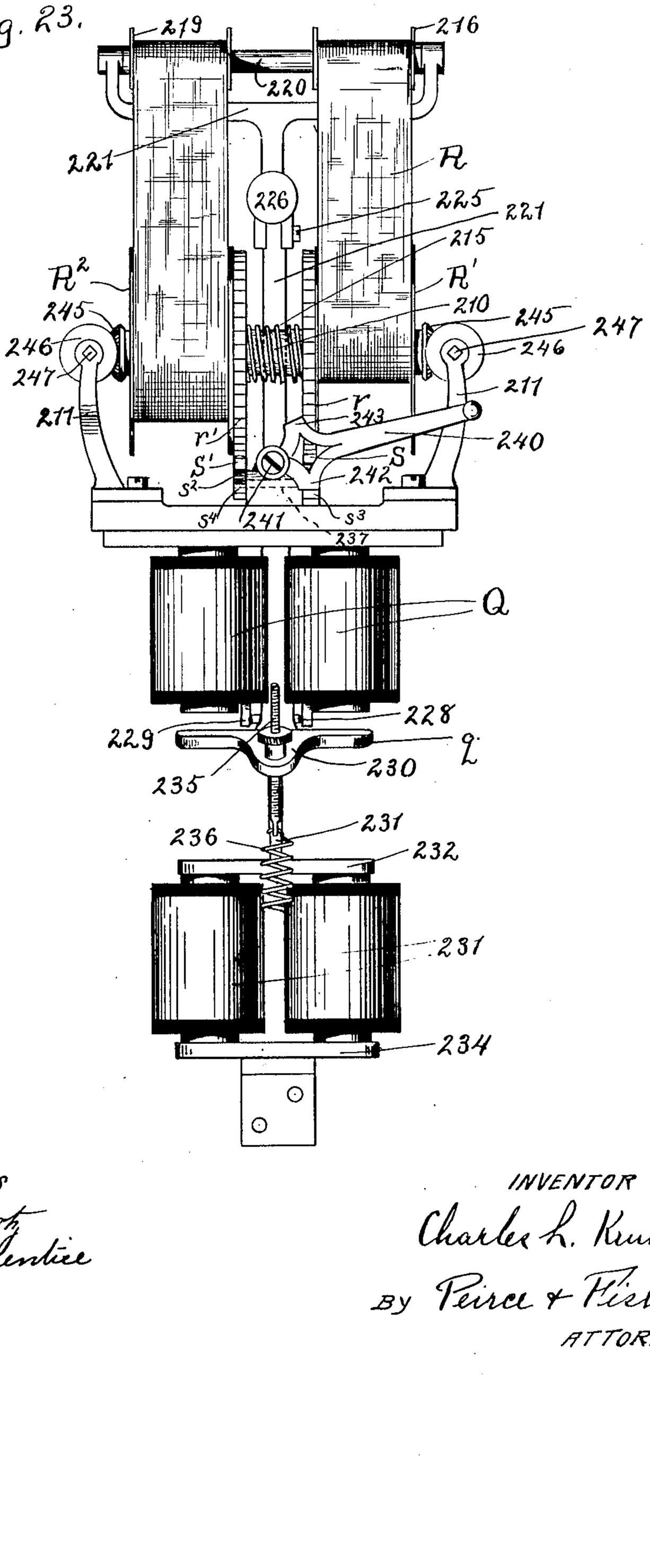
Fig. 23.



WITNESSES

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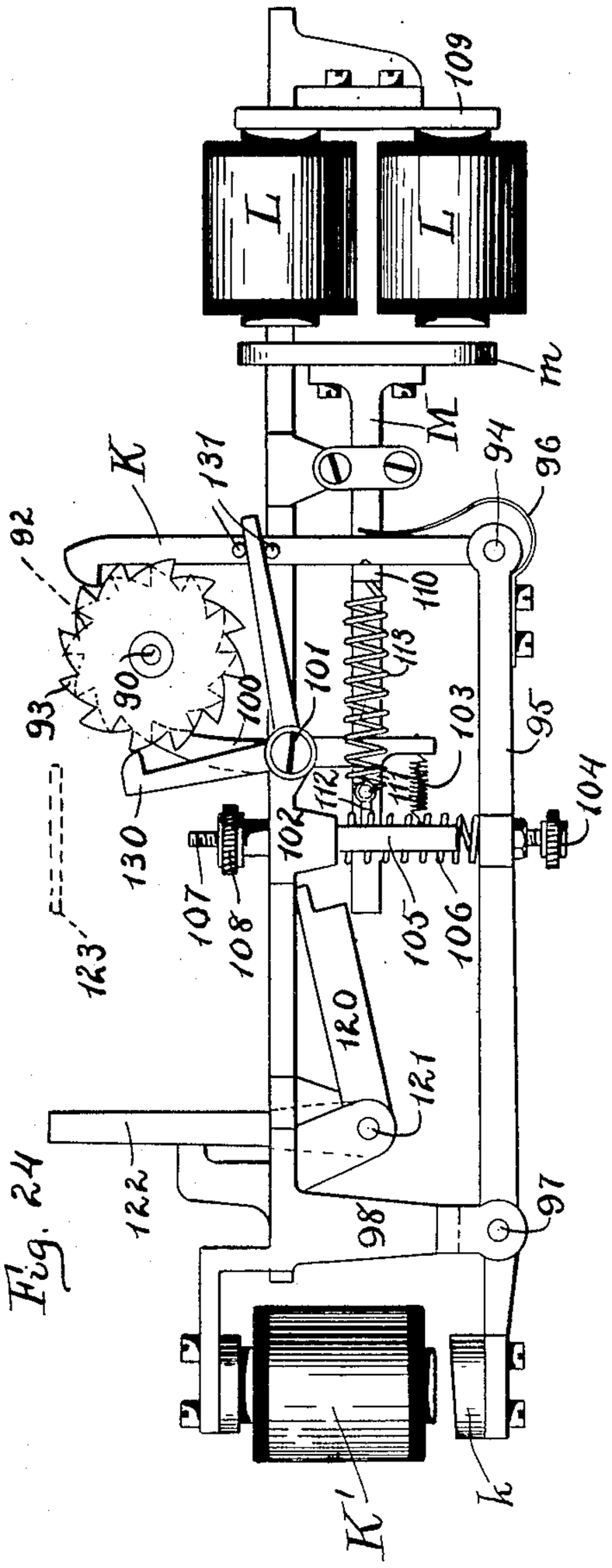

Fig. 24

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Fig. 25.

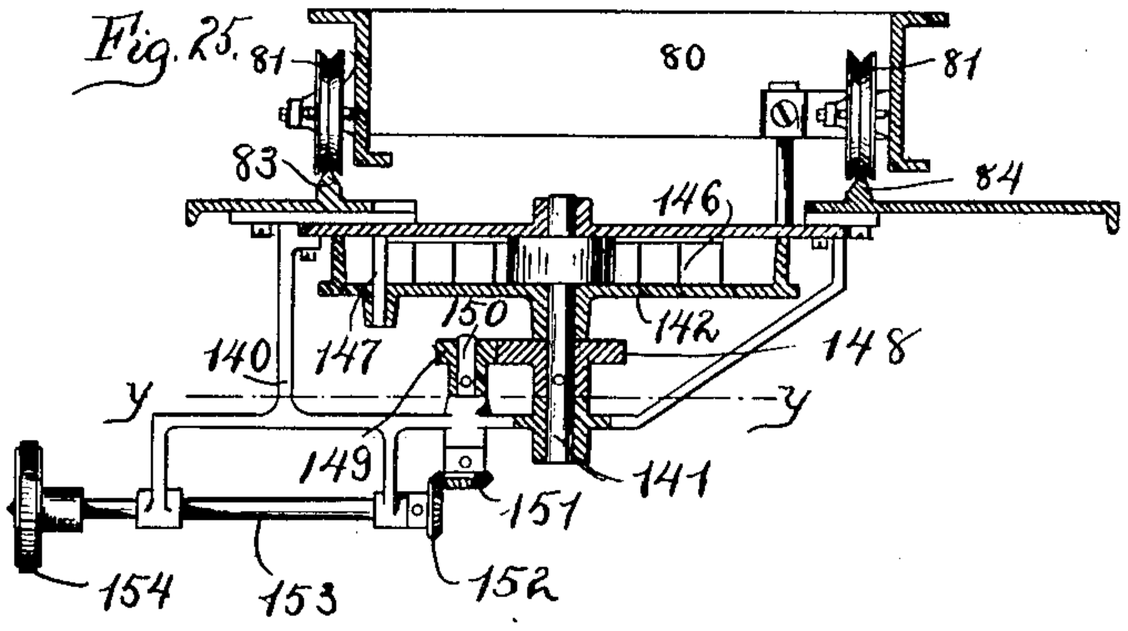


Fig. 26.

