J. E. WRIGHT.

PRINTING TELEGRAPH.

APPLICATION FILED MAY 14, 1907.

954,489.

Patented Apr. 12, 1910.

8 SHEETS—SHEET 1.

Fig. 1

Witnesses
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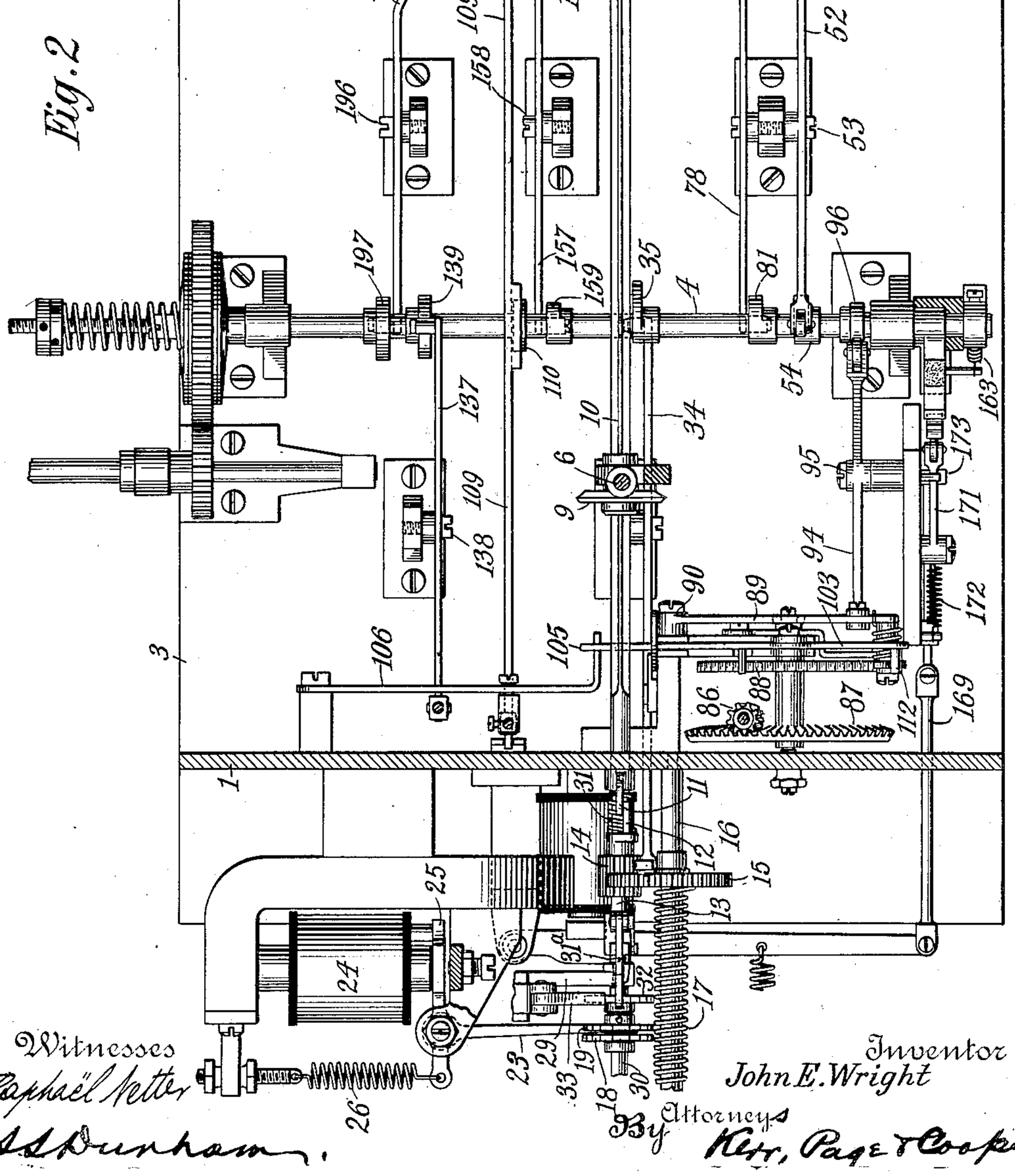
8 SHEETS—SHEET 2.

