

No. 638,579.

Patented Dec. 5, 1899.

E. C. HEGAN.
RECORDING APPARATUS.

(Application filed June 23, 1898.)

(No Model.)

9 Sheets—Sheet 1.

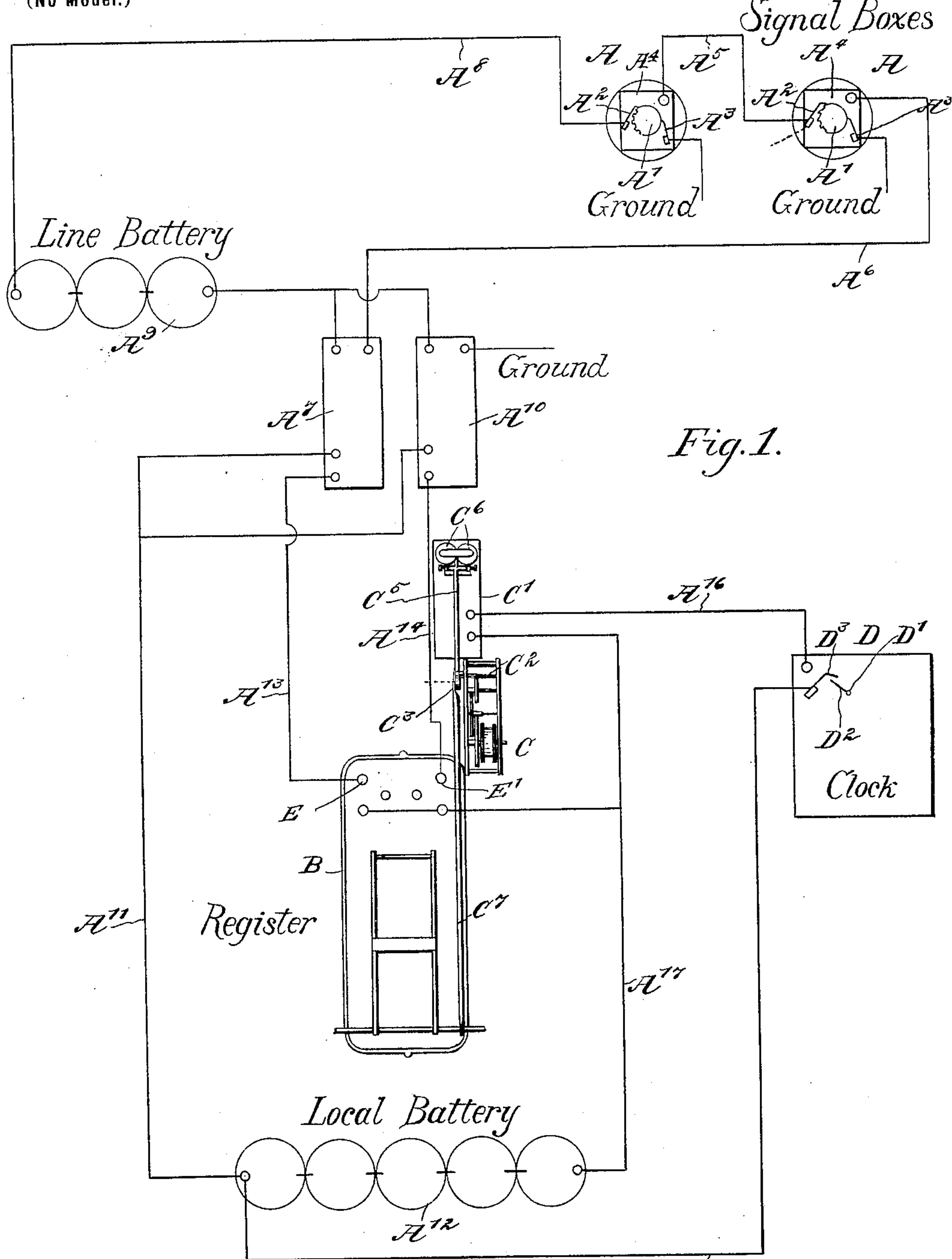
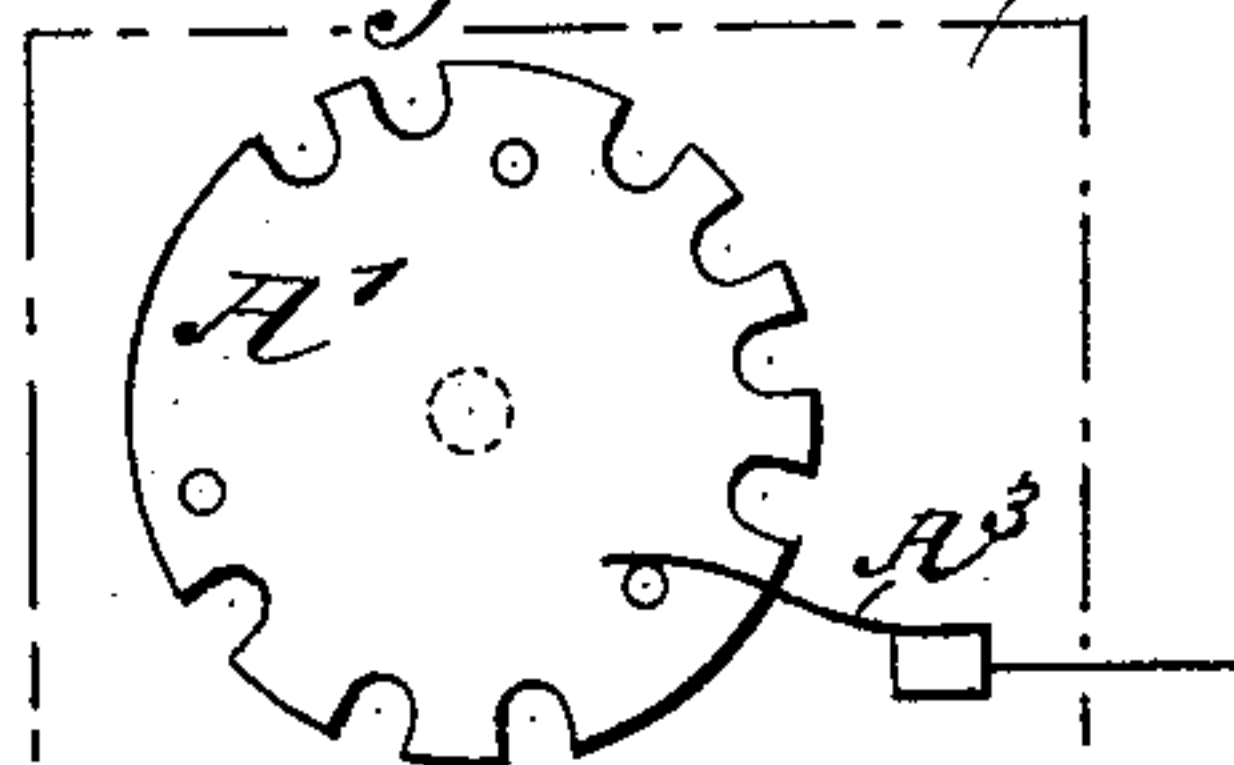


Fig. 1a.



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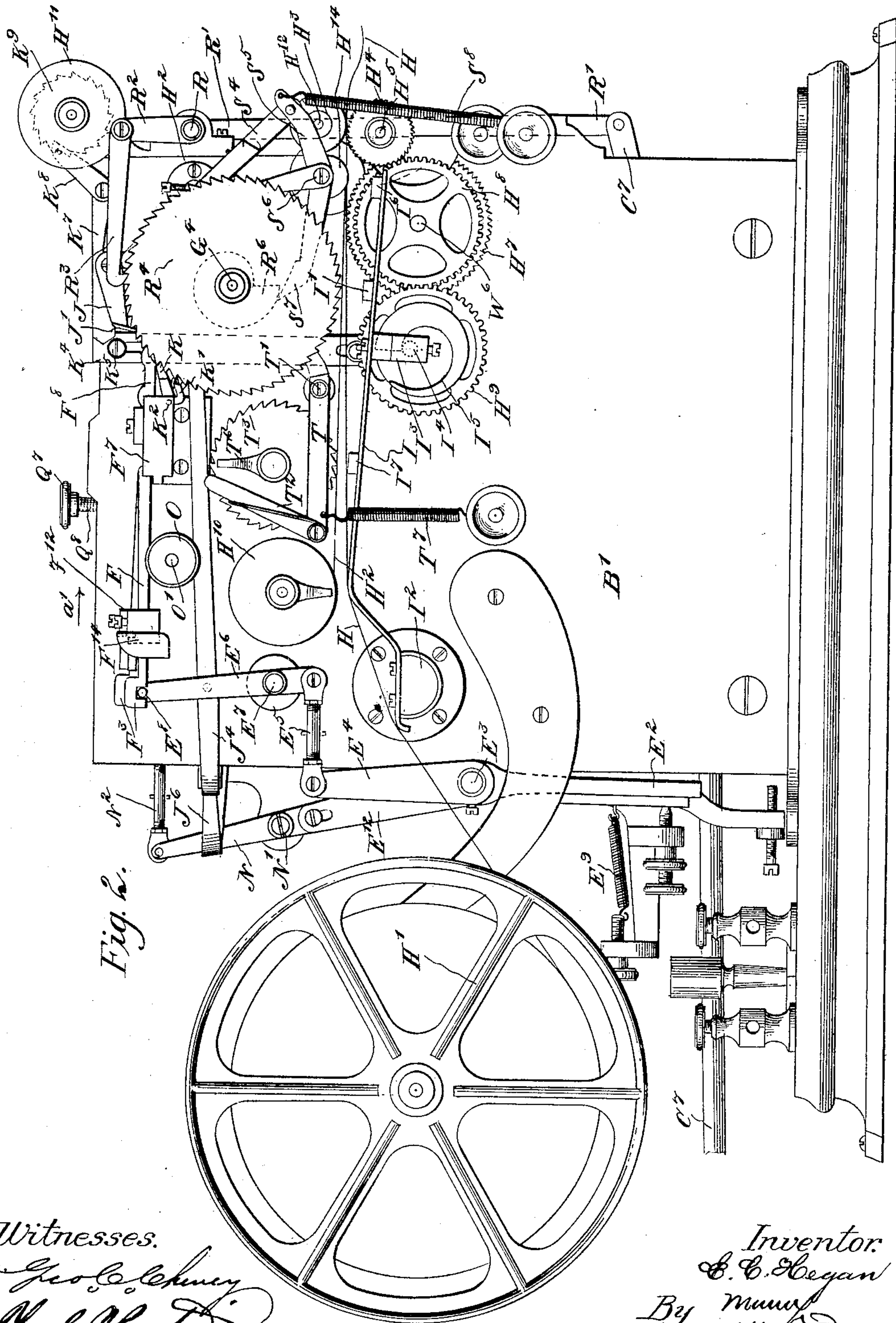
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9 Sheets—Sheet 2.