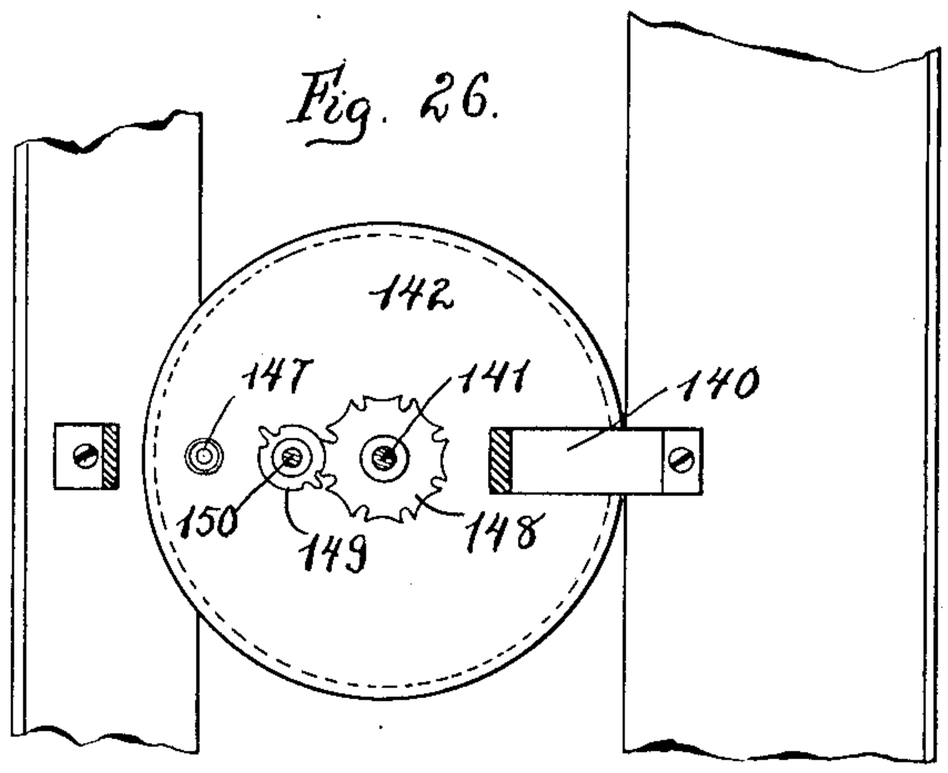
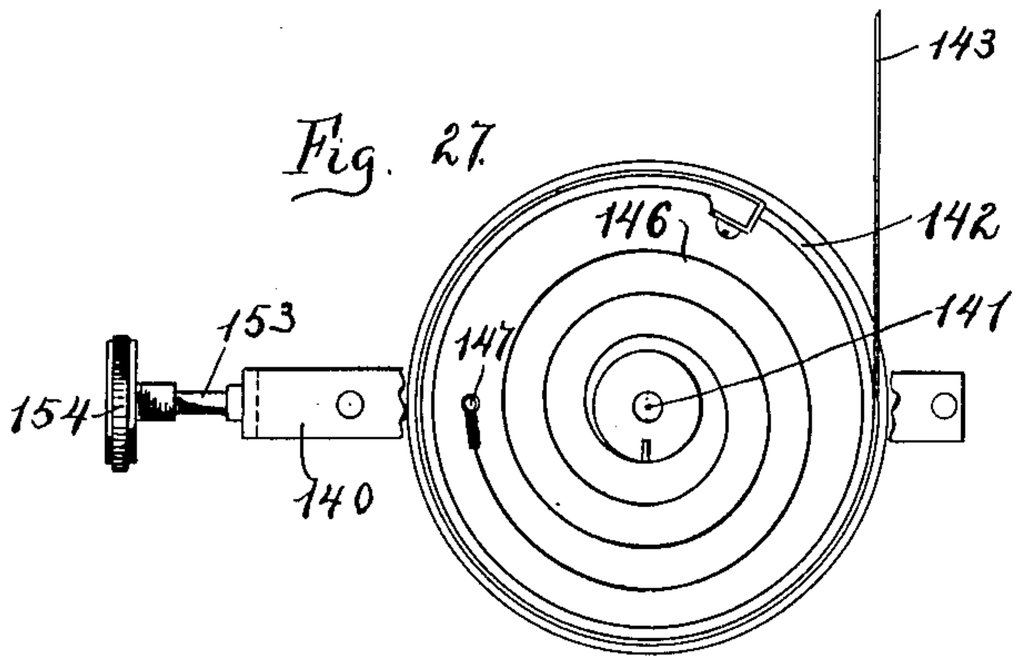


Fig. 27.



WITNESSES

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No. 888,335. PATENTED MAY 19, 1908.

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APPLICATION FILED AUG. 22, 1903.

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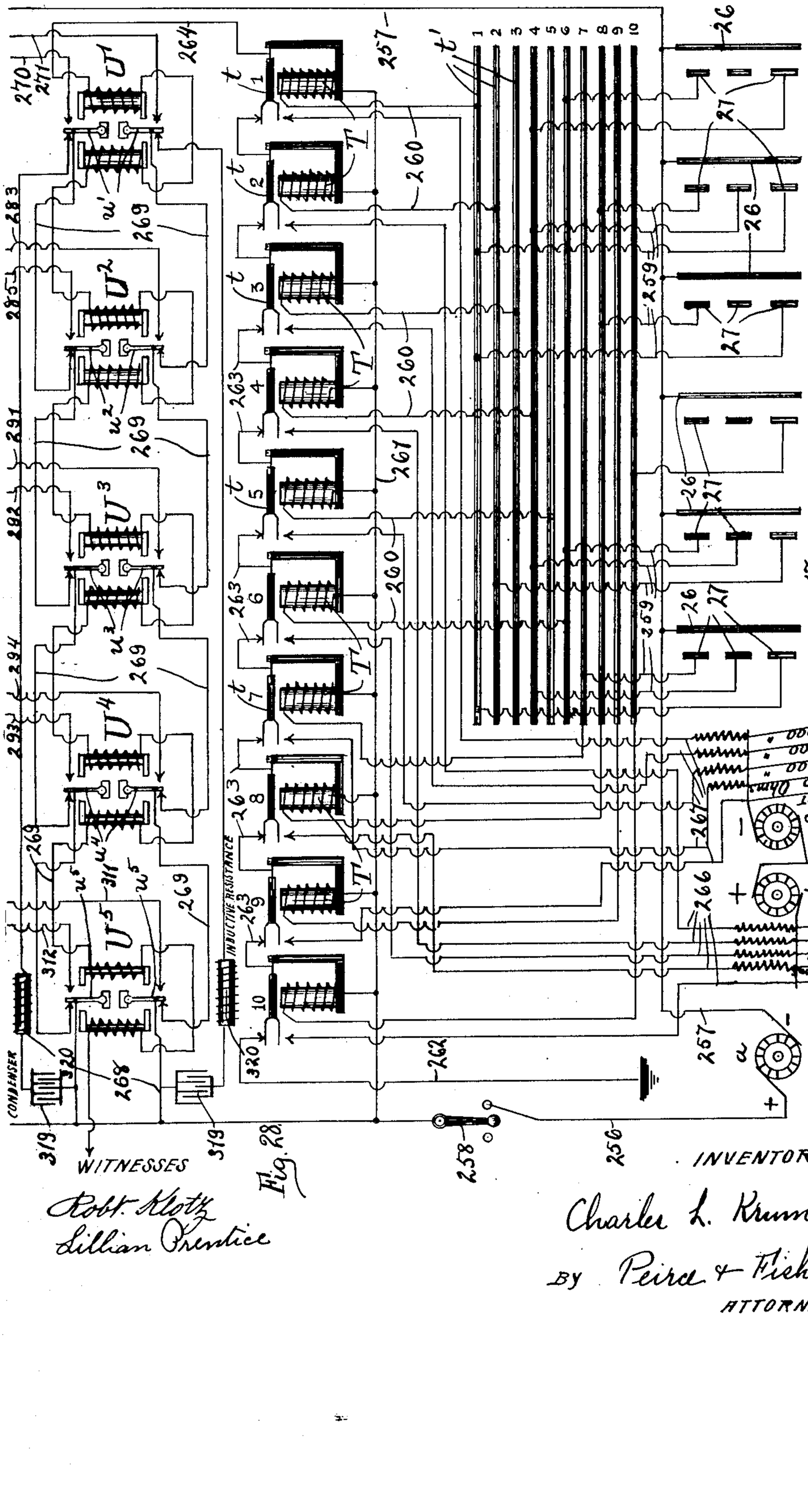

No. 888,335. PATENTED MAY 19, 1908.

C. L. KRUM.

PRINTING TELEGRAPH.

APPLICATION FILED AUG. 22, 1903.

16 SHEETS—SHEET 16.

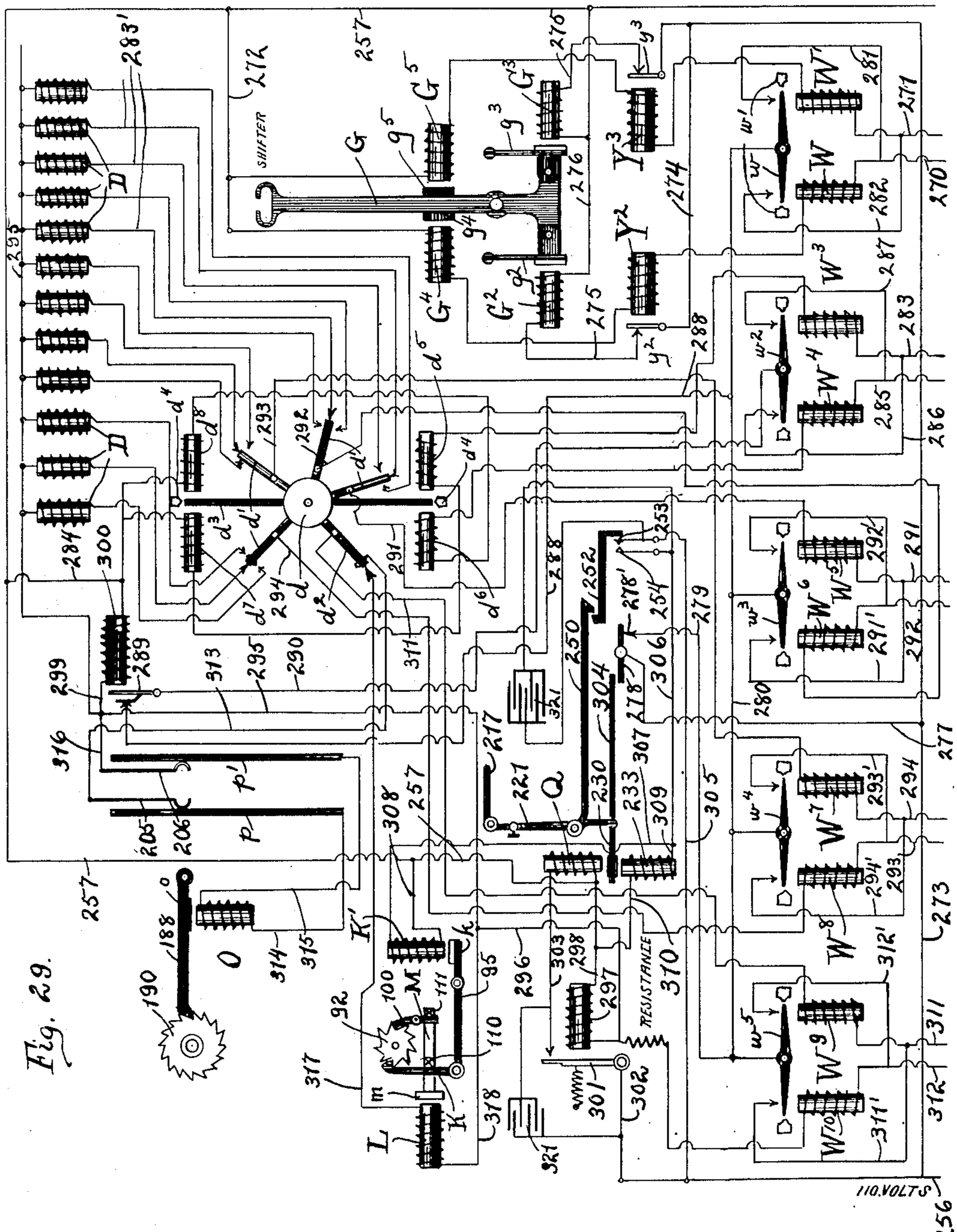

Fig. 29.

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UNITED STATES PATENT OFFICE.

CHARLES L. KRUM, OF CHICAGO, ILLINOIS.

PRINTING-TELEGRAPH.

No. 888,335. Specification of Letters Patent. Patented May 19, 1908.

Application filed August 22, 1903. Serial No. 170,419.