Fig. 2



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8 SHEETS—SHEET 3.

Fig. 5

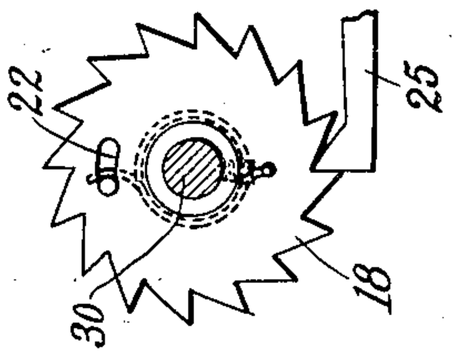


Fig. 6

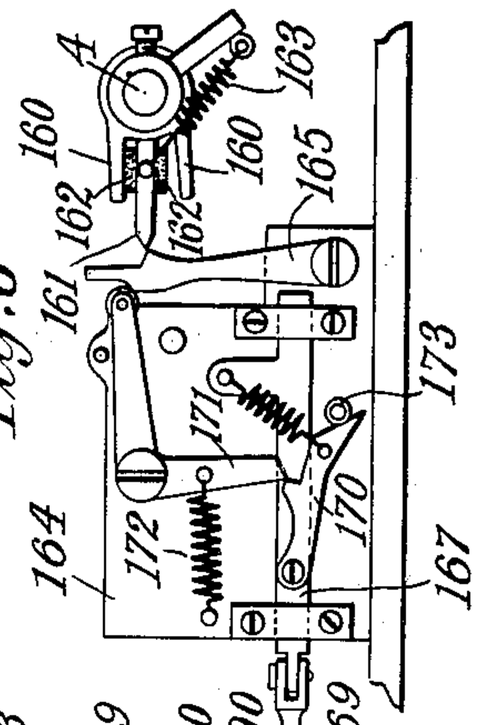