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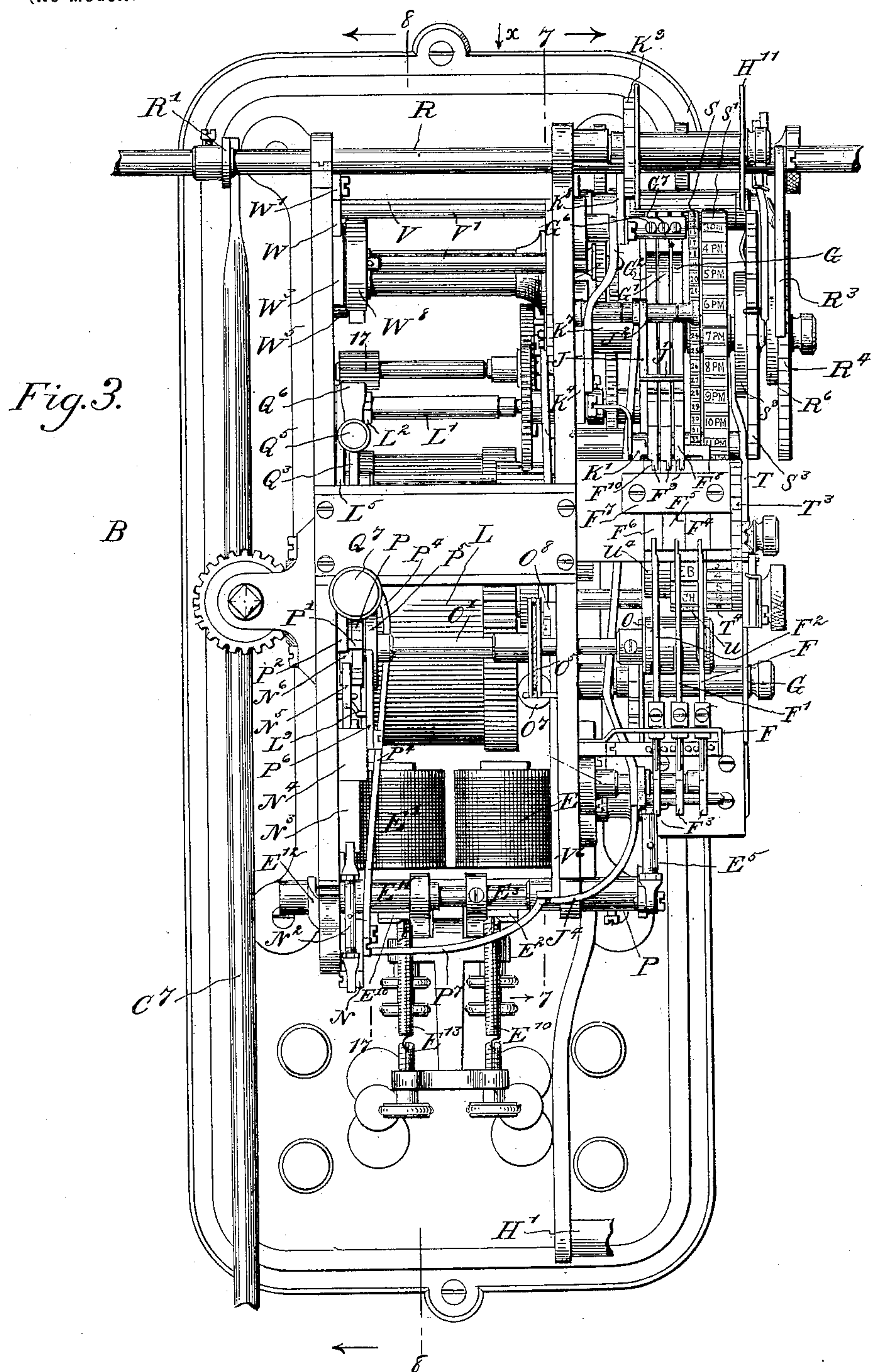
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9 Sheets—Sheet 3.



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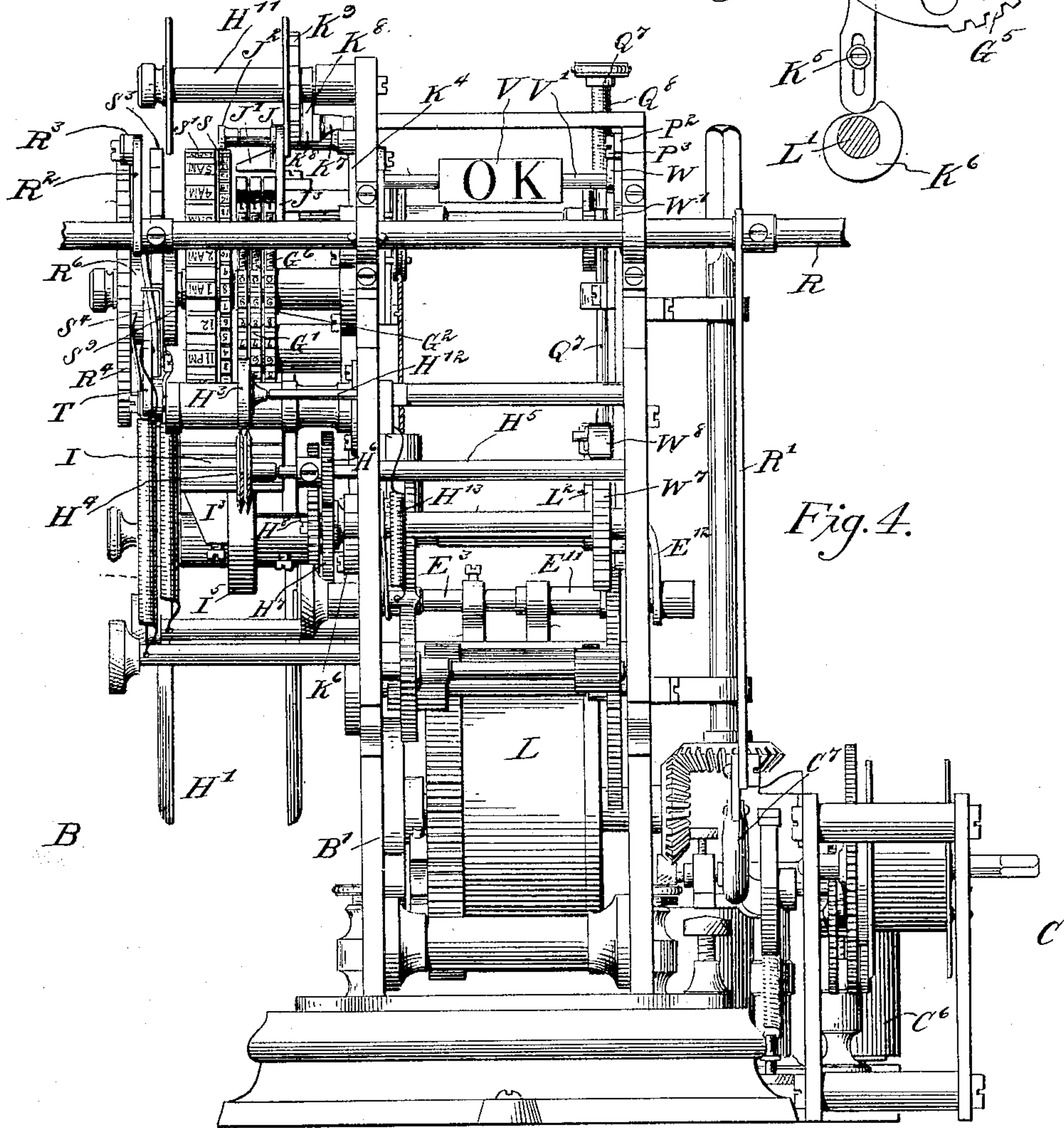
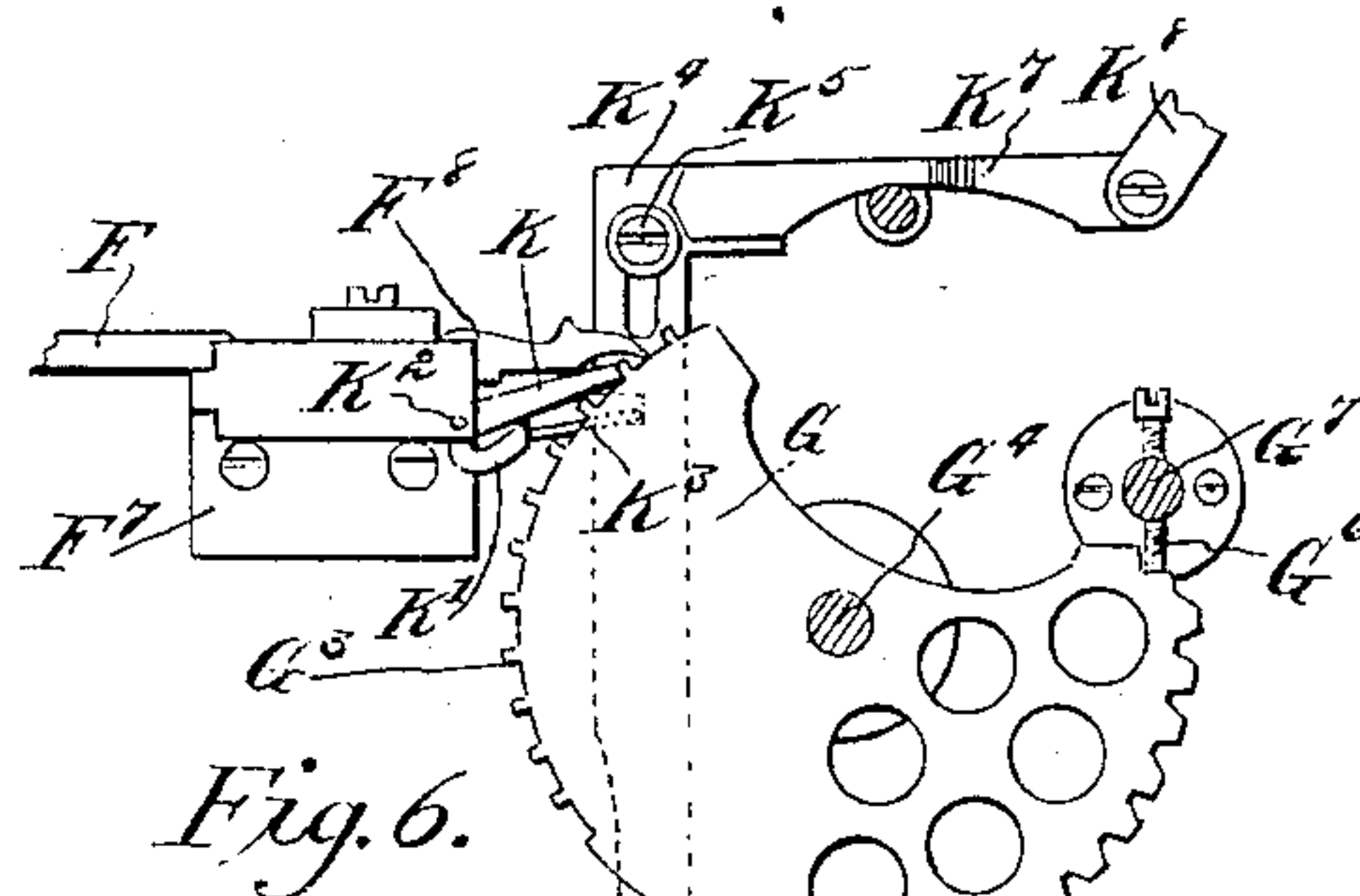
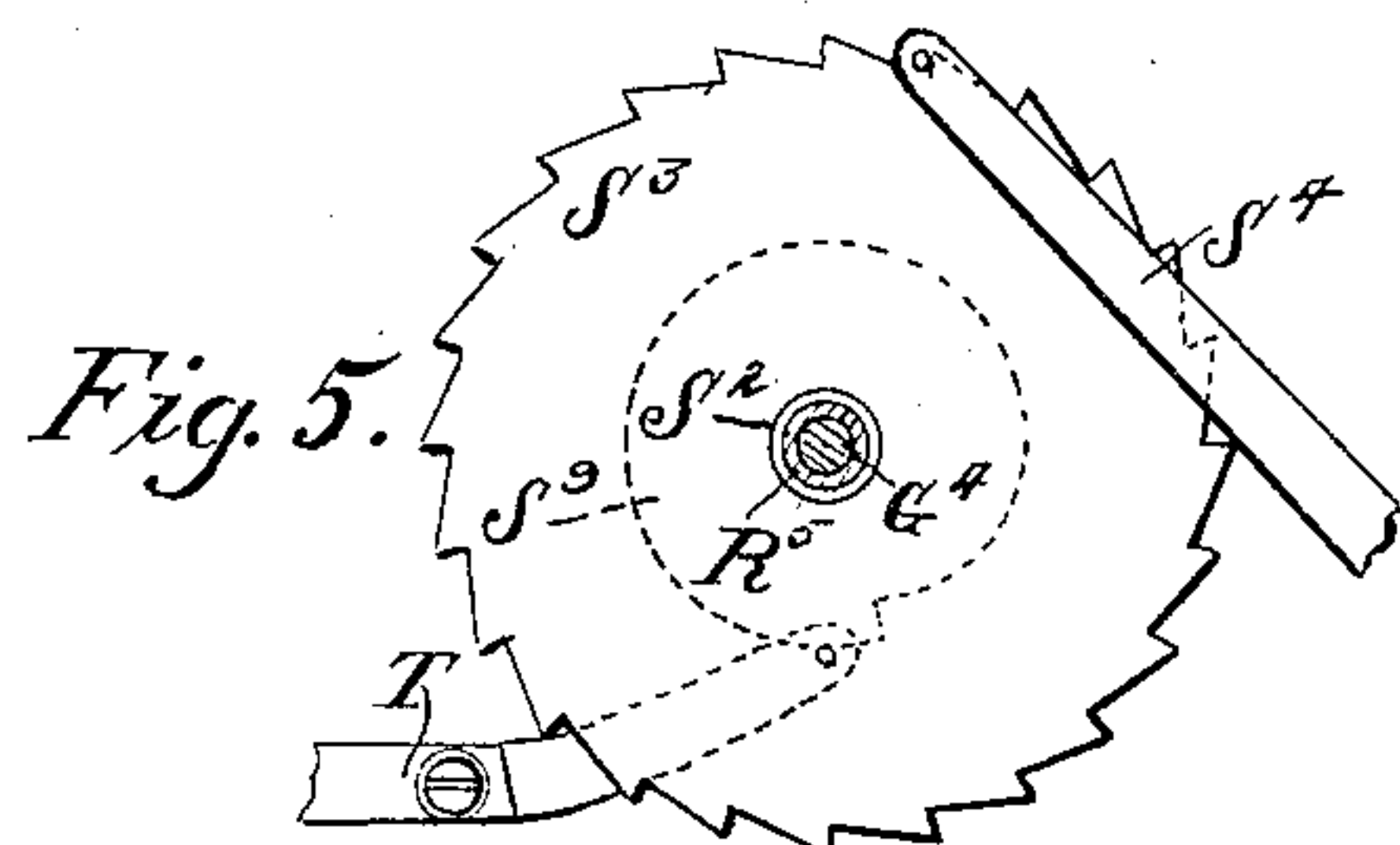
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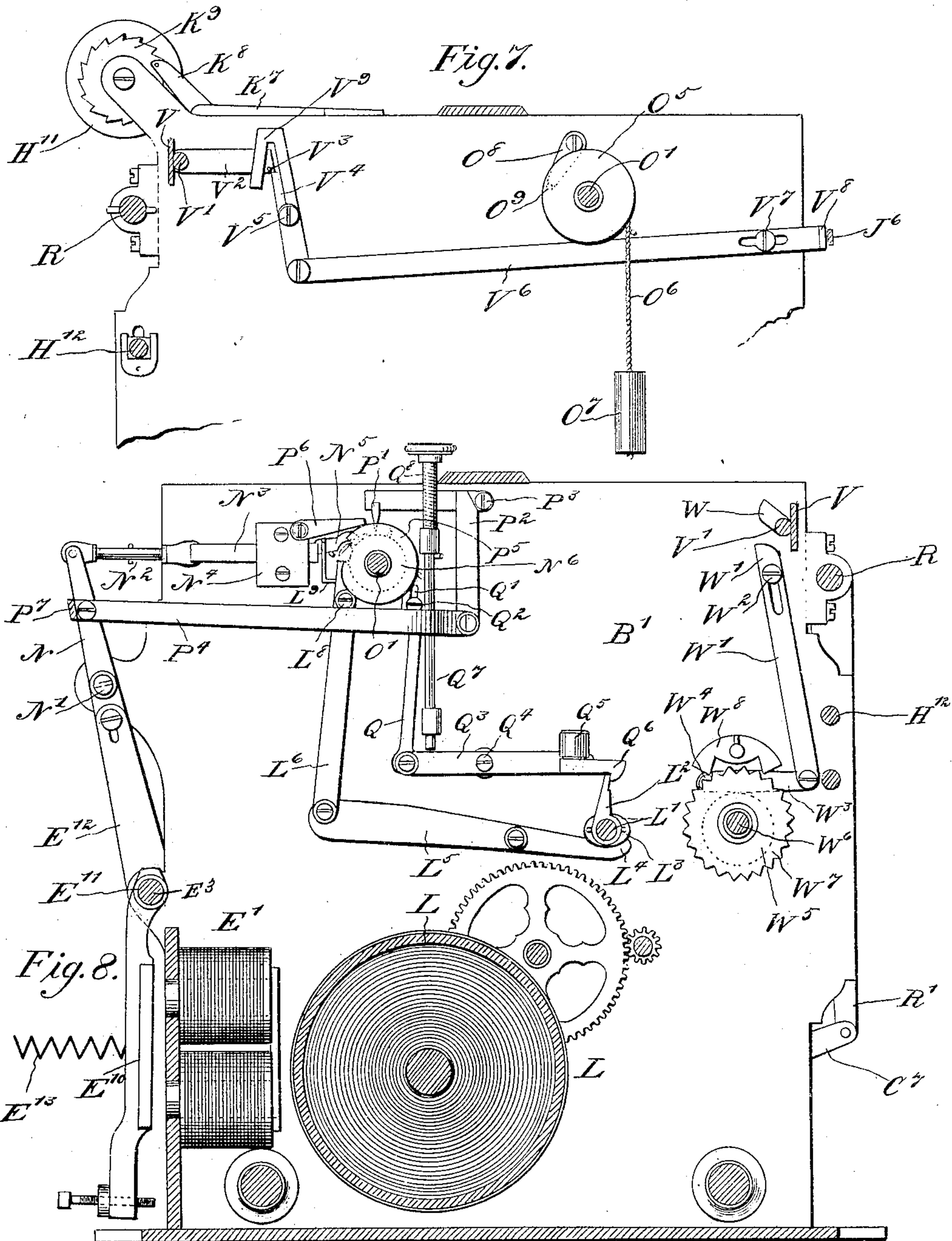
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9 Sheets—Sheet 5.