To all whom it may concern:

Be it known that I, CHARLES L. KRUM, a citizen of the United States, and a resident of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a full, clear, and exact description.

This invention has relation more particularly to that class of printing telegraphs in which the messages transmitted are reproduced at the receiving station by being printed upon sheets of paper as in ordinary typewriter work.

The main object of the invention is to provide improved means for the reproduction of the messages at the receiving station although features of the invention will be found applicable for use in other situations.

The invention consists in the features of improvement hereinafter described, illustrated in the accompanying drawings and particularly pointed out in the claims at the end of this specification.

Figure 1 is a front view of my improved machine, certain parts being omitted. Fig. 2 is a view in rear elevation. Fig. 3 is a view in horizontal section through the main frame of the machine, the upper parts of the mechanism being omitted. Fig. 4 is a view in vertical cross-section. Fig. 5 is an enlarged detail view of part of the mechanism for actuating the inking ribbon. Fig. 6 is a view in vertical cross-section adjacent the inner side wall of the main frame, parts being shown in elevation. Fig. 7 is a view in horizontal section through the base portion of the main frame a slight distance above the key levers, the finger pieces of the key levers being shown in plan. Fig. 8 is a plan view of the upper portion of the main frame, certain parts sustained thereby and the main paper carriage upon the main frame. Fig. 9 is a detail view showing one of the key levers and circuit controlling mechanism at the inner end thereof, parts being shown in vertical section. Fig. 10 is a detail plan view of the key lever shown in Fig. 9. Fig. 11 is an enlarged detail plan view of the inner end of one of the key levers, the contact brushes being removed. Fig. 12 is a detail view in rear elevation of the bars that support the contact plates with which the key lever brushes coöperate. Fig. 13 is a detail view in perspective of one of the contact strips. Fig. 14 is a detail perspective view of one of the individual contact plates. Fig. 15 is a detail view in vertical longitudinal section through the frame of the main paper carriage showing the contact rail beneath the same. Fig. 16 is a detail plan view of the main paper carriage, its supporting rails and the contact rail beneath the main carriage. Fig. 17 is a view in central cross-section through the parts shown in Figs. 15 and 16. Fig. 18 is a detail plan view of the part of the main frame above the paper carriage platen together with the type bars, their hangers and part of the inking ribbon mechanism. Fig. 19 is a detail view in front elevation of the platen, a part of the inking ribbon and its support in front thereof and certain of the type bars. Fig. 20 is a detail plan view of the platen and mechanism for feeding the paper thereto and adjacent parts. Fig. 21 is a view in vertical cross-section through the supplemental paper carriage or platen support adjacent one end of the platen, certain parts being shown in cross-section. Fig. 22 is a detail view in end elevation of the platen supporting frame, the platen and part of the mechanism for effecting the line-space movement of the platen. Fig. 23 is an enlarged detail view in front elevation of the inking ribbon and parts of the mechanism whereby it is supported and controlled. Fig. 24 is an enlarged detail view of the pawl and ratchet mechanism for imparting the letter-space movement to the paper carriage, adjacent parts being shown in elevation. Fig. 25 is a detail view in vertical cross-section through the main paper carriage, the spring drum for retracting said carriage, and the carriage rails, certain connected parts being shown in elevation. Fig. 26 is a view in cross-section on line *y*—*y* of Fig. 25, the parts being shown inverted. Fig. 27 is a detail plan view of the carriage retracting spring and drum with the cover removed. Figs. 28 and 29 are diagrams of the operating circuits.

The various details of construction will first be described and thereafter the electrical circuits and connections whereby the operation of the parts is effected will be set forth.

The frame A of the machine will be of the appropriate construction and shape to receive the various parts of the mechanism. As shown, the front of the frame is stepped (see Figs. 4 and 6) to form a key board through which extend the stems *b* of the key levers B, the heads of the stems *b* being provided with the usual finger pieces marked with characters corresponding to the various

key levers, etc. The key levers B are removably pivoted upon U-shaped hangers 2 that depend from the portion *a* of the top plate of the main frame at the rear of the key board, the key levers B being furnished preferably with U-shaped metal bearing plates 3 extending around the bottom and sides of the key levers (see Figs. 9 and 10) these bearing plates formed with notches to receive the hangers 2. Preferably guard hooks 4 pivoted as shown, to the bearing plates 3, are employed to more securely retain the key levers in position upon their hangers and each of the bearing plates is shown as provided with a "hump" or slight offset 5 over which the hook 4 may be sprung, this offset serving to retain the hook in the position shown in Figs. 6 and 9 of the drawings. The hangers 2 are arranged in rows corresponding in distance apart with the several banks of keys, thereby insuring uniformity of touch in action to the keys.

At the front of the key board there is arranged a spacer bar B′ that is connected with the key lever 6 corresponding in construction to the key levers B of the several finger keys. The spacer bar B′ (see Fig. 7) is supported upon a U-shaped frame *b′* pivoted as at 7 to the sides of the main frame, the downward movement of this U-shaped frame being limited by lugs 8 projecting inwardly from the sides of the main frame and beneath the U-shaped frame *b′*. Across the top of the several key levers B and from side to side of the machine extends the universal bar 10, the arms of which are pivoted to the sides of the main frame as at 11 and are formed with the upper extensions 12 (see Fig. 6) to which are connected coil springs 13 that serve to press the universal bar and consequently the various key levers, down to normal position. By reference more particularly to Fig. 6 of the drawings it will be seen that each of the tension springs 13 has its forward end connected to a threaded rod 14 that extends to the front of the main frame and is fitted with an adjusting nut 15 that enables the tension of the spring 13 to be adjusted as desired.

Each of the key levers B has mounted upon its rear end a block of insulating material 16 that is slotted to receive the rear end of the key lever (see Figs. 9—12) and upon this block of insulating material are mounted two contact brushes 17 and 18 normally insulated from each other and projecting forwardly from the upturned end of the angular insulating block 16. Each of the key levers B is provided with means whereby the brushes 17 and 18 shall be in electrical connection while the key is performing its functions and whereby these contact plates shall be electrically disconnected when the key has completed its function. Preferably this contact between the plates 17 and 18 of each key lever is effected by means of the U-shaped pin 20, the arms of which pass through holes or sockets in the insulating block 16. Each of the pins 20 loosely fits its socket so that it may be shifted in such manner that its shorter arm may be forced between the brushes 17 and 18 to close the electrical circuit therethrough or may be shifted from between these contact plates to electrically disconnect them. To prevent the accidental shifting of the pin 20 I prefer to attach to the side of the insulating block 16 a spring plate 22 having at its end a pin 23 that passes through the side of the insulating block 16 and bears lightly against the pin 20 so as to hold it by frictional contact in any position to which it may be moved.

The brushes 17 and 18 on the rear end of each of the key levers, have their free ends arranged to work between a plurality of contact bars or supports 25 that are arranged beneath the top plate of the main frame at its rear. These contact bars are arranged as a grid or grating and each of the bars has attached to one of its sides a continuous metal contact strip 26 and to its opposite side one or a number of individual contact plates 27 that are embedded in the hard rubber or like material of which the bars 25 are formed. The upper ends of the bars 25 are secured to or formed in piece with the top plate 28 of hard rubber or like insulating material that rests upon and is secured to a bridge plate 30 extending from side to side of the base of the main frame at its rear. Preferably the contact strips 26 are formed with angular portions whereby they may be securely fastened to the edges of the bars 25 and in like manner each of the contact plates 27 is shown as formed with an offset part adapted to extend over the edge of the corresponding bar 25 and to receive a set screw 32. The screws 32 of the contact plates 27 serve as binding posts for these plates to which binding posts will be connected electric wires that will lead to an electrical selective apparatus which will be connected with the various electro magnets in the machines of both the sending and receiving stations, it being understood that the machine herein described is used for both the sending and receiving instruments. The purpose of the contact plates 27 is by their number and by their connections to enable the actuation of any one of the key levers B to cause the electrical selective apparatus to appropriately energize such electric magnets of the machine at the sending and receiving stations as may be in electrical connection with the various contact plates with which such key lever is designed to co-act.

By reference more particularly to Fig. 9 of the drawings it will be seen that when the key levers B are in their normal position, as shown by full lines, the U-shaped pin 20 serves as a bridge or electrical connection between the contact brushes 17 and 18 and as

these contact plates are of spring metal they will bear upon the opposite sides of the shorter arm of the U-shaped pin 20. If, now, the operator depresses one of the character keys, the rear end of the corresponding key lever B will be raised, thereby lifting the brushes 17 and 18 and causing them to pass respectively over the contact strip 26 and contact plates 27 between which the brushes 17 and 18 of such key lever move. Hence, as the brushes 17 and 18 thus travel in upward direction, they will successively close the circuits between the individual contact plates 27 upon one of the bars 25 and the individual contact strip 26 upon the next adjacent bar, thereby permitting current to pass through the circuits in which such plates and strips are interposed, such circuits being open until thus closed by the movement of the brushes 17 and 18. In this way it will be seen that the key levers B will initiate a series of current impulses corresponding to the contact plates 27 and the character of the circuits in which such plates are interposed, as will presently more fully appear. As soon however as a key lever B has risen to the top of the supports 25 between which it moves, the head 29 of the contact pin 20 will strike a bar 35 located upon the under side of the top plate of the base of the main frame at its rear and the contact pin 20 will be shifted from the position shown by full lines to the position shown by dotted lines in such figure. When thus shifted the contact pin 20 no longer serves to connect the brushes 17 and 18 and consequently during the return stroke of each key lever the passage of the brushes over the individual contact plates 27 does not effect the closing of the circuits at such points. As the key lever B that has been actuated in manner above described returns to its normal position, the bottom of the pin 20 will contact with the stop 36 at the base of the main frame and the upper end of the shorter arm of the pin 20 (which will be beveled) will be forced between the brushes 17 and 18, thereby electrically connecting these brushes in readiness for the next operation of the key lever. The various circuits that will be controlled by the operation of the key levers in manner last described will be hereinafter more fully set forth.

By reference more particularly to Figs. 3 and 7 of the drawings it will be seen that in the form of my invention shown, the key board comprises thirty-eight keys, although manifestly the number may be increased or diminished if desired. Of the keys shown, thirty-six are used for characters to be printed, one marked with the abbreviation "Ret." (see Fig. 3) is for effecting the return movement of the paper carriage and one (marked with the abbreviation "Rev.") is for effecting the independent revolution of the paper holding platen. The types whereby the impressions are to be made are carried by type heads *c* (see Fig. 18) that are mounted on the free ends of the type bars C; these type bars being formed at their inner ends with journal bars *c'* that are journaled in brackets 40 and 41 mounted upon the top plate a^2 of the main frame. The type bars are preferably arranged as shown in Fig. 18, in order that the corresponding type of each type head may strike a common printing point upon the platen that is located beneath the top plate of the main frame. As shown, there are twelve type bars, consequently in order that each of the thirty-six characters (corresponding to the keys above described) may be printed, each of the type heads *c* will be furnished with three types and the platen will be shifted in manner to be presently described in order to vary the printing point for any one of the types upon the type heads.