Fig. 4

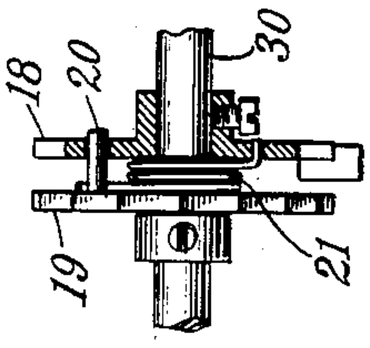
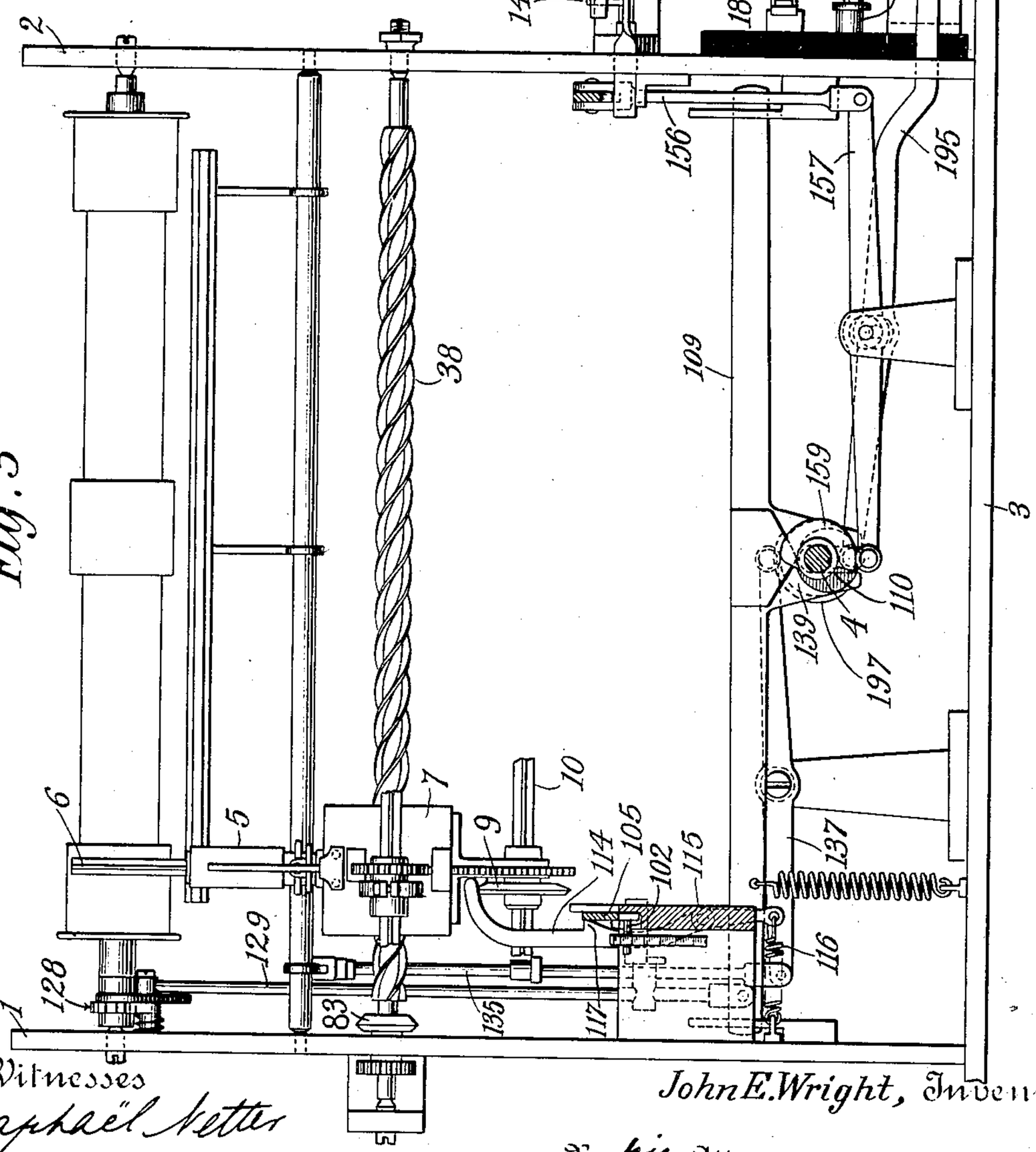


Fig. 3



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8 SHEETS—SHEET 4.