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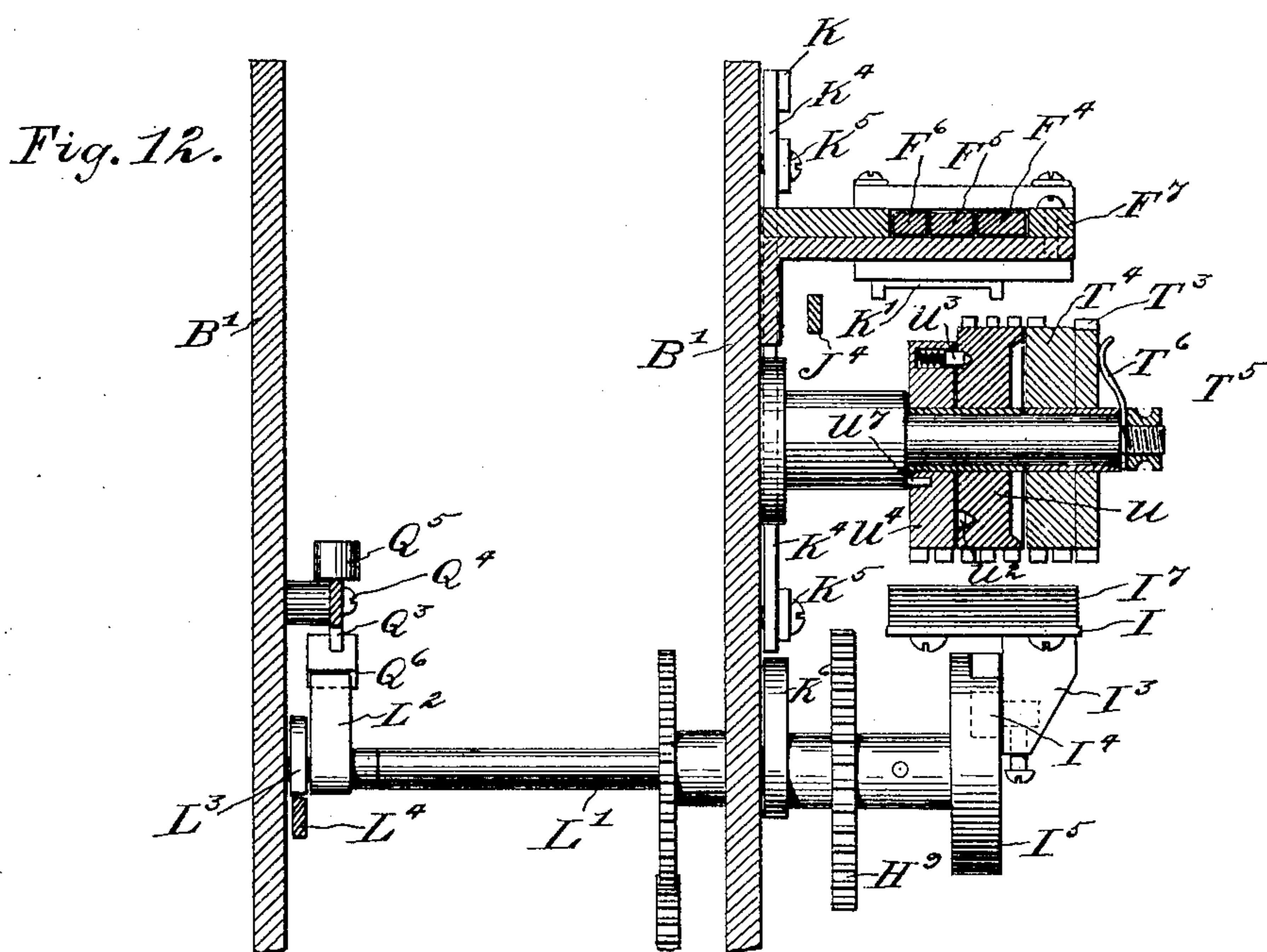
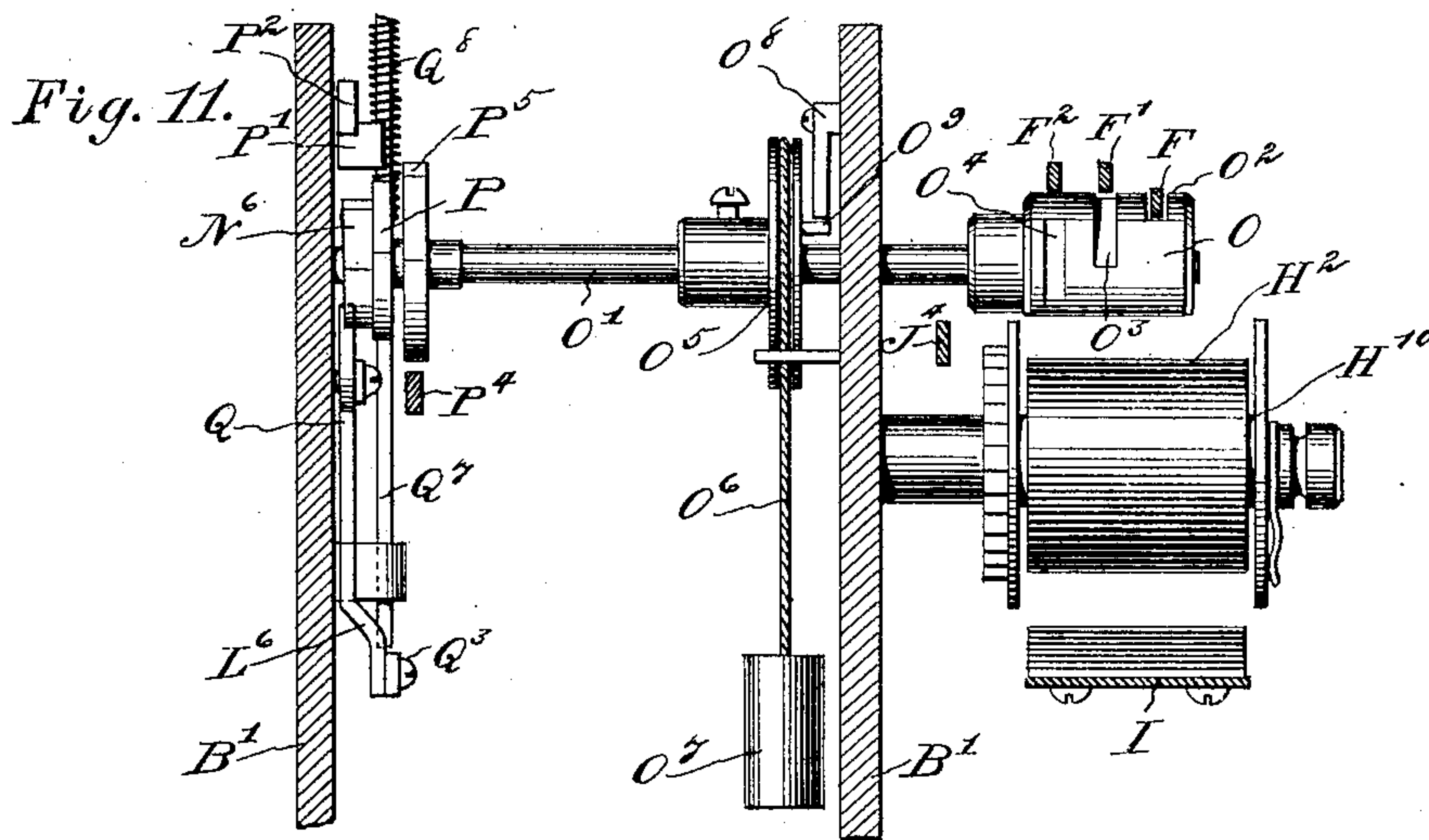
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(No Model.)