The journal bar *c'* of each of the type bars is formed with an offset arm 42 at its outer end and to such offset arm is connected (see Figs. 1 and 6) the upper end of a draw rod 43, the lower end of this draw rod being connected with an operating lever 44 whereby the type bar may be actuated. Each operating lever 44 is secured to the armature bar 45 that is pivoted as at 46 to brackets 47 that rise from the top plate of the base of the main frame. The front end of each of the armature bars 45 extends above an electro magnet D and the rear end of each armature bar extending below the corresponding electro magnet D', the functions of these magnets D and D' being to cause the armature bar to actuate its corresponding type bar when the magnets are energized by the passage of current therethrough. As shown, each pair of magnets D and D' is carried by an angular bar or yoke 48, to the upper and lower arms of which the corresponding magnets are secured. A coiled spring 49 having its lower end attached to the main frame and having its upper end attached to an adjusting rod 50 that passes through the rear end of the armature lever 45, serves to restore the lever to normal position after a type bar has been actuated by the energization of the magnets D and D', and an adjusting nut 51 upon the threaded rod 50 enables the tension of the spring 49 to be varied as desired.

The paper to be printed will be carried by a cylindrical platen E (similar to the platen commonly used in ordinary typewriting machines) that is journaled in uprights *e e'* upon a paper carriage to which a step-by-step motion will be imparted in order to effect the letter-space movement of the platen and to which a rotary motion will be imparted to effect the necessary "line-space" movement of the paper. The carriage whereby the platen is supported will also have imparted thereto movement at right angles to its line of travel in order that any one of the three

types carried by each of the type heads *c* may strike centrally and in the line of print upon the platen. In order to guide and retain the paper upon the platen, I provide the platen at the rear with a pair of pressure rolls E′ and E² that are mounted upon two angular arms or levers 55, one upon each end of a shaft 56 extending across the paper table F at the rear of the platen. The roller carrying arms 55 at the opposite sides of the paper table, being connected together by the shaft 56, it is obvious that these arms and their rollers will move in unison and one of the arms 55 is provided with a forwardly extending handle 58 whereby the arms and rolls may be shifted. In piece with one of the angular arms or levers 55 is the extension 59, having a yoke-shaped piece e^5 pivoted thereto. The yoke e^5 is provided with abutments for engaging either the upper or the lower member of the lever 55, and a spring e^4 is arranged to hold the yoke on one side or the other of central position. By this means one or the other of the pair of pressure rollers E′ and E² will be spring-held into engagement with the platen. A screw e^2 connected to one end of the spring e^4 and thumb-wheel e^3 serve to adjust its tension. The opposite end of the spring e^4 (see Fig. 20) is connected to the part *e* on the carriage.

The paper table F is secured to the end of the standards *e* and *e′* whereon the platen E is journaled, and as shown (see Figs. 20 and 22) the paper table extends rearwardly and its forward end is preferably provided with an upper guide plate *f* below which the paper will pass. By reference to Fig. 21 it will be seen that the forward edges of the paper table F and of the guide plate *f* are bent so as to better guide the paper and avoid danger of tearing it. Across the front of the platen extends a plate *f′* that serves to press the paper against the platen, the free edge of this plate *f′* being provided with the usual letter-space scale as clearly shown in Fig. 20. The scale plate *f′* is mounted upon a rod f^2 carried by the guide arms or plates f^3 that extend upwardly from below the platen and serve to direct the paper around the platen. Upon the rod f^2 are mounted coil springs f^4, the ends of which bear upon the plate f^1 (as shown in Fig. 20) and serve to normally force the free edge of the plate *f′* toward the platen E. The rod f^2 to which the plate *f′* is attached has one of its ends f^5 bent and extended outward over the arm or lever 58 so that when this arm or lever 58 is lifted, the pressure of the plate *f′* upon the platen will be released. When a sheet of paper is to be inserted it will be placed upon the table F and will be moved toward the platen. The arm 58 will be raised thereby lifting the free edge of the scale plate *f′*, relieving the pressure of the upper feed roll E from the platen and forcing the lower feed roll E² against the platen. The operator by then turning the hand-wheel E³ at the end of the platen, will cause the free edge of the paper to pass around the platen until the upper edge of the paper is beneath the presser roll E′; then by depressing the arm or lever 58 the presser roll E′ will be brought to bear against the paper, holding it snugly upon the platen, and the scale plate *f′* will also be brought to bear upon the paper. By means of the plate *f′* and feed roll E′, the paper will be held snugly upon the platen and when revolution has been imparted to the platen, the paper will be moved the necessary distance to effect the necessary spaces between lines of print.

The mechanism whereby the transverse shifting of the paper carriage and of the platen E sustained thereby will be effected, will next be described, it being understood that this transverse shift of the platen is made in order to permit any one of the several types at the ends of the type bars to make its impression in the line of print. The platen E is mounted upon a supplemental frame or carriage 60 (see Figs. 1, 2, 4 and 6) that is supported upon anti-friction rollers 61 journaled in brackets 62 at the ends of the main paper carriage. These rollers 61 are preferably formed with V-shaped peripheries to receive the correspondingly shaped edges of the end bars of the supplemental frame or paper carriage 60. Suitable bars 63 at the ends of the supplemental paper carriage 60 serve to retain the supplemental carriage in position upon the supporting rollers 61. Pins 63^a on the lower ends of the bars 63 engage lugs 63^b 63^b upon the main paper carriage to hold the supplemental carriage 60 against vertical displacement. Centrally beneath the supplemental paper carriage 60 and from end to end thereof extends a web or bar 65 that is straddled by the yoke shaped upper end of the platen shift bar G and preferably in the yoke shaped end of this platen shift bar are journaled small anti-friction rolls 66 that bear on opposite sides of the pendent web or bar 65. The platen shift bar G is pivoted as at 68 to a bar 69 supported on the main frame of the machine (see Fig. 4) and at its lower end the platen shift bar G has forwardly and rearwardly projecting arms *g* that are provided with pins *g′* that extend through the slots 70 formed in the pendent armature bars g^2 and g^3 that are pivoted as at 71 and 72 to the bar or bracket 69. Each of the armature bars g^2 and g^3 is provided with an armature facing its corresponding magnet G^2 and G^3 and the tension of these magnets G^2 and G^3 is to normally hold the platen shift bar or platen in median or central position and avoid the use of springs for such purpose.

The magnets G^2 and G^3 are supported respectively by brackets 75 and 76 projecting

from the frame of the machine, as shown in Fig. 4. Above these magnets G^2 and G^3 and upon suitable brackets 77 and 78 are mounted the platen shift magnets G^4 and G^5 arranged upon opposite sides of the platen shift bar. Armature bars g^4 and g^5 are attached to the opposite sides of the platen shift bar adjacent the magnets G^4 and G^5 so that when either of the magnets G^4 or G^5 is energized, it will serve to attract toward it the corresponding armature bar g^4 or g^5 and the platen shift bar G. Hence, it will be seen that if the character to be printed is the one located centrally of the type head C, no shift of the platen will be necessary to enable such character to make its impression in the line of print upon the paper on the platen; but if the character to be printed be at one side or the other of the center of a type head C, the platen must be shifted before the character can make its impression on the line of print. When therefore, a character other than one occupying a central position on a type head is to be printed, it is necessary to first shift the platen E either forwardly or backwardly from its normal central position. To enable this shift of the platen to be effected, electric current will be caused to pass through the magnet G^4 or G^5 according as the platen is to be shifted toward the front or rear of the machine. If the shift of the platen is to be toward the front, the magnet G^4 will be energized and at the same time (in manner to be hereinafter described) the magnet G^2 immediately beneath it, will be deënergized, thereby releasing the subjacent armature bar g^2 and permitting the shifter bar G to turn about its pivot point 68. The slots 70 of the armature bars g^2 and g^3 permit the movement of the lower end of the platen shift bar when either of the magnets G^2 or G^3 is deënergized. When however, after the desired type has been caused to make its impression, the magnet G^4 is deënergized, current will be again passed through the magnet G^2 beneath it and the armature bar g^2 being attracted thereby, will restore the shift bar G and platen E to the normal central position shown in the drawings.

The main paper carriage 80 whereby the platen E and supplemental paper carriage 60 are sustained, is supported by the rollers 81 carried by brackets 82 secured to the front and rear rails of the main paper carriage, and these rollers are preferably V-shaped and travel upon the front and rear carriage rails 83 and 84 (see Fig. 8). The paper carriage 80 is shown as provided at its bottom with horizontal flanges 85 over which extend the angular ends or brackets 86, these brackets being secured to the top plate of the main frame and serving to hold the main paper carriage in position upon its rails. At the rear of the main paper carriage is formed a rack bar 88 having downwardly facing teeth that mesh with the teeth of a pinion 89 that is fixed to the inner end of a shaft 90 journaled in a bracket 91 at the back of the main frame. The outer end of the shaft 90 has fixed thereto a ratchet wheel 92 and preferably also a second ratchet wheel 93. With the teeth of the ratchet wheel 92 engages a letter-space pawl K (see Fig. 24) that is pivotally mounted as at 94 at one end of a spacer lever 95, a spring 96 serving to normally force the pawl K into engagement with the teeth of the ratchet wheel 92.