Fig. 7

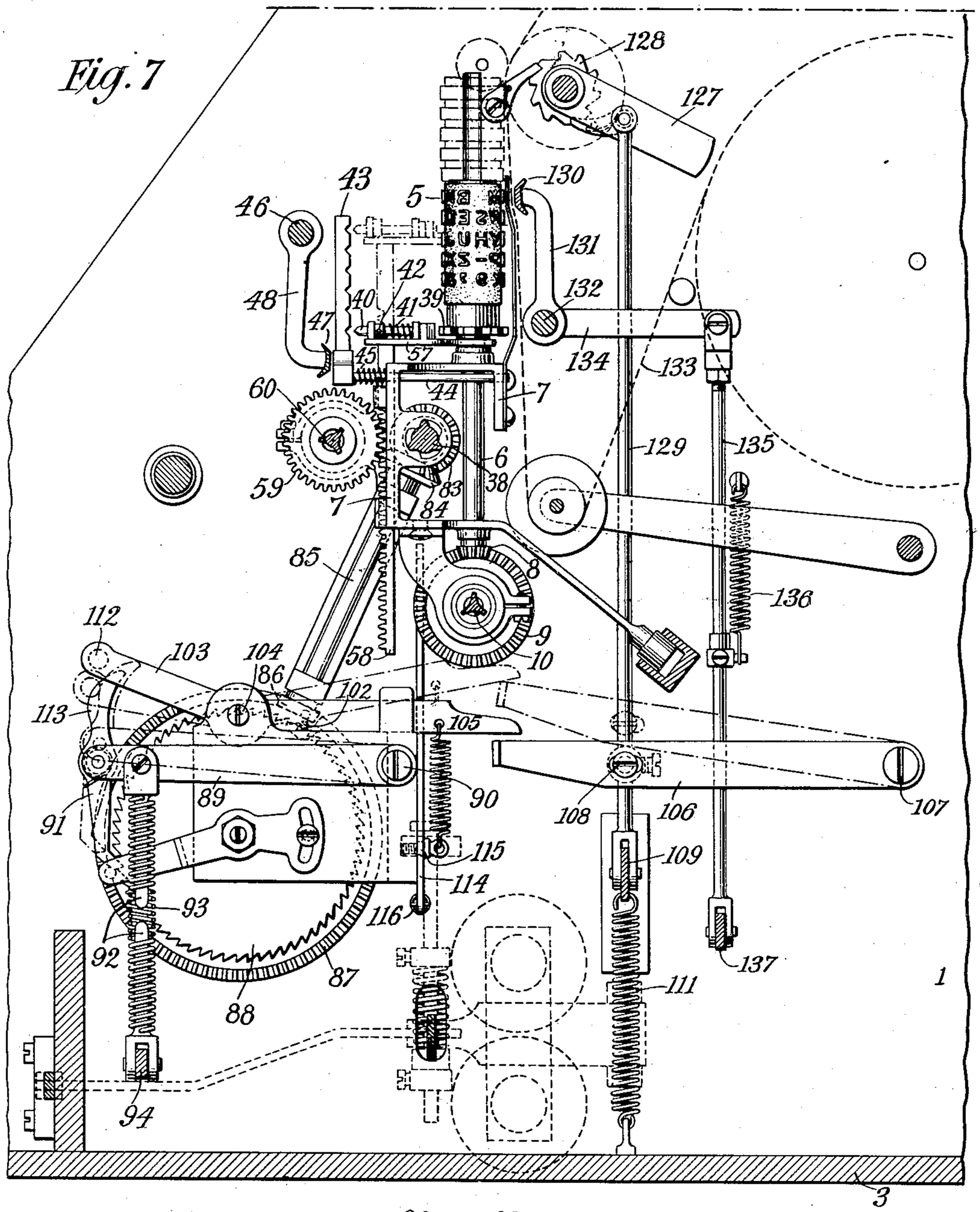
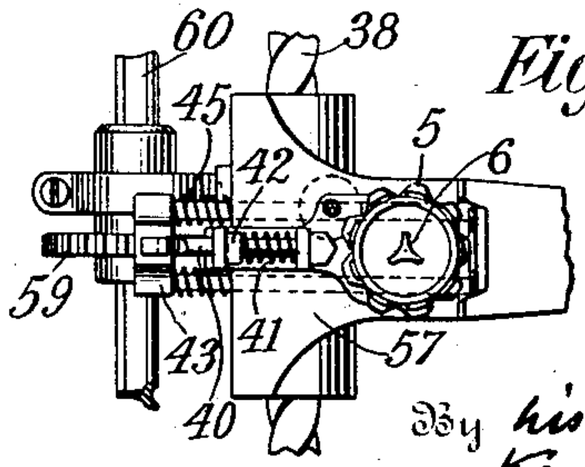


Fig. 8



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8 SHEETS—SHEET 5.