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(No Model.)

Fig. 15.

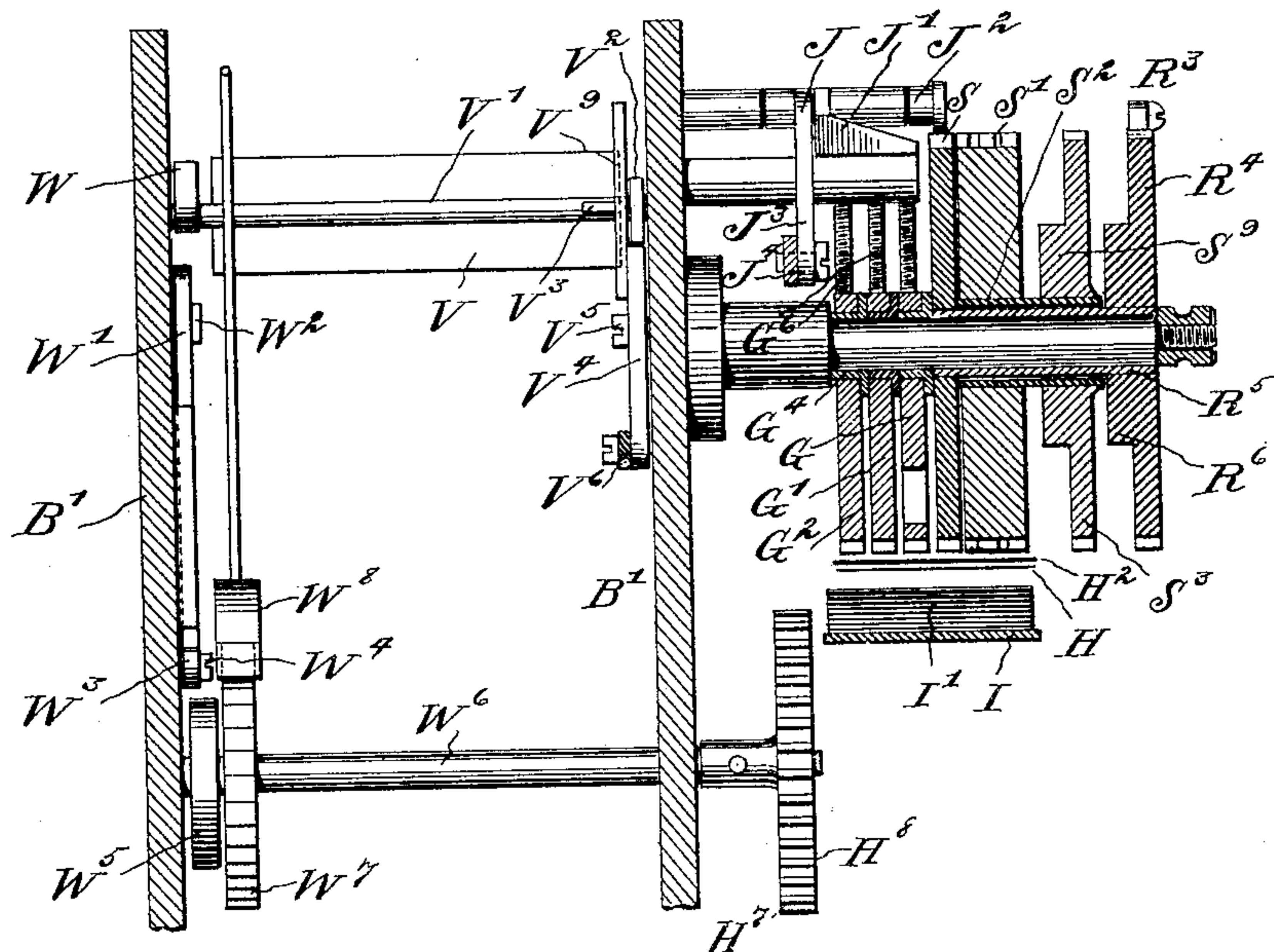
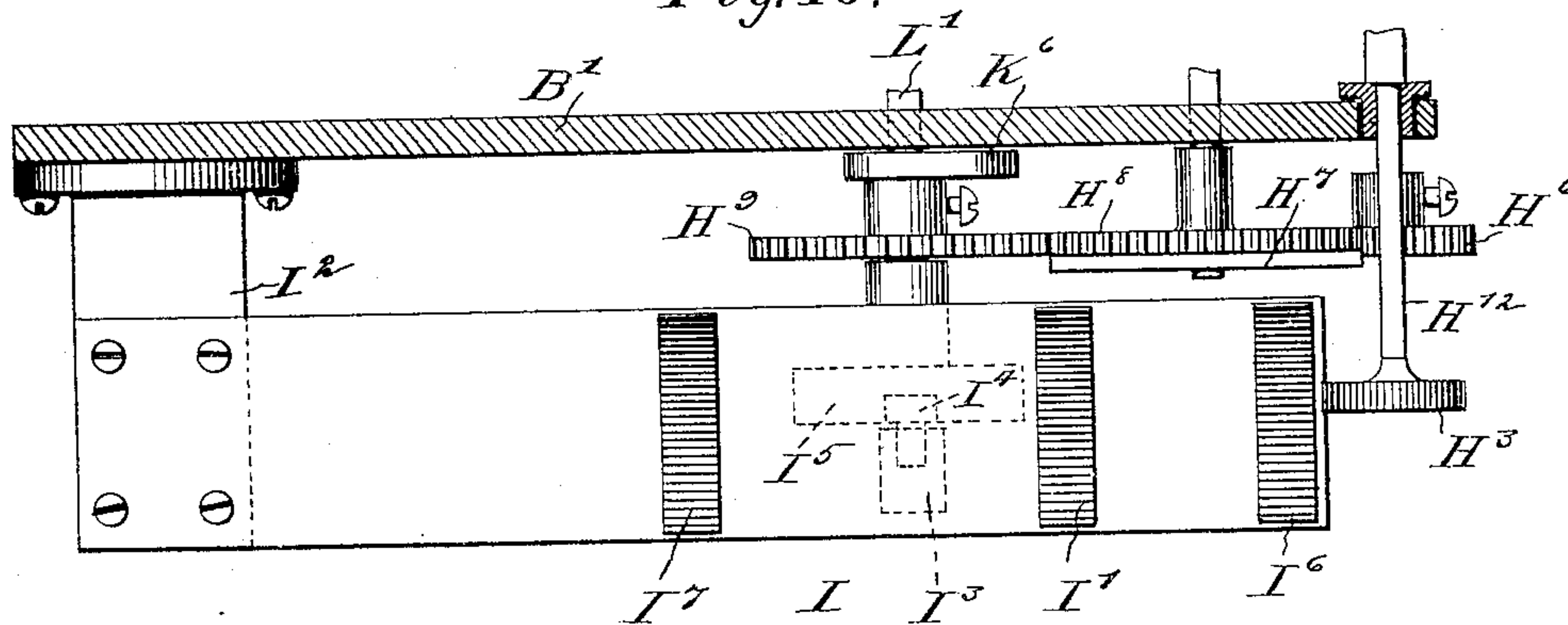


Fig. 16.