The spacer bar or lever 95 is pivoted as at 97 to a bracket 98 at the back of the main frame, and the rear end of the spacer bar 95 carries an armature k adjacent which is mounted a magnet K′ that is supported by the bracket 98. With the teeth of the ratchet wheel 92 also engages a dog 100 that is pivoted as at 101 upon a bracket 102 at the back of the main frame, the lower end of this dog 100 having connected thereto a spring 103 whereby the dog will be thrown normally toward the ratchet wheel 92. The extent of movement of the spacer bar or lever 95 and consequently of the pawl K, may be controlled by a set screw 104 passing through the spacer lever 95 and adapted to contact with the depending stop 105. A spring 106 has its lower end connected with the spacer lever and its upper end connected with an adjusting screw 107 whereby the tension of the spring may be varied, the screw 107 being fitted with an adjusting nut 108. Hence it will be seen that when the magnet K′ is energized (in manner to be presently hereinafter defined) after the printing of a character has been effected, the armature k will be attracted and the spacer bar 95 will cause the pawl K to turn the ratchet wheel 92 and to correspondingly advance the paper carriage and platen the distance necessary to bring the platen into position to receive the impression from the next character to be printed. When the paper carriage has thus been advanced step-by-step to the end of its travel (which fact will be announced to the operator in the usual manner, by the signal bell X that will be struck by the bell hammer x, see Fig. 2) the operator will depress the "return key" of the key board (see Fig. 3) and (by mechanism to be presently described) will thereby cause electric current to pass through the coils of the electro magnet L that are supported upon a bracket 109 at the back of the main frame (see Fig. 24). Opposite these magnet coils L is an armature m attached to the end of a release bar M that is mounted to slide within suitable supports and is provided with lugs 110 and 111 adjacent the pawl K and dog 100 respectively. A coiled spring 113 having one end attached to the lug 110 of the release bar M and having its other end attached to a fixed piece 112 serves to normally hold the release bar M in

the retracted position shown in Fig. 24. Hence it will be seen that when the coils L of the release magnet are energized, the armature *m* will be attracted thereto and the release bar M will be thus moved toward the magnet, thereby causing the stop 110 to contact with the space pawl K and throw it out of the path of the ratchet wheel 92. This same movement of the release bar M will cause the lug 111 to engage with the lower end of the dog 100 and throw its upper end from the path of the ratchet wheel 92. When the release bar is thus shifted, a gravity latch 120 that is pivotally mounted as at 121 at the back of the main frame (see Figs. 2 and 24) will drop behind the end of the release bar M and will retain the spacer pawl K and dog 100 in released position until the paper carriage is retracted to the right-hand end of the machine by mechanism to be presently described. The latch bar 120 is an angular bar and its upper end 122 extends into the path of a lug or offset 123 at the back of the paper carriage and consequently when the paper carriage has reached the end of its return movement, that is to say, has reached the point at which the printing of a line will be begun, the stop or offset 123 will strike the arm 122 and will lift the latch 120 out of engagement with the end of the release bar M, thereby permitting the spring 113 to retract the bar M, and allow the springs 96 and 103 respectively, to throw the space pawl K and dog 100 into operative engagement with the ratchet wheel 92. The teeth of the ratchet wheel 93 that is preferably employed, are faced in a direction opposite the teeth of the ratchet wheel 92 and with the teeth of this ratchet wheel 93 will engage the hooked end of the angular pawl 130 (see Fig. 24) that is pivoted upon the stud 101, the opposite end of this pawl 130 extending between pins 131 projecting from the side of the pawl K. The pawl 130 is designed to prevent the "overthrow" or excess movement of the ratchet wheel 92 and when the ratchet wheel 92 is moved one tooth by the outward movement of the feed pawl K, the hooked end of the check pawl 130 will be brought into engagement with the teeth of the ratchet wheel 93 and hence will prevent any excess turning of the shaft whereon the ratchet wheels 92 and 93 are mounted, and consequently will prevent any excessive movement of the paper carriage.

The forward movement imparted to the paper carriage and the platen by the pawl K, in the manner above described, will be against the force of spring mechanism that is adapted to return the paper carriage to the position at which the printing of a line is to be begun. This spring mechanism will next be described, reference being had more particularly to Figs. 8, 25, 26 and 27 of the drawings: Beneath the paper carriage and upon a suitable supporting bracket 140 depending from the under side of a transverse plate at the top of the main frame, is mounted a shaft 141, the upper portion of which passes loosely through the hub of a drum 142 that has attached to its periphery one end of a steel tape or strap 143, the opposite end of which is connected to an arm or pin 144 depending from the under side of the paper carriage and attached thereto by a bracket 145. To the upper portion of the shaft 141 is connected one end of a coil spring 146, the opposite end of which spring is attached to a stud 147 fixed to the drum 142. To the shaft 141 is fixed a wheel 148 of an intermediate gearing, the opposite wheel 149 of this gearing being attached to a short shaft 150 that is journaled in the bracket 140. The shaft 150 carries at its lower end a beveled pinion 151 that engages with a correspondingly beveled pinion 152 mounted on the inner end of a shaft 153 that is journaled in arms depending from the bracket 140, and the shaft 153 is provided at its outer end with a hand-wheel 154 whereby it may be conveniently turned.

By reference more particularly to Fig. 26 of the drawings it will be seen that the gear wheels 148 and 149 are of the familiar construction known as "Geneva stop gear", the construction of the wheels 148 and 149 being such that the teeth of the wheel 149 when in engagement with the notches of the wheel 148, will impart a partial evolution to the wheel 148, but when the teeth of the wheel 149 are out of the notches of the wheel 148, the wheel 148 is held by the curved portion of the wheel 149 against revolution.

By reference to Fig. 8 of the drawings it will be seen that the hand-wheel 154 is located at the front of the machine above the key board, and by turning this hand-wheel the operator can conveniently adjust the tension of the spring 146 whereby the paper carriage will be returned to the starting point at the right of the machine.

In order to relieve the paper carriage and frame from the shock of a too sudden return of the carriage, I prefer to mount at the right-hand end of the machine one or more dash pots 160 (see Fig. 8) that are preferably supported by a bracket 161 fixed to the main frame and into these dash pots will enter the pistons 162 that are carried by rods 163 that project toward the right from the left-hand end of the paper carriage.

In order to prevent the further operation of the printing mechanism when the paper carriage has reached the end of its travel towards the left and until the carriage has been brought back again to the starting point, I prefer to employ the mechanism next to be described, reference being had particularly to Figs. 6 and 7 of the drawings: Across the top of the key levers B extends a rod 170 that passes through bearings in the

side walls of the base of the main frame. Between a collar 171 of this rod and the main frame is placed a coil spring 172 that serves to normally hold the rod 170 in the position shown in Fig. 7. To the collar 171 on rod 170 are fixed arms 173 that depend to a point slightly to one side of the pivot arms of the universal bar 10. Hence it will be seen that the arms 173 are held normally in such position that they do not interfere with the raising of the universal bar 10 incident to the operation of the key levers B. Adjacent one end of the rod 170 is pivotally mounted a vertical shaft 175, the upper and lower ends of which are sustained in suitable brackets, and to the lower portion of the shaft 175 is fixed an arm 176 that is connected by a link 177 and suitable pins or screws with the rod 170. To the upper portion of the vertical shaft 175 is fixed an arm 178 that extends in position to be struck by a rod or arm 179 that depends from the under side of the paper carriage adjacent its right-hand end. Hence, it will be seen that while the paper carriage is traveling from right to left in the printing of a line, the depending arms 173 will not interfere with the lifting of the universal bar 10 or of the key levers, but when the paper carriage reaches the end of its travel and the contact of the arm 179 with the bar 178 rocks the shaft 175 and causes the arm 176 to shift the rod 170 against the force of the spring 172, the depending arms 173 will be brought above the pivot arms of the universal bar 10 and will serve to dog the universal bar against upward movement and will consequently prevent the operation of the key levers B. As soon however as the paper carriage is moved toward the right, the spring 172 will cause the parts to assume the normal position shown in Fig. 7 of the drawings.

In order to effect the partial revolution or line-space movement of the platen E, I provide the mechanism next to be described, reference being had more particularly to Figs. 1, 2, 20 and 22 of the drawings: At one end of the supplemental frame 60 whereby the platen E is sustained, is mounted an electro-magnet O, the armature *o* of which is carried by an armature lever *o'* that is pivoted as at 180 to a bracket 181 at one side of the magnet. The free end of the armature lever *o'* enters a slot 182 (see Fig. 22) in a lever 183 that is pivoted as at 184 to a bracket 185 that rises from the platen support *e'*. One end of the lever 183 is formed with an angular or downwardly turned portion 186 that limits its movement in one direction, a spring 187 that is attached to the bracket *e'* bearing upon the end portion 186 of the lever 183. The free end of the lever 183 has pivoted thereto a pawl 188 pressed by a spring 189 into engagement with the teeth of a ratchet wheel 190 that is mounted at the right-hand end of the platen E. Hence it will be seen that when the magnet O is energized, its armature *o* will be attracted thereto, causing the armature lever *o'* to move downwardly the lever 183 and thereby forcing the pawl 188 by its engagement with the ratchet wheel 190 to impart a partial revolution to the platen sufficient to give the necessary space between the lines to be printed upon the paper carried by the platen. The energization of the magnet O will be effected by electrical selective apparatus, the operation of which, for the purpose of imparting a line-space movement to the platen, may be controlled by a special key upon the key board of the mchine, such key being shown as marked with the abbreviation "Rev." on Fig. 3 of the drawings. The platen E is furnished at its left-hand end with the usual hand-wheel whereby the platen can be manually turned when inserting the paper or for any other purpose.

In order to enable the line-space mechanism (*i. e.*, the mechanism whereby the platen is revolved) to be operated regardless of the position of the paper carriage and without returning the carriage to the starting point, I provide the carriage upon its under side with metal contact strips or rails *p* and *p'* (see Figs. 15, 16 and 17) extending from end to end of the carriage and suitably mounted upon an insulating bar P that is secured to the end bars of the carriage frame. With these strips or rails *p* and *p'* wires leading to magnet O are connected by binding posts or screws 200 and 201. Against the contact strips or bars *p* and *p'* bear two brushes 205 and 206 that consist of spring arms mounted upon an insulating block 207 attached to the main frame of the machine. To the binding posts or screws 208 of the brushes 205 and 206 are connected suitable electric wires that lead to the electric selective apparatus, as will presently be described, and suitable electric wires will connect the binding posts of the contact strips or rails *p* and *p'* with the electro-magnet O (see Fig. 2) that is mounted upon the carriage at the end of the platen E. Hence it will be seen that no matter what may be the position of the carriage, current may be sent to the electro-magnet O that is mounted upon the carriage, since the brushes 205 and 206 are at all times in contact with the contact strips *p* and *p'* attached to the under side of the carriage and extending from end to end thereof.

The mechanism whereby the movement of the inking ribbon will be controlled will next be described, reference being had more particularly to Figs. 1, 3, 4, 5, 8, 18, 19 and 23: The inking ribbon R is wound upon two spools R' and R² that are loosely mounted upon a shaft 210, the ends of this shaft being supported by brackets 211 that rise from the main frame at the front of the machine.

The spools R′ and R² are independently revoluble and these spools are provided at their inner end with the ratchet wheels *r* and *r′* respectively. Between the ratchet wheels of the spools R′ and R² is interposed a coil spring 215 that affords sufficient friction upon the spools to prevent their accidental movement. From one of the ribbon spools, for example the spool R′, the ribbon passes up over a roller 216, then over a frame 217 of the construction shown more particularly in Fig. 18 of the drawings, then around and under the end of the frame 217 and beneath the open space 218 thereof, then back over the frame 217 and then down over the roller 219 to the other ribbon spool R². The rollers 216 and 219 are carried by a shaft 220 that is mounted upon the yoke-shaped upper end of a lever 221, and to the shaft 220 the ribbon frame 217 is pivoted. The inner portion of the ribbon frame 217 is supported by a long anti-friction roller 222 that is supported by brackets depending from the top plate of the main frame. The ribbon frame 217 is provided with flanged edges, to accurately guide the ribbon in its travel over the frame. The yoke-shaped upper portion of the lever 221 is so connected to the body of the lever that the ribbon frame 217 will be withdrawn when a new ribbon is to be inserted. As shown, the upper portion of the lever 221 is pivotally connected as at 225 (see Figs. 4 and 23) to the body of the lever and a thumb screw 226 that passes through the overlapping portions of the lever 221 retains the yoke-shaped upper portion of the lever in rigid connection with the body portion of the lever beneath it until it is desired to insert a new ribbon, when by withdrawing the thumb screw 226 the yoke-shaped upper portion of the lever may be turned forward and downward so as to permit the old ribbon to be removed from the ribbon plate and a new ribbon to be placed thereon. The lever 221 is pivotally mounted as at 228 on a bracket 229 of the main frame, and the lever 221 is shown as provided with the forwardly extending arm 230 from which depends a bar 231 carrying the armature 232 of the electro magnet 233, the coils of this magnet being supported by a bracket 234 (see Fig. 4) adjacent the key board. To the arm 230 of the lever 221 is connected by an adjusting screw 235 a coil spring 236, the opposite end of this spring being connected to a fixed part of the main frame beneath it, and the purpose of this spring being to normally aid the magnet 233 in restoring the ribbon shifting lever 221 to the position seen in Fig. 4 of the drawings. Upon the upper side of the extension 230 of the lever 221 is connected the armature *q* of the ribbon shifting magnet Q that is sustained beneath the forwardly projecting top plate of the main frame as shown in Fig. 4 of the drawings. Preferably, the magnets 233 and Q each comprises two coils as shown more particularly in Fig. 23 of the drawings.

To the opposite sides of the ribbon shifting lever 221 are connected the pawls S and S′ that engage with the ratchet wheels of the ribbon spools R′ and R². Each of the pawls S and S′ is preferably connected to the lever 221 by a pin or screw passing through a slot *s* in the pawl, the purpose of this pin-and-slot connection being to allow sufficient lost motion to the lever 221 before it causes the pawls to actuate the ratchet wheels of the ribbon spools. The pawls S and S′ are forced normally into engagement with the ratchet wheels of the ribbon spools by springs *s′* and *s²* respectively, that are fixed to blocks *s³* and *s⁴* journaled upon a short shaft 237 that is mounted upon a projecting portion of the main frame below and in front of the ribbon spools. The spring-carrying blocks *s³* and *s⁴* are independently movable and by tipping the front end of either of these blocks downward, its spring will be caused to lift the corresponding pawl *s′* and *s²* into engagement with the corresponding ratchet wheel of the ribbon spools. In order to enable the blocks *s³* and *s⁴* to be shifted so that one of the pawls S and S′ is thrown into action while the other is thrown out of action, I provide the shifter handle 240 that is pivotally mounted as at 241 upon the adjacent bracket and is provided with two bearing surfaces 242 and 243 that will contact with the blocks *s³* and *s⁴* beneath it.

The operation of the ribbon actuating mechanism will be seen to be as follows: When the magnet Q is energized by the passage of current through its coils, under the control of suitable electrical selective apparatus, as will hereinafter more fully appear, the armature *q* will be attracted, thereby causing the lever 221 to rock about its pivot point 228. The upper end of the lever 221 being thus moved inward it will carry the ribbon plate 217 and the ribbon above the printing point of the platen E. As soon however, as the magnet Q is deënergized, the spring 236 and the magnet 233 (which latter will at such time be energized), will return the lever 221 and the ribbon plate to the normal position shown in the drawings, thereby exposing to the operator's view the line of print upon the platen. As the lever 221 thus returns to normal position it will cause one of the pawls S or S′, which at such time will be in engagement with one of the ratchet wheels of the ribbon spools, to move its ribbon spool so as to slightly wind thereon the inking ribbon that will be drawn off from the opposite spool. The inking ribbon will be thus wound on to one spool and will be drawn off of the other spool so long as the same pawl S or S′ is in the operative position to engage the teeth of the ratchet wheel. When however, the ribbon has been com-

pletely wound from one spool on to the other, and the direction of its movement is to be reversed, the operator will turn the ribbon shifting handle 240 in such manner as to throw into action the pawl S or S′ that has been out of action, and to throw out of action the pawl that has been effecting the winding of the ribbon in one direction. Hence, the reverse winding of the ribbon will be thus effected.

By reference more particularly to Figs. 4 and 23 of the drawings it will be seen that at one end of each of the ribbon spools there is secured a beveled pinion 245 that engages with a corresponding beveled pinion 246 mounted upon a shaft 247 that is journaled in the bracket 211. The front end of each of these shafts 247 is squared so as to permit a key to be fitted thereon so as to enable the ribbon spools to be rapidly revolved when a new ribbon is to be wound thereon or when the direction of travel of the ribbon is to be rapidly reversed.

As shown in Fig. 4, an arm 250 is pivoted to the shift lever 221 at its forward end while its rear end rests upon a support 251 which is mounted upon the bracket 78. On the backward shift of the lever 221 the rear hooked end of the arm 250 is adapted to engage the forward hooked end of a spring-held rod 252 which is mounted to shift longitudinally upon the support 251. The rear end of the rod 252 carries a contact 253 which is insulated therefrom and is adapted to engage a contact 254 mounted upon an insulating support. These contacts normally stand out of engagement but are brought into operation by the arm 251 as the ribbon-shift lever 221 returns to normal. The engagement of these contacts closes a circuit through the ribbon return magnet 233 and through the latter-space magnet K′. At the end of the return stroke of the ribbon shifter the rear hooked end of the arm 250 is disengaged from the forward hooked end of the rod 252 by a wedge-shaped cam 255 fixed upon the front end of the support 251 beneath the rear end of the arm 250. To the pivot end of the ribbon shifter is also secured a rearwardly extending arm 304 having an insulated end-piece which is adapted to strike as the ribbon shifter is actuated upon a spring-held switch 278 which normally engages a contact 278′. This operation momentarily breaks the circuit through the operating magnets and permits the return of the various mechanisms to normal in the manner hereinafter described. The circuits and parts operated thereby are indicated there diagrammatically in Figs. 29 and 30. The circuits at one station only are indicated in these views but it will be understood that they are correspondingly arranged at the other stations. The local or operating circuit at each station derives current from a generator or battery *a* from which extend the conducting wires 256 and 257. An ordinary make-and-break switch 258 is interposed in the conductor 256. Each of the transmitting plates 26 is connected to the conductor 257 while the corresponding plates 27 are connected to a series of conducting strips *t′* (numbered one to ten inclusive) by wires 259 and these conducting strips are connected respectively by wires 260 to a series of relays T (correspondingly numbered one to ten inclusive) which control the line circuit. The opposite terminals of the coils of the relays T are all connected by a wire 261 to the return conductor 256.

Whenever the gap between one of the strips 26 and a plate 27 is bridged by the contact pieces 17 and 18 upon the corresponding key lever B, current may be traced from generator A, wire 257 to strip 26, contacts 17 and 18 (which are bridged as previously described by the conducting pin 20) to plate 27, thence by wire 259 to one of the conducting strips *t′*, by wire 260 to one of the relays T and by wires 261 and 256 back to the generator; so that when operating any one of the key levers one or more of the relays T may be successively operated. The connections are so arranged that when two or more of the relays T are operated by a single movement of one of the key levers, the operation of the relays will occur in the order in which they are numbered, and this order corresponds to or represents the particular character represented by the actuated key lever. It will be noted that some of the conducting plates 27 are not connected to the conducting strips *t′* so that certain of the key levers will only actuate one or two of the relays T. Only six sets of contact plates 27 are illustrated but it will be understood that the other sets corresponding to the remaining key levers are similarly arranged and connected to the conducting strips *t′* in accordance with the various characters to be transmitted. The armatures *t′* of the relays T are normally spring-held against their back contacts and the line circuit extends from ground by wire 262 to the back contact of relay 10. Armature 10 is connected to the back contact of relay 10 by a short wire 263 and each of the armatures *t* is correspondingly connected to the back contact of the next preceding relay. The line circuit is therefore normally traced from the ground by wire 262 to armature t^{10} and by wires 263 and the several armatures *t*, thence by wire 264 through the coils of relays U connected in series to the line. At the distant station the line passes through a corresponding set of relays U similarly arranged in series and through the armatures *t* of a correspondingly arranged set of relays T to the ground.

The line circuit derives current from a pair

of generators or batteries a', a^2, unlike poles of which are connected to ground by a wire 265. The opposite pole of the generator a' is connected by a series of conductors 266 to the front contact of the relays T numbered 2, 4, 6, 8 and 10, while the generator a^2 is connected by a series of wires 267 to the front contacts of the relays T numbered 1, 3, 5, 7 and 9. In four of the conducting wires 266 and in four of the conducting wires 267 are interposed, as indicated, a series of varied resistances, so that by the operation of the several relays T, impulses either positive or negative and of varying strengths may be transmitted through the several relays U over the line and through the corresponding relays U at the distant station. For example, when one of the relays T is operated, current may be traced from ground by wire 265, through one or the other of the generators a', a^2 and by either wire 266 or 267 to the front contact of the relay T, which has been actuated, and by the wires 263 and armatures t to the armature of relay numbered 1 and from thence by wire 264 through the coils of the relays U. The relays U control the operation of the printing mechanism, both at the sending and the receiving stations, and for this purpose are provided with a pair of oppositely wound coils between the poles of which vibrate a pair of armatures u', u' which are normally held against their back contacts. The several relays are so wound that they will respond to different strengths of current. That is to say, the relay U′ responds to the current impulse of weakest strength while the relay U^5 responds to the current impulse of greatest strength, and one or the other of the armatures u', u' will be operated in accordance with the polarity of the impulse. The armatures u^5, are connected by wires 268 to one of the conductors 256 of the local circuit. The back contacts of the relay U^5 normally engaged by the armatures u^5, are connected by wires 269 to the armatures u^4 of the relay U^4 and the back contacts of that relay are connected in a corresponding manner to the armatures of the next succeeding relay. The front contacts of the relay U^1 are connected respectively by the wires 270 and 271 to the coils of a pair of locking magnets W, W′ through the coils of a pair of magnets Y^2, Y^3 and through the coils of the carriage-shifting magnets G^4, G^5 and thence by wire 272 to the main return wire 257 of the local circuit.

When a weak positive or weak negative impulse is transmitted over the line by relay 1 or 2, one of the armatures u' will be operated in accordance with the polarity of the impulse and the local circuit may be traced from main lead wire 256, wire 268, through the armatures of the several relays U, by wire 269 to the armature u' which has been operated and by either the wire 270 or the wire 271 through the magnets W, Y^2, G^4 or through the magnets W′, Y^3 and G^5 and from thence by wire 272 to the return wire 257 of the local circuit. By this means either magnet G^4 or G^5 is operated to shift the carriage in one or the other direction so that the machine will be in position to receive impact from the uppermost to the lowermost type upon a single type bar. It will of course be understood that if the character corresponding to the signal received is centrally located upon its type bar, the relay U′ will not be operated and the combination of impulses corresponding to that character will not operate the relay U′ and the shifter G, and the carriage of the machine will remain in central position.