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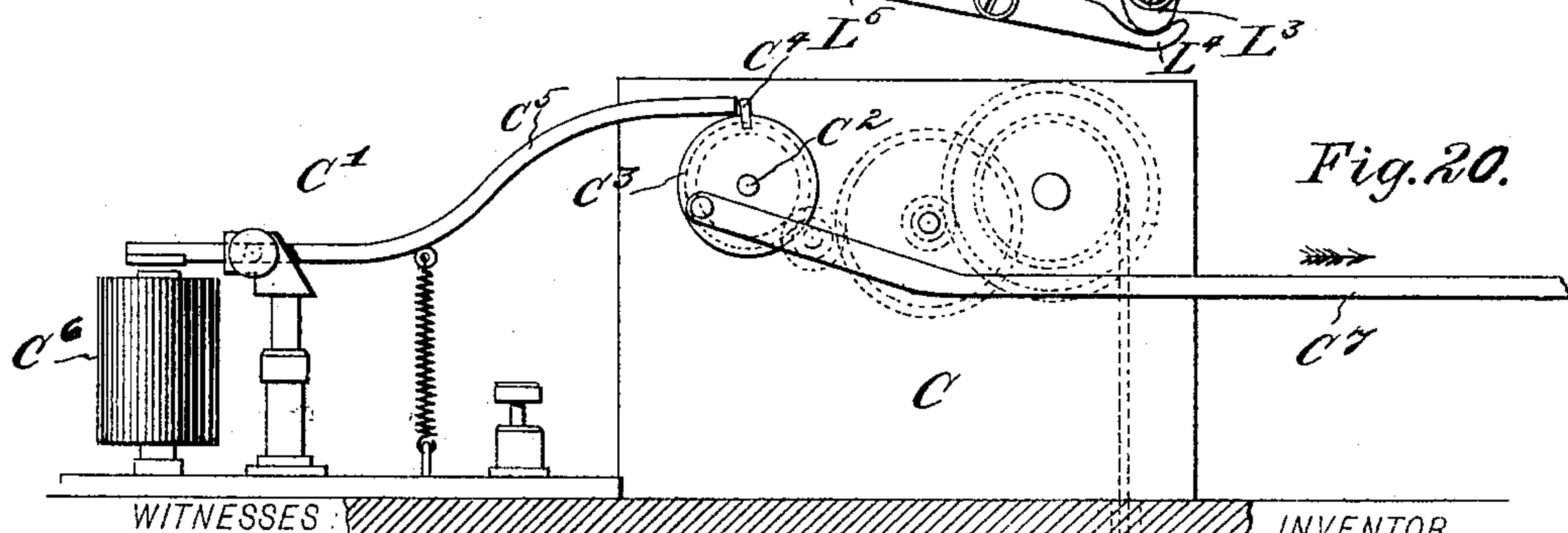
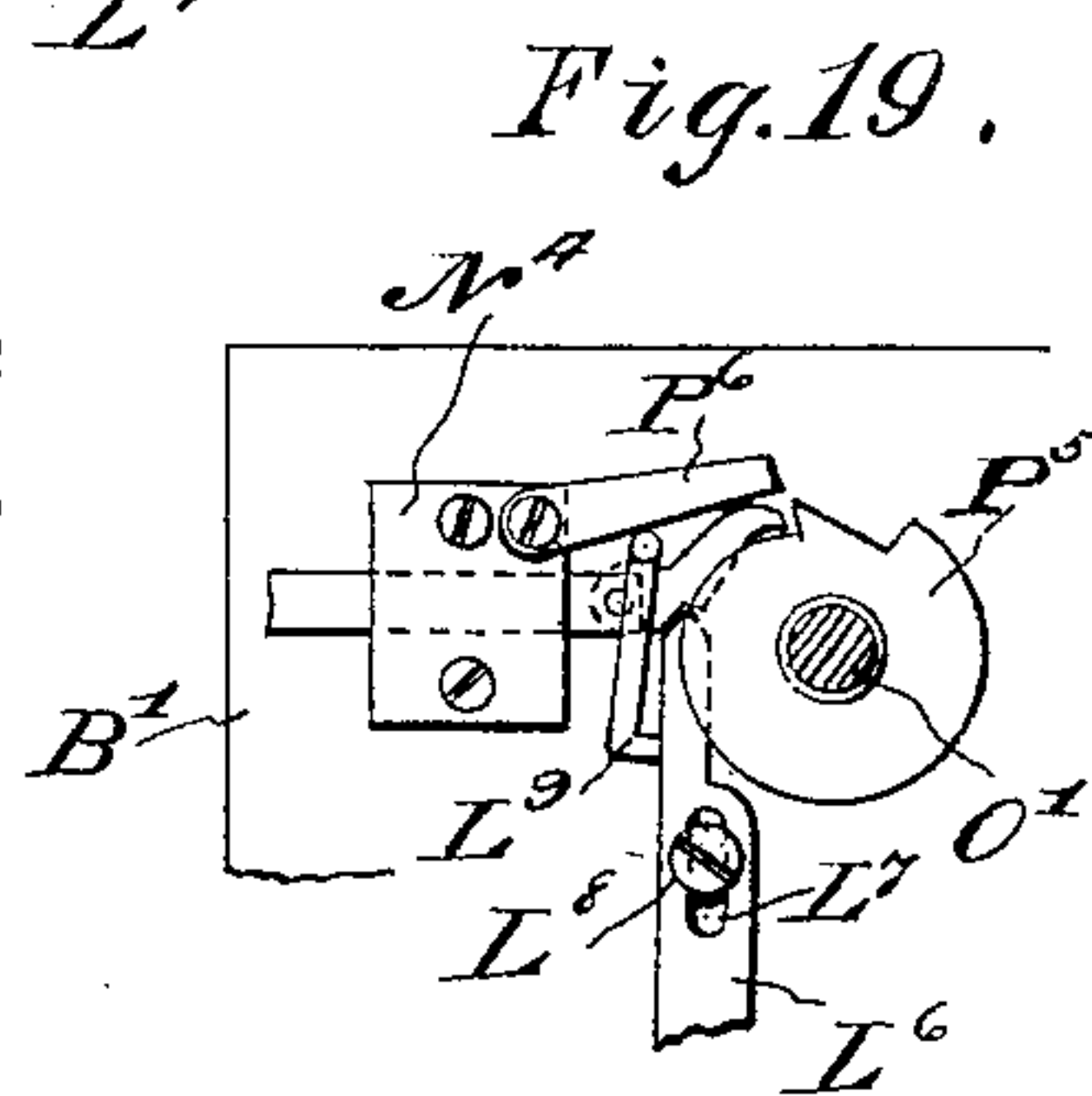
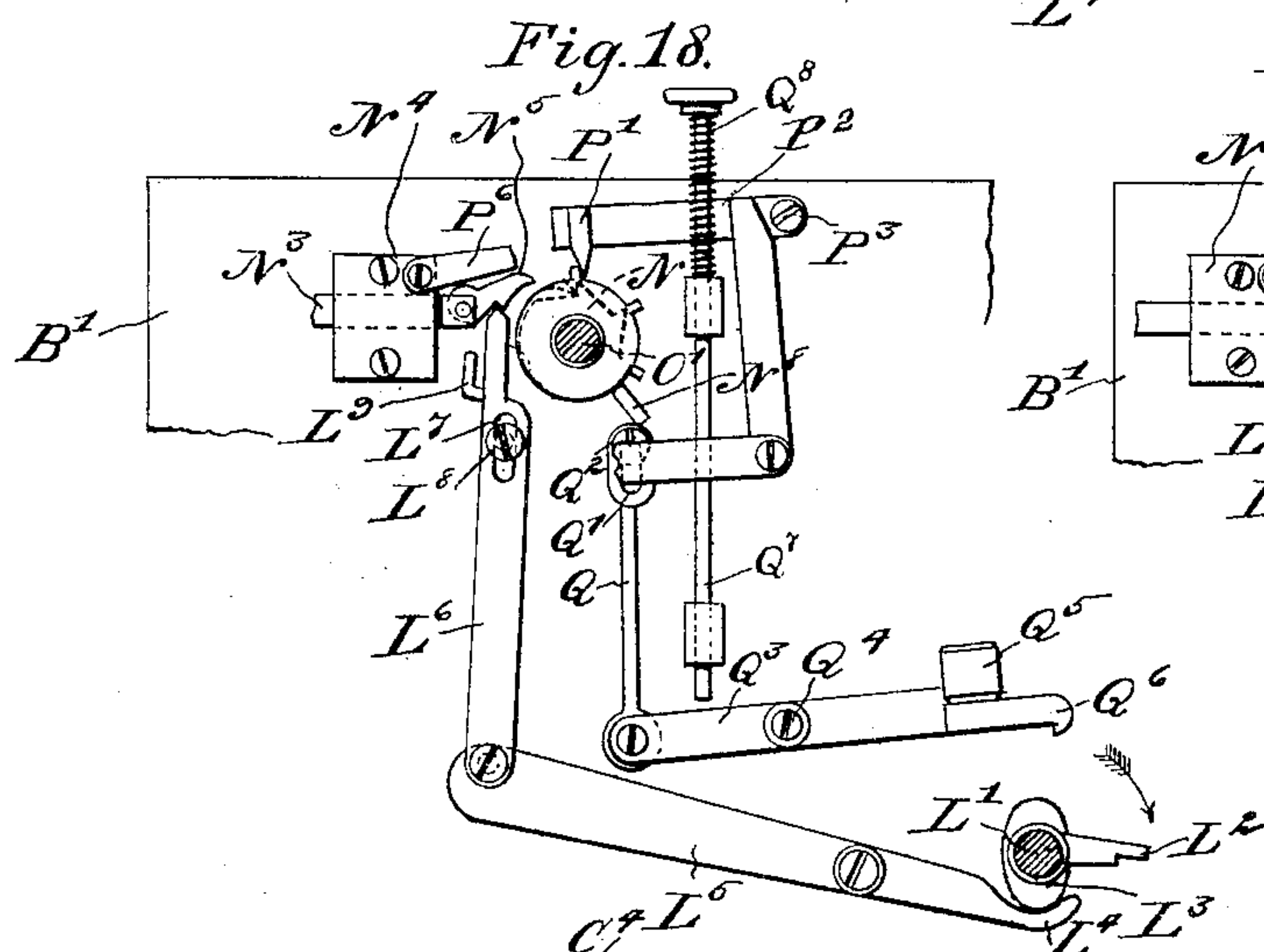
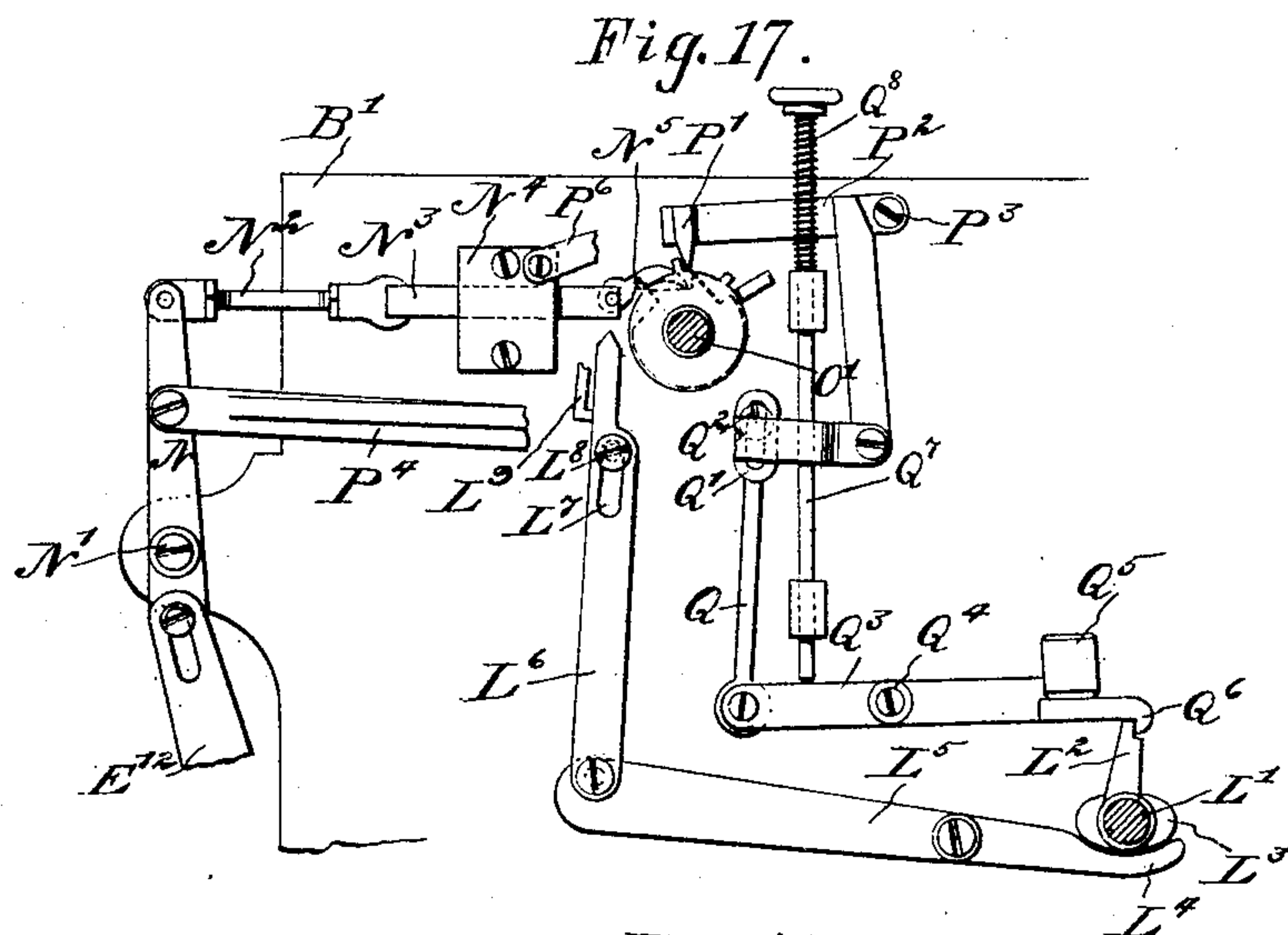
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E. C. HEGAN.
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(No Model.)

9 Sheets—Sheet 9.



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UNITED STATES PATENT OFFICE.

EDWIN COULSON HEGAN, OF LOUISVILLE, KENTUCKY.

RECORDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 638,579, dated December 5, 1899.

Application filed June 23, 1898. Serial No. 684,265. (No model.)

To all whom it may concern:

Be it known that I, EDWIN COULSON HEGAN, of Louisville, in the county of Jefferson and State of Kentucky, have invented a new and
5 Improved Recording Apparatus, of which the following is a full, clear, and exact description.

The invention relates to recorders used in district telegraph-offices, fire-alarm and police
10 stations, and other similar institutions and places transacting business by telegraphing signals.

The object of the invention is to provide a new and improved recording apparatus which
15 is completely automatic in operation and arranged to furnish a full and complete record in plain writing on a tape of all the telegraph-work done during a given period, with the date and the number of the circuit.

20 The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying
25 drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a diagrammatic plan view of the circuit arrangement of the improvement.
30 Fig. 1^a is a face view of the signal-box-circuit wheel and of a brush engaged therewith. Fig. 2 is a rear elevation of the registering apparatus. Fig. 3 is a plan view of the same. Fig. 4 is an end elevation of the same in the direction of the arrow *x* in Fig. 3. Fig. 5 is an enlarged side elevation of the hour-wheel ratchet and the actuating-lever therefor. Fig. 6 is a sectional side elevation of the number-wheel and adjacent parts. Fig. 7 is a rear
35 sectional elevation of part of the improvement on the line 7 7 in Fig. 3. Fig. 8 is a sectional side elevation of the improvement on the line 8 8 in Fig. 3. Fig. 9 is an enlarged plan view of part of the improvement. Fig. 10 is a sectional side elevation of the same on the line 10 10 in Fig. 9. Fig. 11 is a transverse section of the same on the line 11 11 in Fig. 9. Fig. 12 is a like view of the same on the line 12 12 in Fig. 10. Fig. 13 is a face
40 view of the year dating-wheel. Fig. 14 is a like view of the month dating-wheel. Fig. 15 is an enlarged cross-section of part of the

improvement on the line 15 15 in Fig. 10. Fig. 16 is a sectional plan view of part of the improvement, showing the platen and means for
55 moving the same, substantially on the line 16 16 in Fig. 10. Fig. 17 is a sectional side elevation of part of the improvement on the line 17 17 in Fig. 3. Fig. 18 is a like view of the same with parts in a different position. 60 Fig. 19 is a similar view of part of the same, showing a changed adjustment; and Fig. 20 is a rear elevation of the weight-motor for actuating the time-stamp.

The several signal-boxes A in the system
65 are alike in construction and are so arranged that the circuit is always closed when the box is not in use. Each signal-box A is provided with a revoluble circuit-wheel A', having in its periphery sets of notches and operating, in
70 conjunction with a brush A², so that when the wheel A' revolves at the time a signal is sent to the central station then the circuit is broken on the brush passing over the notches. The notches in the circuit-wheel indicate the num-
75 ber of the corresponding box A, and which number is to be recorded on the apparatus when the time-signal box is used. Thus if the number of a signal-box is, say, No. 243, the wheel A' of this box is provided with three
80 sets of notches, of which the first set has two notches close together for the numeral "2," the second set is spaced therefrom and has four notches for the numeral "4," and the third set is spaced from the second one and has three
85 notches for the numeral "3." The wheel A' is further provided at its rear face with pins (see Fig. 1^a) for making contact with a brush A³ at the time the other brush A² is in contact with the wheel between adjacent sets of
90 notches, said brush A³ being connected with the ground.

The several signal-boxes A in the system are connected with each other as indicated in Fig. 1—that is, the plate A⁴, which carries
95 the signal-box works, is connected by a wire A⁵ with the brush A² of the next signal-box, and this box is connected at its plate A⁴ with the brush A² of the following box, and so on throughout the system. The plate A⁴ of the
100 last box in the series is connected by a wire A⁶ with a relay A⁷, and the brush A² of the first box is connected by a wire A⁸ with a line-battery A⁹ and with the relay A⁷ and the re-

lay A^{10} , the latter being also connected with the ground. The relays A^7 and A^{10} are connected by a wire A^{11} with a local battery A^{12} , connected with the register B, located in the central office, said register being also connected by wires A^{13} and A^{14} with the relays A^7 and A^{10} .

From the foregoing it will be seen that the register is actuated by two electric currents coming over the same wire, one being a ground-current, which necessitates the other being a closed metallic current. As the currents come successively to the relays A^7 and A^{10} the latter are actuated and in turn cut in the local battery A^{12} for actuating the register B. When the signal-box—say No. 243—is used and its mechanism is set in motion in the usual manner, then the relay A^7 is first twice actuated or receives two successive impulses by the breaking of the circuit on the brush A^2 , passing over the first set of notches (two notches) of the wheel A' , and then the relay A^{10} is actuated by the pin on the wheel A' coming in contact with the brush A^3 . The relay A^7 next receives four impulses for the numeral “4” and the relay A^{10} is actuated by the second pin on wheel A' . Then the relay A^7 receives three impulses, and finally the relay A^{10} receives another impulse. The local battery A^{12} is also connected with a releasing device C' for a spring or weight motor C, employed for actuating the time-stamp, said releasing device being electrically connected with a clock D, also connected with the local battery A^{12} . The clock D carries on its seconds-hand staff D' an arm D^2 , adapted to move at every revolution—that is, every minute—in contact with a contact-plate D^3 , secured to but insulated from the clock-casing. A wire A^{15} connects the contact-plate D^3 with the local battery A^{12} , and a wire A^{16} leads from the clock-casing to the releasing device C' of the motor C, so that when the arm D^2 moves in contact with the plate D^3 the circuit for the releasing device C' is closed and the motor is allowed to actuate the time-dating stamp, as hereinafter more fully described, it being understood that the time is thus obtained when a signal from a signal-box A is recorded.

The register B is provided with a suitably-constructed framework B' , on which are mounted two electromagnets E E' , of which the former is connected by the wire A^{13} with the relay A^7 , and the other electromagnet E' is connected by the wire A^{14} with, and is actuated from, the relay A^{10} . The spring-pressed armature E^2 of the electromagnet E is secured at its upper end to a transversely-extending shaft E^3 , journaled in suitable bearings on the framework B' and provided with an upwardly-extending arm E^4 , connected by a link E^5 with the lower end of a lever E^6 , fulcrumed at E^7 on the framework B' . The upper end of the lever E^6 is provided with a transversely-extending pin E^8 , adapted to be engaged by the hook F^3 of one of three bars F F' F^2 , extending longitudi-

nally and arranged one alongside the other, the bars being connected with slides F^4 F^5 F^6 , respectively, mounted to slide in a suitable guideway F^7 , attached to the framework B' . On the forward ends of the slides F^4 F^5 F^6 are fulcrumed the pawls F^8 F^9 F^{10} , respectively, adapted to engage teeth G^3 on the numeral-wheels G G' G^2 , respectively, mounted to turn loosely and independently of each other on a stud G^4 , secured to the framework B' , this construction being best shown in Figs. 2, 9, and 10. When the electromagnet E is energized and its armature E^2 is attracted, then the shaft E^3 is turned and the arm E^4 pulls on the link E^5 to impart a swinging motion to the lever E^6 , so that the latter, by the pin E^8 , imparts a forward movement to the bar F , F' , or F^2 in the direction of the arrow a' , whichever bar is connected by its hook F^3 with the pin E^8 . The forward movement given to the bar F is transmitted to the corresponding slide and pawl, so that the corresponding intermediate wheel G , G' , or G^2 is turned the distance between two of its ratchet-teeth G^3 . When the current is broken, the spring E^9 , connected with the armature-lever E^2 , returns the several parts—that is, the armature-lever, the shaft E^3 , the arm E^4 , the link E^5 , the lever E^6 , the bar F , F' , or F^2 , and the corresponding slide and pawl—to their former positions.

Each of the numeral-wheels G G' G^2 is provided at the lower portion of its periphery with type G^5 , representing the successive numerals from “0” to “9,” for printing the number of the signal-box upon a piece of tape H, unwinding from a reel H' , the printing being accomplished by the use of a ribbon H^2 and a block I' on a platen I, made in the form of a longitudinally-extending spring-plate secured at one end to a bracket I^2 on the framework B' . (See Fig. 2.) The wheels G G' G^2 are cut out in their upper portions between the teeth G^3 and the type G^5 , as is plainly indicated in Figs. 3 and 10, so that said wheels are free to return by their own gravity to a normal position after the numeral of the signal-box is printed, as hereinafter more fully described, it being understood that the said wheels normally stand with their lowermost peripheral portions at blank, the pawls F^8 F^9 F^{10} being then in engagement with the uppermost tooth G^3 . The pawls F^8 F^9 F^{10} are held in engagement with the teeth G^3 by a spring F^{11} , carried by the bracket F^7 . The teeth G^3 and the types G^5 are so arranged relative to each other that a full forward stroke of each pawl turns the corresponding wheel G , G' , or G^2 to bring the next type-numeral into a lowermost position. Thus when the electromagnet E is actuated twice in succession two successive strokes are given to a wheel G to bring the latter with the type-numeral “2” lowermost.

Near the rear ends of the bars F F' F^2 are secured by set-screws slotted blocks F^{12} , adapted to engage a transversely-extending rod F^{13}

at the time the hook end of the bar is in an uppermost position, so as to lock the corresponding bar against longitudinal movement. The hook ends of the bars normally rest on suitable guideways F^{14} , carried by the framework B' , also carrying the rod F^{13} . (See Figs. 9 and 10.)

A return movement of the wheels G G' G^2 by their own gravity is normally prevented by dogs K , fulcrumed on the bracket F^7 . (See Fig. 10.) The numeral-wheels G G' G^2 are prevented from being turned too far by the momentum given to said wheels by the pawls F^8 F^9 F^{10} , and for this purpose a transverse dog J' is provided, extending across the peripheries of the wheels at their upper ends between adjacent teeth G^3 , said dog being held on an arm J , secured to a shaft J^2 , journaled on the framework B' and provided with an arm J^3 , pivotally connected by a link J^4 with the lever E^6 , so as to work in unison with the pawls F^8 F^9 F^{10} , but in such a manner as to engage the teeth G^3 of the several wheels at the time either pawl F^8 , F^9 , or F^{10} is at or near the end of its forward stroke. When the pawls F^8 F^9 F^{10} are moved forward by the action of the lever E^6 , the dog J' swings downward by its connection with said lever, and when the pawls move backward the dog swings upward to disengage the teeth G^3 and unlock the wheels. The dogs K are located under their corresponding pawls F^8 F^9 F^{10} and are adapted to be lifted by a transversely-extending lifting-arm K' , after the printing of the numeral is done, to permit the numeral-wheels G G' G^2 to return by gravity to their normal position, the wheels then abutting against set-screws G^6 , carried on an arm G^7 , projecting from the framework B' .

The lifting-arm K' for the dogs K is fulcrumed on the same pivot K^2 that carries the dogs, and said lifting-arm is provided at its rear end with an extension K^3 , engaging a slot in a vertically-disposed bar K^4 , fitted to slide vertically on screws K^5 , extending through slots in the said bar K^4 , the screws being secured to the framework B' . The lower end of the bar K^4 is adapted to be engaged and lifted by a cam K^6 , secured on a shaft L' , journaled in suitable bearings in the framework B' and connected by suitable gear-wheels with a spring-motor L of any approved construction and carried by said framework. (See Fig. 8.) When the shaft L' is rotated from the motor, as hereinafter more fully described, then the bar K^4 is lifted, and in doing so the extension K^3 of the arm K' imparts an upward swinging motion to the latter to lift the dogs K and the pawls F^8 F^9 F^{10} out of mesh with the teeth G^3 to permit the latter to return, as above explained. It is understood that normally the dog J' is out of mesh with the teeth G^3 , so that this dog does not need to be lifted at the time the dog K and the pawls F^8 F^9 F^{10} are swung upward.

The platen I is drawn downward against its spring tension and then suddenly released to

make an impression, the block I' pressing against the tape H and the ribbon H^2 pressing against the corresponding types G^5 to print the number of the signal-box on the tape. For this purpose the under side of the platen I is provided with a depending arm I^3 , carrying a friction-roller I^4 , engaged by a spiral cam I^5 , secured on the outer end of the shaft L' , so that when the motor L rotates the shaft, as previously mentioned, then the cam I^5 by engaging the friction-roller I^4 draws the platen I downward against its spring tension, and when the friction-roller nears the abrupt end of the cam and passes over the same then the platen swings back and moves the block I' up to make the impression, as above explained. (See Fig. 2.) When the platen I is drawn downward and the block I' is away from the tape H , then the latter is fed forward, and for this purpose the outer end of the tape passes between a smooth roller H^3 and a toothed roller H^4 , of which the latter is secured on a shaft H^5 , mounted to turn in suitable bearings in the framework B' .

On the shaft H^5 is secured a gear-wheel H^6 , adapted to mesh with a mutilated gear-wheel H^7 , secured on a gear-wheel H^8 , in mesh with a gear-wheel H^9 , fastened on the shaft L' . When the latter is rotated, a rotary motion is transmitted by the gear-wheels H^9 , H^8 , H^7 , and H^6 to the toothed wheel H^4 , so as to draw the tape H forward while the platen I is drawn downward by the friction-roller I^4 and the cam I^5 ; but when the friction-roller drops off the cam, as above explained, then at this time the mutilated gear-wheel H^7 moves out of mesh with the gear-wheel H^6 , and consequently the toothed wheel H^4 remains stationary for the time being—that is, while the platen makes an impression on the paper, which is now at a standstill. A similar intermittent forward movement is given after each impression to the ribbon H^2 , which unwinds under spring tension from a spool H^{10} and winds up on a spool H^{11} , both carried by the framework B' . For this purpose the bar K^4 is provided at its upper end with an extension K^7 , carrying a pawl K^8 , in mesh with a ratchet-wheel K^9 , secured on the spool H^{11} , so that when the cam K^6 pushes the bar K^4 upward then the pawl K^8 turns the ratchet-wheel K^9 and the ribbon-spool H^{11} to wind up the ribbon H^2 at the time the platen I swings downward.

The friction-roller H^3 is journaled on a stud H^{12} , fitted to slide vertically in the framework B' and drawn upon by a spring H^{13} for pressing the roller H^3 in proper contact with the toothed wheel H^4 and for feeding the tape H forward. The tension of the spring H^{13} may be regulated by suitable mechanism. This construction is best shown in Fig. 4.