The shifter G is held in position, as previously described, by the magnets G^2 and G^3, the coils of which are on a normally closed circuit which may be traced as follows: from main wire 256, wire 273, branch wires 274 to the armatures y^2 and y^3 by wires 275 through the coils respectively of the magnets G^2 and G^3 and by the wire 276 to the return wire 257. The armatures y^2 and y^3 are normally spring-held in position to maintain these circuits in closed condition, but when one of the magnets G^4 and G^5 are energized as previously described, either one or the other of the magnets Y^2 or Y^3 corresponding thereto, will be operated to draw up its armature and break the circuit through one or the other of the magnets G^2 or G^3. That is to say, when the magnet G^4 is energized, the circuit through the corresponding magnet G^2 will be broken so that shifter G may be actuated by the pull of the magnet G^4. In a corresponding manner, when the magnet G^5 is energized to move the shifter G in the opposite direction, magnet Y^3 will draw up its armature y^3 and break the circuit through the shifter-holding magnet G^3.

The magnets W, W′ are provided with a common centrally pivoted armature w normally held in central position between the poles of a permanent magnet w'. When the relay U′ is operated to close the circuit, for example, through the magnet G^4, the circuit is also closed through the magnet W so that its armature is shifted to engage a contact above the magnet W′. A circuit may then be traced from main local circuit wire 256, by wires 273 and 277 to a normally closed spring-held switch 278, thence by wires 279 and 280 to the armature w, by wire 281 to the wire 270 and thence through the magnets W, Y^2 and G^4 back to the return wire 257 as before. In this manner the local operating circuit is held or locked in closed condition through the magnet G^4 independently of the continued operation of the relay U′, so that the line impulses through the relay U′ need only be of short duration. In other words, as soon as the relay U′ is operated by a line impulse to close the local circuit through the

magnet G⁴ the locking magnet W shifts its armature *w* to close a shunt around the relay armature *u'* so that the local circuit through the magnet G⁴ is locked in closed condition. Correspondingly, if a line impulse of opposite polarity operates to close the local circuit through the magnet G⁵, magnet W' shifts the armature *w* in the opposite direction and the locking shunt circuit is closed from wire 280 to armature *w*, wire 282 to wire 271 and thence through the magnets W', Y³ and G⁵ as before.

The circuits through the type-bar magnets D are controlled by a centrally pivoted switch *d* provided with a series of four arms *d'* and with a fifth arm d^2. Each of the arms *d'* coöperates with a series of three contacts connected respectively by wires 283' to one terminal terminal of the several coils of magnets D. Each arm *d'* normally engages the center of one of the group of three contacts with which it coöperates, but as the switch is shifted in one or the other direction, the engagement is broken and the arms *d'* are disengaged from the center contacts and shifted into engagement with the contacts at either side thereof. An armature d^3 connected to the pivot of the switch *d* is normally held in central position between the poles of a terminal magnet d^4 and operating magnets d^5, d^6, d^7 and d^8 are arranged on either side of the opposite ends of the armature d^3.

A wire 283 extends from one of the front contacts of relay U² through the coils of the magnet W³ through the coils of magnets d^5 and d^7 and is connected by a wire 284 with the return wire 257 of the local circuit. A second conductor 285 extends in a similar manner through the coils of magnets W⁴, d^6 and d^8 and also connects to the return wires 284 and 257. When a line impulse of either polarity and of sufficient strength traverses the coils of the relay U² one or the other of its armatures u^2 will be operated and the local circuit will be closed from main feed wire 256, through wires 268 and 269 and through the armatures of relays U³, U⁴ and U⁵ to the shifted armature u^2 and by wires 283 and 285 through the set of magnets W³, d^5 and d^7, or through the set of magnets W⁴, d^6 and d^8 and by wires 284 and 257 back to the generator. The connected pairs of magnets d^5, d^7 and d^6, d^8 are arranged as shown, at opposite ends of the armature d^3 and on opposite sides thereof, so that when one of these pairs of magnets is energized as described in accordance with the polarity of the line impulse which energizes the relay U², the switch *d* will be shifted in one direction whereas, if the other pair of magnets is operated, the switch will be shifted in the opposite direction. A line impulse of sufficient strength to energize the relay U² will also of course be sufficient to energize the relay U', but since one of the armatures u^2 is operated, the local circuit is broken at this point and the movements of the armature *u'* will not close the circuit through the shifter-operating magnets G⁴ and G⁵.

The locking magnets W³ and W⁴ are similar in arrangement to locking magnets W' and W² previously described, and coöperate with a similar pivoted armature w^2 which is normally held in central position and adapted to coöperate with a pair of contacts connected respectively to the wires 283 and 285 by the branch wires 286 and 287. When, for example, circuit is closed through magnets W³, d^5 and d^7, the local circuit may be traced from main feed wire 256, wires 273 and 277, switch 278, wires 279, 280, 288 to the pivoted spring-held switch 289 by wire 290 to the armature w^2, wire 286 to wire 283 and thence through magnets W³, d^5 and d^7 as before, so that the magnet W³ serves to lock the branch of the local circuit controlled by the relay U² by closing a shunt around the relay when the latter is operated. When the relay U² closes the circuit through the locking magnet W⁴ and switch operating magnets d^6 and d^8, the armature w^2 is rocked in the opposite direction and coöperates with the conductor 287 and its terminal contact to similarly lock this branch of the local circuit in closed condition. In this manner the branches of the local circuit controlled by the relay U² are locked and held in closed condition by the magnets W³ and W⁴ without necessitating the continued operation of the line relay U².

Conductors 291 and 292 connect the front contacts of relay U³ to the coils of locking magnets W⁵ and W⁶ and to a pair of arms *d'* of the switch. Similar conductors 293 and 294 connect the front contacts of relay U⁴ with the coils of locking magnets W⁷ and W⁸ and to the remaining pair of arms *d'* of the switch so that any one of the four arms *d'* of the switch may be selected by the operation of the line relays U³ and U⁴ in accordance with the polarity and strength of the line impulse. For example, if a line impulse of proper strength and polarity operates relay U³ to close a local circuit through the locking magnet W⁵, this circuit may be traced as follows: from main feed wire 256, by wires 268 and 269, through the armatures u^5, u^4 and u^3, wire 291, through locking magnet W⁵ to one of the switch arms *d'*. From thence the current will pass through one of the three conductors controlled by that particular arm according to the position of the switch. That is to say, if the switch has not been previously shifted, current passes from the switch arm *d'* by the normally engaged center contact and to the conductor connected thereto; or the current passes through one or the other normally disengaged side contacts and the conductor connected thereto if the switch has been previously shifted by the operation of the relay U². From the particular type-bar actuating magnet D thus energized, the current passes to a conductor

295 common to all of the magnets D and by a wire 296 through the coils of a magnet 297 and thence by a wire 298 to the return wire 257 of the local circuit. It is thus clear that by the operation of the relays U^2, U^3 and U^4 any particular one of the type-bar operating magnets D may be energized to operate its type-bar and by the operation of the relay U', the carriage shifter G may be operated to select any one of the three type upon the actuated type-bar. Thus, in the present instance, in which twelve type bars are employed, any one of thirty-six characters may be selected without necessitating the transmission of more than three impulses over the line. Of this number, four characters may be operated by the transmission of a single impulse of such strength and polarity as to properly actuate either the relay U^3 or the relay U^4; sixteen characters may be selected by the transmission of two impulses of proper strength and polarity to operate either the carriage-shifting relay U' or the switch-shifting relay U^2, or one or the other of the relays U^3, U^4; and sixteen characters may be selected by transmitting three impulses over the line. This arrangement is of course arbitrary and may be varied within wide limits without departure from the essentials of the invention; but by using the shorter impulse for the morefrequently used signals and by providing an arrangement in which only three impulses at most are necessary, the messages may be transmitted and properly printed very rapidly.

Pivoted armatures w^3 and w^4 coöperate respectively with the pairs of locking magnets W^5, W^6 and W^7, W^8. These armatures are connected by wires 279 and 280 to the contact 278' of the unlocking switch 278. The armature w^3 is adapted to engage, when swung in either direction, with one or the other of the pair of contacts connected respectively by wires 291' and 292' with the conductors 291 and 292, so that when the relay U^3 is operated to close either one of the branch circuits controlled thereby, the latter is locked in closed condition by the operation of one of the locking magnets W^5 or W^6 which closes a shunt around the relay and through the unlocking switch 278 in the manner previously described in connection with the locking magnets W', W^2. In a similar manner the armature w^4 coöperates with a pair of contacts connected by wires 294' and 293' to the wires 294 and 293 respectively, so that the local branch circuits controlled by the line relay U^4 are locked and held in closed condition when the relay is momentarily energized.

Whenever one of the type-bar operating magnets D is energized the branch circuit is closed from the wire 295, by wire 299, through the coil of the magnet 300 and from thence by wire 284 to the return wire 257. This magnet when energized operates the spring switch 289 and breaks at this point the circuit through the locking magnets W^1 and W^3 and through the switch-operating magnets d^5, d^6, d^7 and d^8, so that the switch may return to normal position in readiness to receive the next signal. So also, when one of the type-bar magnets D is energized its circuit is closed through magnet 297 as previously described, which then draws up its spring-held armature 301 so that the branch of the local circuit is closed from main feed wire 256, by wire 302 to armature 301 and by wire 303 through the coils of the ribbon-shifting magnet Q and to the return wire 257. This actuates the ribbon shifter so that the ribbon is interposed between the paper-holding platen and the type on the actuated type bar. This movement of the ribbon shifter also causes the arm 304 thereon to strike against the spring-held unlocking switch 278 and the circuits through the locking magnets W', W^2, W^5, W^6, W^7, W^8, through the carriage-shifting magnets G^4 and G^5 and through the type-bar operating magnets D is broken at this point, so that the parts may return to normal position in readiness to receive the signal. When either of the carriage-shifting magnets G^4 or G^5 is deënergized, the corresponding one of the pair of magnets Y^2 and Y^3 is also deënergized to release its armature and close the circuit through the corresponding one of the carriage-shifter holding magnets G^2 and G^3, so that the carriage and shifter are returned to and rigidly held in normal central position.

As soon as the circuit through the type-bar magnet D is broken at unlocking switch 278, the magnet 297 is deënergized, its spring-held armature is drawn back and the circuit through the ribbon-actuating magnet Q is broken. The ribbon shifter 221 is then drawn back by its spring and the hooked end of arm 250 thereon engages the hooked end of the sliding rod 252 so that the contacts 253 and 254 are brought into engagement. This closes a circuit from the main feed wire 256, by wire 305, contacts 253 and 254, wires 306 and 307, through the letter-space magnet K' and by wire 308 back to the return wire 257. Magnet K when thus energized, operates as above described, to shift the paper carriage the distance of a single letter space. The engagement of contacts 253 and 254 also closes a branch circuit by wires 306 and 309 through the coil of the magnet 233 and thence by wires 310 and 298 to the return wire 257. When this magnet is energized it assists the spring of the ribbon shifter to quickly return the latter to normal. At the end of its return stroke the arm 250 is shifted upwardly by the cam 255 (see Fig. 4) and the outer hooked end of the arm is disengaged from the sliding rod 252 so that the latter is then shifted by its spring to

disengage the contacts 253 and 254. The operating parts of the machine are then in position to receive the next signal and print the corresponding character.