The bars F F' F^2 , by their hooks F^3 , are connected with and disconnected from the pin E^8 by a mechanism controlled from the electromagnet E' , energized from the relay A^{10} , as previously mentioned. The electromagnet E' has its armature E^{10} secured at the upper

end to a sleeve E^{11} , mounted to turn on the shaft E^3 . A spring E^{13} normally holds the armature-lever E^{10} out of contact with the said electromagnet, as shown in Fig. 8. On the shaft E^{11} is secured an upwardly-extending arm E^{12} , (see Figs. 8, 17, and 18,) and said arm E^{12} has a pivotal connection with the lower end of a lever N , fulcrumed at N' to the framework B' . The upper end of the lever N is pivotally connected by a link N^2 with a slide N^3 , fitted to slide longitudinally in a suitable bearing or guideway N^4 , attached to the framework. On the free end of the slide N^3 is fulcrumed a pawl N^5 , in mesh with a toothed wheel N^6 , secured on a shaft O' , extending transversely and journaled in suitable bearings in the framework B' . On the forward end of the shaft O' is secured a cam O , formed in its peripheral surface with three notches O^2 O^3 O^4 , in vertical alinement with the bars F F' F^2 , as is plainly indicated in Figs. 9 and 11, said notches O^2 O^3 O^4 being arranged successively on the peripheral surface, so that one of the notches is engaged at a time by the corresponding bar. When this takes place, the bar is in such a lowermost position as to engage with its hook F^3 the pin E^8 , and consequently when the lever E^6 receives a swinging motion, as previously explained, then this bar is pushed forward to actuate the corresponding number-wheel G , G' , or G^2 . Normally the cam O is in such a position that the first bar F is in engagement with the notch O^2 , and when the electromagnet E' is energized by an impulse from the relay A^{10} then the armature-lever E^{10} in swinging inward causes the arm E^{12} to impart a swinging motion to the lever N , which by the link N^2 imparts a sliding motion to the slide N^3 and causes the pawl N^5 to turn the wheel N^6 , so as to turn the shaft O' and cam O a distance to lift the bar F out of the notch to disengage the hook F^3 of this bar from the pin E^8 and to bring the notch O^3 on the top of the cam for the bar F' to drop into and with its hook F^3 now engaging the pin E^8 . On the next impulse given to the electromagnet E' the above-described operation is repeated—that is, the shaft O' and cam O are again turned a distance to lift the bar F' out of the notch O^3 and disconnect the hook of this bar from the pin E^8 and to allow the bar F^2 to swing by its own weight down into the notch O^4 , which is now uppermost, so that the hook F^3 of this bar engages the pin E^8 . It is understood that when the impulse given to the electromagnet ceases then the spring E^{13} draws the armature-lever E^{10} back to its former position (shown in Fig. 8) to return the arm E^{12} , lever N , link N^2 , slide N^3 , and the pawl N^5 . The pawl N^4 normally rests on a pin N^7 , held on the framework.

The shaft O' , with the cam O and toothed wheel N^6 , is returned to its former position, after the number of the signal-box has been recorded, by means of a pulley O^5 and a rope O^6 , secured to the pulley and carrying at its

lower end a weight O^7 , as shown in Figs. 7 and 11. A stop O^8 , secured to the framework, is adapted to be engaged by a pin O^9 on the forward face of the pulley O^5 to limit the return movement of the pulley and shaft, as indicated in Fig. 7, it being understood that at this time the notch O^2 is uppermost, the bar F being in the notch and its hook F^3 in engagement with the pin E^8 .

In order to prevent the shaft O' and its cam O from being turned too far by the action of the pawl N^5 , I provide the said shaft with a ratchet-wheel P , arranged alongside the wheel N^6 and engaged by a dog P' , secured to a bell-crank lever P^2 , fulcrumed at P^3 on the framework B' . The bell-crank lever P^2 is pivotally connected by a link P^4 with the lever N , previously mentioned, so that when the lever receives a swinging motion at the time the electromagnet is energized then the link P^4 imparts a swinging motion to the bell-crank lever P^2 to bring the dog P' downward to engage a tooth of the ratchet-wheel P at the time the pawl N^5 is at the end of its stroke. Thus a further turning of the shaft O' and cam is checked.

In order to prevent the shaft O' from turning in the opposite direction by the action of the weight O^7 , rope O^6 , and pulley O^5 at the time the slide N^3 moves outward with the pawl N^5 , I provide a dog P^6 , fulcrumed on the bearing N^4 and engaging a ratchet-wheel P^5 on the shaft O , as is plainly indicated in Fig. 19. This ratchet-wheel P^5 has but two teeth, and the free end of the dog P^6 rests on the uncut peripheral surface of said wheel at the time the shaft O' and the cam O are in a normal position, as will be readily understood by reference to Fig. 8. When the first impulse is given to the electromagnet E' , the dog P^6 drops into the first tooth at the time the notch O^2 is in a top position, and when the next impulse is given to the electromagnet E' and the shaft O' is again turned then the dog drops into the next tooth. When the third impulse is given to the electromagnet E' , then the cam O is turned to move the bar F out of engagement with the pin E^8 , so that all three bars are now disengaged from the said pin, and at this time a pin N^8 on the wheel N^6 is moved in engagement with the upper end of a link Q to push the same downward, the link being formed near its upper end with an elongated slot engaged by a guide-pin Q^2 , secured to the framework. The lower end of the link Q is pivotally connected with one end of a lever Q^3 , fulcrumed at Q^4 to the framework, (see Figs. 8, 17, and 18,) and the forward end of said lever carries a weight Q^5 and a hook Q^6 , adapted to engage a stop-arm L^2 , secured to the shaft L' of the spring-motor L . Normally the hook Q^6 engages the stop-arm L^2 , so as to lock the spring-motor; but when the pin N^8 presses the link Q then a swinging motion is given to the lever Q^3 , and the hook O^6 moves out of engagement with the stop-arm L^2 to allow the shaft L' to make one

revolution, the said shaft being driven from the spring-motor, as previously described. When this takes place, the several parts connected with the shaft L', as above described, are actuated—that is, after the several number-wheels G G' G² have been set by the action of the bars F F' F² and connected parts, as previously explained, then the number of the signal-box is printed on the tape H.

10 When the shaft L' is released and the motor sets the shaft in motion, then the rotary motion of the shaft causes a resetting of the shaft O' and the cam O by the action of the weighted rope O⁶ and pulley O⁵, and for this
15 purpose the said shaft is provided with a cam L³, engaging one end L⁴ of a lever L⁵, fulcrumed on the framework and connected with a link L⁶, formed near its upper end with a slot L⁷, engaged by a guide-pin L⁸. The extreme upper end of the link L⁶ is adapted to engage the pawl N⁵ and lift it out of mesh with the wheel N⁶, and the said link is also provided with an extension-arm L⁹, adapted to engage the pawl P⁶ and lift it out of engagement with the ratchet-wheel P⁵ (see Fig. 19) to unlock the shaft O' and allow the
25 weighted rope and pulley to turn the said shaft O' and its cam O until the pin O⁹ abuts against the stop O⁸. When the shaft O' returns, the pin N⁸ moves away from the link Q, and the weight Q⁵ causes the lever Q³ to swing downward, its forward hook Q⁶ moving into the path for the stop-pin L², so that when the latter completes its revolution it again
35 moves against the hook Q⁶ to arrest the motor. The downward swinging motion of the lever Q³ is limited by the pin Q² engaging the slot Q' of said link. The lever Q³ may receive a swinging motion by the hand of the
40 operator whenever desired, and for this purpose a rod Q⁷ is employed, fitted to slide vertically in suitable bearings on the framework B', (see Fig. 8,) and this rod is held normally in an uppermost position by a spring Q⁸, so
45 as not to interfere with the workings of the device, as above explained; but when the operator presses the button end of the rod Q⁷ the lower end of the latter moves in contact with the lever Q³ and imparts a swinging motion thereto to lift the hook Q⁶ out of engagement with the stop-arm L². As soon as the operator releases the pressure on the rod Q⁷ the latter returns to its normal position by the action of the spring Q⁸, and the lever Q³
55 returns to its normal position by the action of the weight Q⁵.

The operation is as follows: When the several parts are in a normal position and a signal-box—say No. 243—sends the customary
60 signal to the central office, then two successive impulses pass to the relay A⁷ and to the register B to energize the electromagnet E twice, so that the first bar F, slide F⁴, and pawl F⁸ are actuated the same number of
65 times to bring the type G⁵ bearing the numeral "2" into a lowermost position. An impulse is then sent by the ground-current from

the brush A³ to the relay A¹⁰, so that the other electromagnet E' is energized, and consequently the cam O is turned to lift the bar F 70 and its hook F³ out of engagement with the pin E⁸ and to bring the hook F³ of the next bar F' in engagement with said pin as the bar F' drops into the notch O³. Then four successive impulses are given to the relay A⁷ 75 and the electromagnet E to cause the second bar F', slide F⁵, and pawl F⁹ to move the second number-wheel G' such a distance as to bring the type G⁵ bearing the numeral "4" into a lowermost position. Another impulse 80 is now given to the relay A¹⁰ from the brush A³ to turn the cam O a second time to set the bar F' out of action and to connect the hook F³ of the bar F² with the pin E⁸. Three impulses now pass through the relay A⁷ to the 85 recorder to energize the electromagnet E three times in succession and cause the bar F², slide F⁶, and pawl F¹⁰ to shift the third numeral-wheel G² until the type G⁵ bearing the numeral "3" is in a lowermost position. Thus 90 the three numeral-wheels are now moved in position to display at their bottoms the numerals "2 4 3"—that is, the number of the signal-box. The several wheels are locked in place by the dogs K, as previously explained. 95 Another and the last impulse passes to the relay A¹⁰ and the electromagnet E' to cause the cam O to throw all three bars F F' F² out of engagement with the pin E⁸, and at the same time the pin N⁸ strikes the link Q to re- 100 lease the motor L, so that the shaft L' can make one revolution. When this takes place, the cam I⁵ is actuated and the platen I is drawn downward and then suddenly released to cause the impression-block I' to make an im- 105 pression on the tape H of the three numerals. During the revolution of the shaft L' the several parts are reset by the mechanism above described, so that the several parts again occupy the position they had at the beginning 110 of the operation. The paper tape H, as well as the ribbon H², is moved forward during the operation, so as to bring a fresh portion of the tape under the printing device. It is understood that the numeral-wheels G G' G² 115 also return to their original position, above described, by their own weight as soon as the lifting-bar K' lifts the dogs K and the pawls F⁸ F⁹ F¹⁰ out of mesh with the teeth G³ of said wheels. 120

In order to record at the same time the number of the signal-box printed on the tape H and the exact time and date, I provide two additional sets of wheels and an impression-block I⁶, one set of wheels having the minutes 125 and hours of the day and the other set having the date of the month, the month, and the year. These sets of wheels are actuated from the motor C, and the connection and construction are as follows: 130

The driven shaft C² of the motor C (see Fig. 20) is provided with a crank-disk C³, carrying on its periphery a stop C⁴, normally abutting against the free end of the arma-

ture - lever C⁵ for an electromagnet C⁶, receiving an impulse every minute by the action of the clock D, as previously explained, so that when the electromagnet is energized at the time the arm D² comes in contact with the brush D³ then the armature-lever C⁵ is attracted and its free end swings out of engagement with the stop C⁴, allowing the crank-disk C³ to make one revolution, the stop C⁴ again abutting against the end of the lever C⁵ after the completion of the revolution and after the contact between the brush and the arm of the clock is broken and the electromagnet is deenergized. The crank-disk C³ is connected by a longitudinally-extending link C⁷ with an arm R', depending from a shaft R, extending transversely and journaled in suitable bearings in the framework B'. The shaft R is provided with an upwardly-extending arm R², on which is fulcrumed a pawl R³, in mesh with a ratchet-wheel R⁴, secured on a sleeve R⁵, mounted to turn loosely on the pin or stud G⁴, carrying the numeral-wheels G G' G². On the sleeve R⁵ is secured a minute-wheel S, formed on its peripheral surface with type characters representing successively the numerals from "0" to "59," and alongside the wheel S is arranged an hour-wheel S', secured on a sleeve S², mounted to rotate loosely on the sleeve R⁵. The hour-wheel S' is formed on its peripheral surface with type characters indicating the hours from one to twelve p. m. and from one to twelve a. m. in succession. The hour-wheel S' carries on its sleeve S² a ratchet-wheel S³, engaged by a pawl S⁴, fulcrumed at one end of a lever S⁵, pivoted at S⁶ to the framework B', and the other end S⁷ of said lever S⁵ is in contact with the peripheral surface of a cam R⁶, formed or secured to the forward face of the ratchet-wheel R⁴. A spring S⁸ draws upon the outer end of the lever S⁵ to hold the end S⁷ in contact with the peripheral surface of the cam R⁶ and cause the end S⁷ to suddenly drop off the abrupt end of the cam R⁶ when the latter has made one revolution. (See Fig. 2.) When this takes place, a swinging motion is given to the lever S⁵ to cause the pawl S⁴ to pull on the ratchet-wheel S³ and rotate the sleeve S² and the hour-wheel S' to change the latter to the next hour. The wheel S is adjacent to the numeral-wheel G, and the wheel S' is adjacent to the wheel S, so that the type characters of all the wheels G G' G² and S S' are in alinement with each other at the bottom of the wheels, and consequently an impression is made on the paper when the platen I is released and swings upward, as previously explained, it being understood that the impression-block I' is sufficiently wide to extend across all the wheels, as is plainly indicated in Fig. 15. Thus when the signal-box number is printed on the tape H the time in minutes and hours is printed alongside the numeral. The date, the month, and the month of the year are printed at the

same time, somewhat in the rear of the impression made by means of the impression-block I', held on the platen I in the rear of the block I'. These wheels are actuated from the ratchet-wheel S³, which is for this purpose provided at its inner face with a cam S⁹, (see Figs. 5 and 15,) and a lever T is with one end in contact with the peripheral surface of said cam. The lever T is fulcrumed at T' on the framework B' and carries at the other end a spring-pressed pawl T², engaging a ratchet-wheel T³, carrying on its face the date-wheel T⁴, formed on its periphery with type characters representing the dates of the month from the "1st" to the "31st." The wheel T⁴ and its ratchet-wheel T³ are mounted to rotate loosely on a stud T⁵, secured to the framework B', (see Fig. 12,) and a spring T⁶ presses against the outer face of the ratchet-wheel T³ to prevent the latter from rotating too far when actuated by the pawl T², carried on the lever T, actuated from the cam S⁹ on every revolution of the ratchet-wheel S³.

On the stud T⁵ and alongside the date-wheel T⁴ is mounted to rotate loosely a month-wheel U, formed on its periphery with type characters indicating the twelve months of the year. On the inner face of the wheel U are formed twelve recesses U², (see Figs. 12 and 14,) adapted to be successively engaged by a spring-pressed pin U³, held in the web of the year-wheel U⁴, formed on its periphery with type characters U⁵, indicating successive years—say 1898, 1899, 1900, 1901. The wheel U⁴ is formed on its web with recesses U⁶, adapted to be engaged by a pin U⁷, projecting from the stud T⁵, for holding the year-wheel U stationary, it being understood that this year-wheel is set at the end of a year by hand by first removing the wheels T³, T⁴, and U, then moving the wheel U sufficiently outward to disengage the pin U⁷ from a recess U⁶, and then turning the wheel sufficiently to engage the next following recess with the pin U⁷, so as to bring the type character for the new year to a lowermost position. The other wheels are then replaced on the stud T⁵. The month-wheel U is set by hand at the expiration of a month, the spring-pressed pin normally holding the wheel in position, but allowing it to be turned to bring the type character for the next month into a lowermost position. The wheels T⁴ and U⁴ are in alinement with the numeral-wheels G G' G² and S S', and the impression is made by the block I', as previously explained, when the platen is released by the cam I⁵. It is understood that at the expiration of twenty-four hours—that is, a day—the wheel T⁴ is turned to bring its next type character into a lowermost position, said wheel being actuated by the hour-wheel S' once during each revolution by means of the cam S⁹, as before stated.

The outer impression-block I⁶ is under the roller H¹⁴, under which the ribbon H² passes, to then pass upward upon the spool H¹¹.

When the platen I is released, the block I⁶ serves to lock the tape and the ribbon in place while the impression is being made by the blocks I' and I⁷.

5 In case either electromagnet E or E' is energized from another source than the signal-box then a sign V, (see Fig. 4,) normally displaying the legend "O K" or something similar, is reversed automatically to indicate to
10 the operator in charge of the instrument that something is wrong and that resetting is required by pressing the button-rod Q⁷, previously mentioned. The sign V is in the form of a plate normally standing vertically
15 and secured to a shaft V', journaled in suitable bearings in the framework B'. On the shaft V', near one end thereof, (see Fig. 7,) is secured an arm V², the free end of which is adapted to rest on the upper end of a lever
20 V⁴, fulcrumed at V⁵ to the framework, and pivotally connected at its lower end with a bar V⁶, mounted to slide at its forward end on a pin or screw V⁷, attached to the framework and passing through an elongated slot
25 in the bar. The outer end V⁸ of the bar V⁶ is bent laterally and is adapted to be engaged by either of two arms J⁶ or P⁷, secured to the bars J⁴ and P⁴, respectively. When an electromagnet E or E' is energized and motion is
30 given to the corresponding lever E⁶ or N, as before explained, then the bars J⁴ and P⁴ by their inward movement carry along the arms J⁶ or P⁷ and push the bar V⁶ in a like direction to impart a swinging motion to the lever
35 V⁴ and cause the free end of the arm V² to drop off the upper end of the shaft V'. The weight of the arm V² will cause a turning of the shaft by the arm swinging downward, so that the sign V is turned over and
40 the legend is not visible from the end. It is evident that this motion takes place every time an electromagnet E or E' is actuated; but the sign is returned to its normal position during one operation when a signal from
45 a signal-box is recorded, and for this purpose the shaft V' is provided near its other end with an arm W, (see Fig. 8,) adapted to be engaged by the upper end of a link W', fitted to slide on its upper end on a pin W², and pivotally
50 otally connected at its lower end with an arm W³, fulcrumed at W⁴ to the framework B'. The arm W³ rests on the periphery of a cam W⁵, secured on a shaft W⁶, carrying the wheels H⁷ H⁸, driven from the motor L, as
55 above explained, so that when the shaft W⁶ makes a revolution the cam W⁵ swings the arm W³ upward, and the link W' pushes the arm W upward to turn the shaft V' back to its former position, the sign then displaying
60 its legend in a vertical position. When the shaft V' turns back to this position, the arm V² again swings upward and the pin V³ on said arm V², Fig. 7, now engages an inclined projection V⁹ on the lever V⁴, so that the latter
65 is returned to its previous position and the bar V⁶ is pushed outward. The arm V²

finally moves in contact with the upper end of the lever V⁴, so as to remain in this position for supporting the sign with the legend displayed.

70 When an impulse from a source other than a signal-box causes the corresponding relay to act, the said relay energizes either magnet E or E', the motor is not released, as above explained, and consequently the cam
75 W⁵ remains at a standstill, the sign V being drawn over so that the operator is obliged to reset the machine before other signals to be recorded are received from the signal-box. This is done by pressing the rod Q⁷ and releasing the motor L to bring the several parts
80 back to their original position, as above explained.

The shaft W⁶ is preferably provided with an escapement-wheel W⁷, on which works the
85 escapement W⁸ to insure a proper running of the mechanism when the motor L is released.

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

1. A signal-box provided with a number-wheel having sets of notches, pins between adjacent sets of notches, and contact-brushes in different circuits, one brush operating in conjunction with said wheel at said notches,
95 the other brush operating in conjunction with said pins, for breaking the circuits, substantially as shown and described.

2. A signal-box provided with a number-wheel having sets of notches, pins between
100 adjacent sets of notches, contact-brushes in different circuits, one brush operating in conjunction with said wheel at said notches, the other brush operating in conjunction with said pins, for breaking the circuits, and relays
105 in said circuits, substantially as shown and described.

3. A recorder, provided with numeral-wheels, slides carrying pawls for engaging the said wheels to turn the latter, bars connected with said slides, a cam for holding the bars in or out of an operating position, and means for imparting motion to the bars when in an operating position, substantially as
115 shown and described.

4. A recorder, provided with numeral-wheels, slides carrying pawls for engaging the said wheels to turn the latter, bars connected with said slides, a cam for holding the bars in or out of an operating position, means
120 for imparting motion to the bars when in an operating position, and means for locking the bars against longitudinal movement when the bars are in an inoperative position, substantially as shown and described.

5. A recorder, provided with an actuating device for the numeral-wheels, comprising a lever actuated from an electromagnet, and provided with a pin, a series of bars, each having a hook adapted to engage said pin, a
125 cam for said bars, to allow a hook of one of the bars to engage said pin, one at a time, and

means for turning the numeral-wheels from said bars when the latter are actuated, as set forth.

6. A recorder, provided with an electromagnet, a lever actuated from said electromagnet and provided with a pin, a series of bars having hooks adapted to engage said pin, one at a time, numeral-wheels adapted to be set by said bars, and a cam having notches for engagement by said bars, to allow the corresponding bar to engage with its hook the pin, substantially as shown and described.

7. A recorder, provided with an electromagnet, a lever actuated from said electromagnet and provided with a pin, a series of bars having hooks adapted to engage said pin, one at a time, numeral-wheels adapted to be set by said bars, a cam having notches for engagement by said bars, to allow the corresponding bar to engage with its hook the pin, and a locking device for locking the bars against longitudinal movement by said pin and lever, substantially as shown and described.

8. A recorder, provided with an electromagnet, a lever actuated from said electromagnet and provided with a pin, a series of bars having hooks adapted to engage said pin, one at a time, numeral-wheels adapted to be set by said bars, a cam having notches for engagement by said bars, to allow the corresponding bar to engage with its hook the pin, and a second electromagnet for controlling said cam, substantially as shown and described.

9. A recorder, provided with an electromagnet, a lever actuated from said electromagnet and provided with a pin, a series of bars having hooks adapted to engage said pin, one at a time, numeral-wheels adapted to be set by said bars, a cam having notches for engagement by said bars, to allow the corresponding bar to engage its hook with the pin, a second electromagnet for controlling said cam, and intermediate mechanism, substantially as described, between said cam and the second electromagnet, as set forth.

10. A recorder, provided with an actuating device for the numeral-wheels, comprising a lever actuated from an electromagnet, and provided with a pin, a series of bars, each having a hook adapted to engage said pin, a cam for said bars, to allow a hook of one of the bars to engage one pin at a time, means for turning the numeral-wheels from said bars when the latter are actuated, and a dog controlled from said lever, for preventing the numeral-wheels from being turned too far, substantially as shown and described.

11. A recorder, provided with an actuating device for the numeral-wheels, comprising a lever actuated from an electromagnet, and provided with a pin, a series of bars each having a hook adapted to engage said pin, a cam for said bars, to allow a hook of one of the bars to engage one pin at a time, means for turning the numeral-wheels from said bars

when the latter are actuated, dogs for holding the numeral-wheels against return movement, and a lifting-arm for throwing the dogs out of engagement to release the wheels, substantially as shown and described.

12. The combination of a recorder having numbering devices, a signal-box, two relays actuated by currents controlled by the signal-box, and electromagnetic devices respectively controlled by the relays, one of such electromagnetic devices serving to place the numbers of the numbering apparatus in operative position, and the other of said electromagnetic devices serving to control the action of the first electromagnetic devices, to form the spaces between the numbers.

13. In a recording apparatus, the combination of a series of printing-wheels, pawls serving respectively to actuate the printing-wheels, slides on which the pawls are carried, a prime moving element serving to impart movement to the slides, and means for imparting movement to the slides to engage said prime moving element.

14. In a recording apparatus, the combination of numbering-wheels, a slide for each numbering-wheel, the slides serving to operate the numbering-wheels, a lever having a part serving to engage the slides to drive the same, and means for raising and lowering the slides to engage and disengage the said part of the lever.

15. In a recording apparatus, the combination of a series of printing-wheels, a slide for actuating each wheel, means for imparting movement to the slides, an electromagnet for driving said means, means for raising the slides to disengage the said actuating means, and a second electromagnet serving to actuate the last-named means.

16. In a recording apparatus, the combination of a signal-box, two relays actuated from the signal-box, two electromagnets respectively actuated from the relays, recording-wheels, slides serving to adjust the recording-wheels, means driven by the one magnet for driving the slides, and means for raising the slides to disengage the first-named means, the second-named means being controlled by the other electromagnet.

17. In a recording apparatus, the combination of recording-wheels, a platen tending to engage the same, a cam having connection with the platen to draw the same momentarily away from the recording-wheels, a motor serving to drive the said cam, restraining devices controlling the motor, means for adjusting the recording-wheels, an electromagnet controlling said means, a second electromagnet controlling the restraining device of the motor, and a cam actuated by the said second electromagnet, the said cam serving to control the means for adjusting the recording-wheels.

18. In a recording apparatus, the combination of recording-wheels, a platen, means for actuating the platen, a motor for driving said

means, restraining devices for the motor, a wheel having a pin thereon, the pin serving to release said restraining devices, and electromagnetic means for periodically driving
5 the wheels.

19. In a recording apparatus, the combination of a call-box, two relays actuated thereby, two electromagnets respectively controlled by the relays, printing-wheels for recording the
10 number of the call-box, means for adjusting and impressing the printing-wheels, such means being controlled by the two electromagnets, a time-stamp, a motor having connection with the time-stamp, to drive the

same, an electromagnetic restraining device 15 for the motor, and time-controlled means actuating the said restraining device.

20. In a recording apparatus, a call-box, two relays controlled by the call-box, printing devices, and electromagnetic means for ad- 20 justing and controlling the printing devices, such means being actuated successively by the respective relays.

EDWIN COULSON HEGAN.

Witnesses:

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