A wire 311 is connected to one of the front contacts of the relay U^5, extends through the coils of the magnet W^9 and to the switch arm d^2. A wire 312 connected to the other front contact of the relay U^5 extends through the coil of locking magnet W^{10} and is connected preferably through a resistance to the wire 296.

When it is desired to return the carriage to its starting point and to rotate the paper platen for the commencement of a new line, an impulse of proper strength and polarity is transmitted over the line to energize the relay U^5 and close a circuit through the wire 311 as follows: from local battery, wire 256, wire 268, armature u^5, wire 311, through the magnet W^9 to the switch arm d^2, through a wire 313 connected to the switch arm to brush 205, thence by the conducting strip p and wire 314 to the line-space magnet O, thence by wire 315 to the conducting strip p', brush 206, wires 316, 295 and 296 through the magnet 297, wires 298 and 257 back to the local generator or battery, so that the carriage platen is rotated one step. At the same time a local circuit is closed from the switch arm d^2 by a wire 317, through the carriage-release magnet L and by wires 318 and 296 through the magnet 297 and wires 298 and 257 as before so that the rod M is shifted to release the feed pawls and permit the carriage to be returned to the starting point by its spring.

If it is desired to operate the line-space mechanism alone, two line impulses of proper strength and polarity are transmitted over the line, the first sufficing to operate the relay U^2 and shift the switch d so that the contact between switch arm d^2 and the terminal of wire 317 is broken. The second impulse then operates relay U^5 and closes the circuit as before through the line-space magnet O but does not close the circuit through the carriage-release magnet L. In this instance and in fact whenever the magnet O is energized a branch of the local circuit is closed by wires 316 and 229 through the magnet 300 and by wire 284 to the return wire 257 so that the switch 289 is shifted to break the circuit through the switch-turning magnets at this point in the manner previously described in connection with the operation of the type bar magnets D. The carriage release and line-space magnets may also be actuated by transmitting an impulse over the line circuit of the required strength and polarity to close a circuit as follows: from local circuit, wire 256, wire 258, armature u^5, wire 312, through the relay W^{10}, by wires 296 and 318, through carriage-release magnet L, by wire 317 to switch arm d^2 and thence by wire 313 to the line-space magnet O as before. At the same time a branch circuit will be closed by wire 298, through the magnet 297 and it will be noted that whenever the relay U^5 is operated, a circuit is closed through the magnet 297, so that the circuit will be closed as previously described, through the ribbon-shifting mechanism Q and so that the arm 304 on the ribbon shifter is actuated to open the locking shunt circuit at the unlocking switch 298 and permit the parts to return to normal position. The locking magnets W^9 and W^{10} coöperate, in the manner previously described with reference to the other locking magnets, with the centrally pivoted armature w^5 which is adapted to engage, when shifted in opposite directions, with a pair of contacts 311′ and 312′ with the wires 311 and 312 respectively.

If it is desired to move the carriage one step in letter-space direction without printing a character in order to properly provide space between the words of a message, two impulses of proper strength and polarity are transmitted over the line, the first of which operates to shift the switch d to one side and the second of which energizes the relay U^5 to close the circuit through the wire 312 and through the magnet 297. In this instance the circuit is not closed through the carriage-release magnet L since the terminal of the wire 317 connected thereto is not in engagement with the arm d of the switch. The operation of the magnet 297 thus energized closes the circuit through the ribbon-shifting magnet Q and the shifter in its operation, as previously described, brings the contacts 253 and 254 into engagement so that the current passes through the letter-space magnet K′ and the carriage is spaced one step.

It will be understood of course, that where a signal is composed of or represented by two or more impulses, the latter will be transmitted in such order that two or more of the relays U will be operated in numerical order, relay U′ responding to the weakest impulses and relay U^5 to the strongest. Preferably, a condenser 319 and an inductive resistance 320 are connected in series to each side of the set of relays U so as to prevent sparking between their armatures and contacts. Other condensers 321 may be employed if desired, to prevent sparking between the make-and-break contacts of other parts of the apparatus.

It is obvious that numerous changes can be made in the detail of structure and arrangement of circuits without departure from the essentials of the invention.

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

1. In printing telegraphs, the combination with a carriage for sustaining the paper to be printed, of means for transversely shifting said carriage comprising a shifter connected

with the carriage, armatures connected to said shifter, electro magnets whereby said shifter is actuated, said armatures and electro magnets being arranged at opposite sides of said shifter an electric selective apparatus controlling the flow of current through said magnets.

2. In printing telegraphs, the combination with a carriage for sustaining the paper to be printed, of means for transversely shifting said carriage comprising a pivoted shifter-bar connected with the carriage, armatures attached to opposite sides of said shifter-bar, electro magnets arranged opposite said armatures and electric selective apparatus controlling said magnets.

3. In printing telegraphs, the combination with a carriage for sustaining the paper to be printed, of means for transversely shifting said carriage comprising a shifter connected with the carriage, electro magnets and armatures for actuating said shifter and supplemental electro magnets, armatures for locking said shifter and carriage and electric selective apparatus controlling said magnets.

4. In printing telegraphs, the combination with a carriage for sustaining the paper to be printed, of means for transversely shifting said carriage comprising a pivoted shifter-bar connected with said carriage electro magnets for actuating said shifter-bar to shift the carriage and locking magnets, armatures arranged upon opposite sides of said shifter-bar whereby said shifter-bar may be locked in central position and electric selective apparatus controlling said magnets.

5. In printing telegraphs, the combination with a carriage for sustaining the paper to be printed, of means for transversely shifting said carriage comprising a shifter-bar connected with the carriage, armatures connected to said shifter-bar, electro magnets whereby said shifter-bar is actuated, plural supplemental magnets for locking said shifter-bar in central position, armatures for said supplemental magnets, pivoted supports for said armatures connected with said shifter-bar and electric selective apparatus controlling said magnets.

6. In printing telegraphs, the combination with a carriage for sustaining the paper to be printed, of means for transversely shifting said carriage comprising a shifter-bar connected with the carriage, armatures connected to said shifter-bar, electro magnets whereby said shifter-bar is actuated, plural supplemental magnets for locking said shifter-bar in central position, armatures for said supplemental magnets, pivoted supports for said armatures, said pivoted supports being united to said shifter-bar by pin and slot connections and electric selective apparatus controlling the flow of current through said magnets.

7. In printing telegraphs, the combination with the main paper carriage provided with a longitudinal rack-bar, of a pinion engaging said rack-bar, a shaft carrying said pinion, a ratchet wheel connected to said shaft, a feed pawl engaging said ratchet wheel, an armature suitably connected to said feed pawl, an electro magnet for said armature, a second electro magnet and armature for effecting the release of said feed pawl to permit the carriage to be returned to the starting point, a dog or check for holding the feed pawl out of action during the return movement of the carriage, an arm extending into the path of the carriage for releasing said dog or check when the carriage has reached its starting point and electric selective apparatus controlling said magnets.

8. In printing telegraphs, the combination with the paper carriage provided with a longitudinal rack-bar, of a pinion engaging said rack-bar, a shaft whereon said pinion is mounted, oppositely disposed ratchet teeth mounted on said shaft, a feed pawl and a check pawl respectively engaging said oppositely disposed ratchet teeth, an electro magnet and armature for actuating both said feed pawl and said check pawl an electric selective apparatus controlling said magnets.

9. In printing telegraphs, the combination with the paper carriage and with the revoluble platen and with pawl and ratchet mechanism for revolving said platen to effect the line-spacing of the paper, of contact strips or rails extending from end to end of the paper carriage, suitable brushes for engaging said contact strips or rails, an electro magnet having an armature suitably connected with pawl and ratchet mechanism, said electro magnet being electrically connected with said contact strips or rails and electric selective apparatus controlling said magnet.

10. In printing telegraphs, the combination with the inking ribbon and with a movable support whereby said ribbon may be carried above and away from the printing point, of means for effecting the shift of the inking ribbon support comprising a pivoted lever, an electro magnet having an armature connected to said pivoted lever and electric selective apparatus controlling said magnet.

11. In printing telegraphs, the combination with the inking ribbon and with a movable support whereby said ribbon may be carried above and away from the printing point, of means for effecting the shift of the inking ribbon support comprising a pivoted lever, plural electro magnets and armatures whereby said lever is shifted in opposite directions and electric selective apparatus controlling said magnets.

12. In printing telegraphs, the combination with the inking ribbon and with a movable support whereby said ribbon may be carried above and away from the printing point, of means for effecting the shift of the inking

ribbon support comprising a pivoted lever, plural electro magnets and armatures for actuating said lever in opposite directions, a spring for supplementing the action of one of said electro magnets and electric selective apparatus controlling said magnets.

13. In printing telegraphs, the combination with the inking ribbon and with a support whereby said ribbon may be carried above and away from the printing point, of means for effecting the shift of said inking ribbon support comprising a pivoted lever having an arm extending beyond its pivotal point, armatures connected with the opposite sides of said arm, electro magnets arranged upon opposite sides of said arm for attracting said armatures and electric selective apparatus controlling said magnets.

14. In printing telegraphs, the combination with the inking ribbon spools provided with ratchet wheels and with pawls for actuating said ratchet wheels, of a movable support for the inking ribbon to which support said pawls are connected, an electro magnet having an armature connected to said movable support whereby said support is shifted to move the ribbon above and away from the printing point and to effect the longitudinal advance of the ribbon and electric selective apparatus controlling said magnet.

15. In printing telegraphs, the combination with the inking ribbon and with a support whereby said ribbon may be carried above and away from the printing point, of means for effecting the shift of said inking ribbon support comprising a movable arm or lever, an electro magnet for actuating said movable arm or lever, pawls connected to said movable arm or lever, ratchet wheels with which said pawls may be engaged, ribbon spools to which said ratchet wheels are connected, means for throwing either of said pawls into or out of engagement with its corresponding ratchet wheel and electric selective apparatus controlling said magnet.

16. In printing telegraphs, the combination with the finger keys, the paper carriage and the carriage-feed, of an operating magnet for said carriage-feed, a normally open spring-held switch controlling the circuit through said magnet, a shifter for operating said switch against the tension of its spring, means controlled by the operation of the finger keys for actuating said shifter, a cam for tripping said shifter to permit the return of the switch to normal, open position and electric selective apparatus controlling said magnet.

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