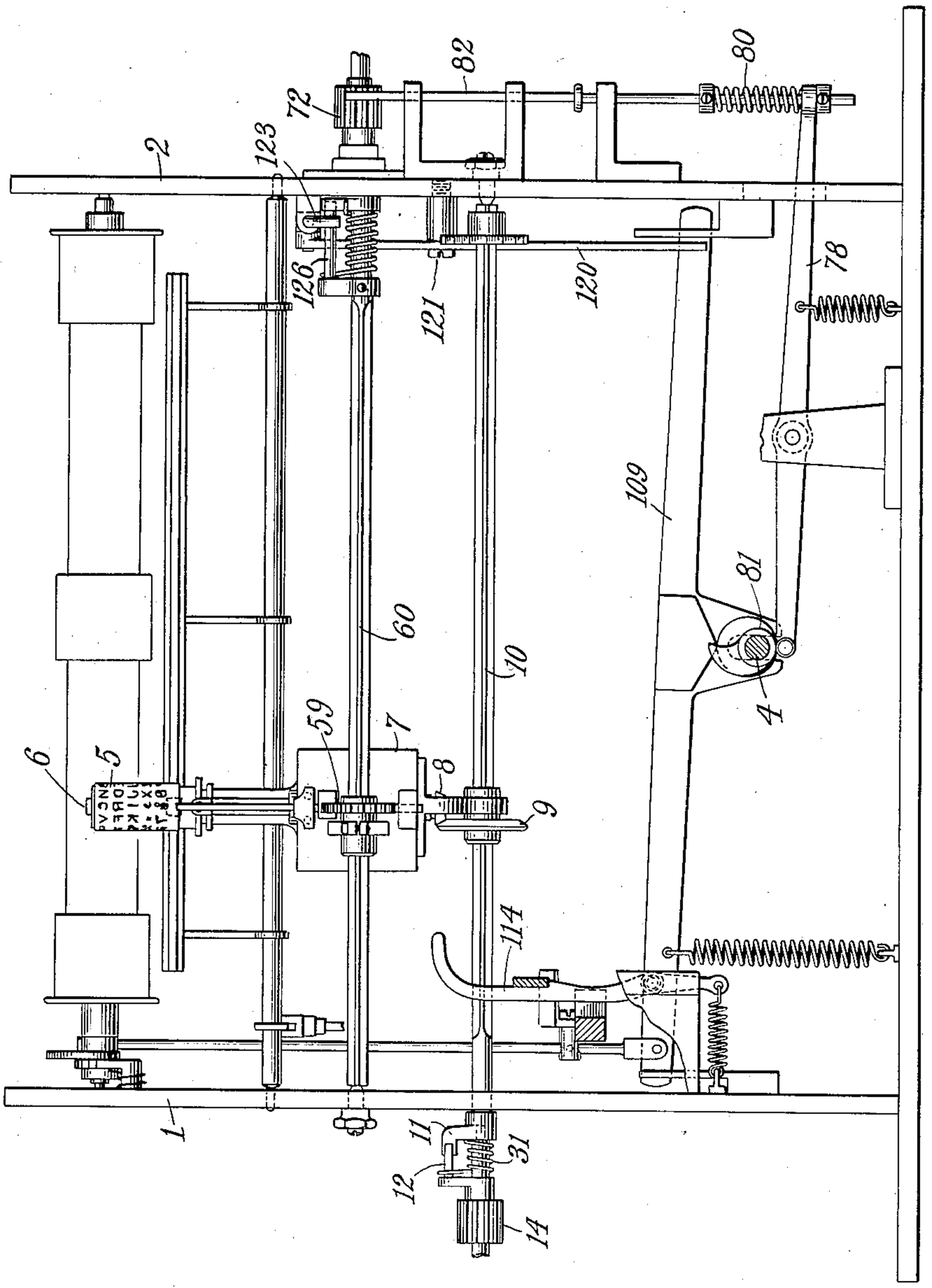

Fig. 9

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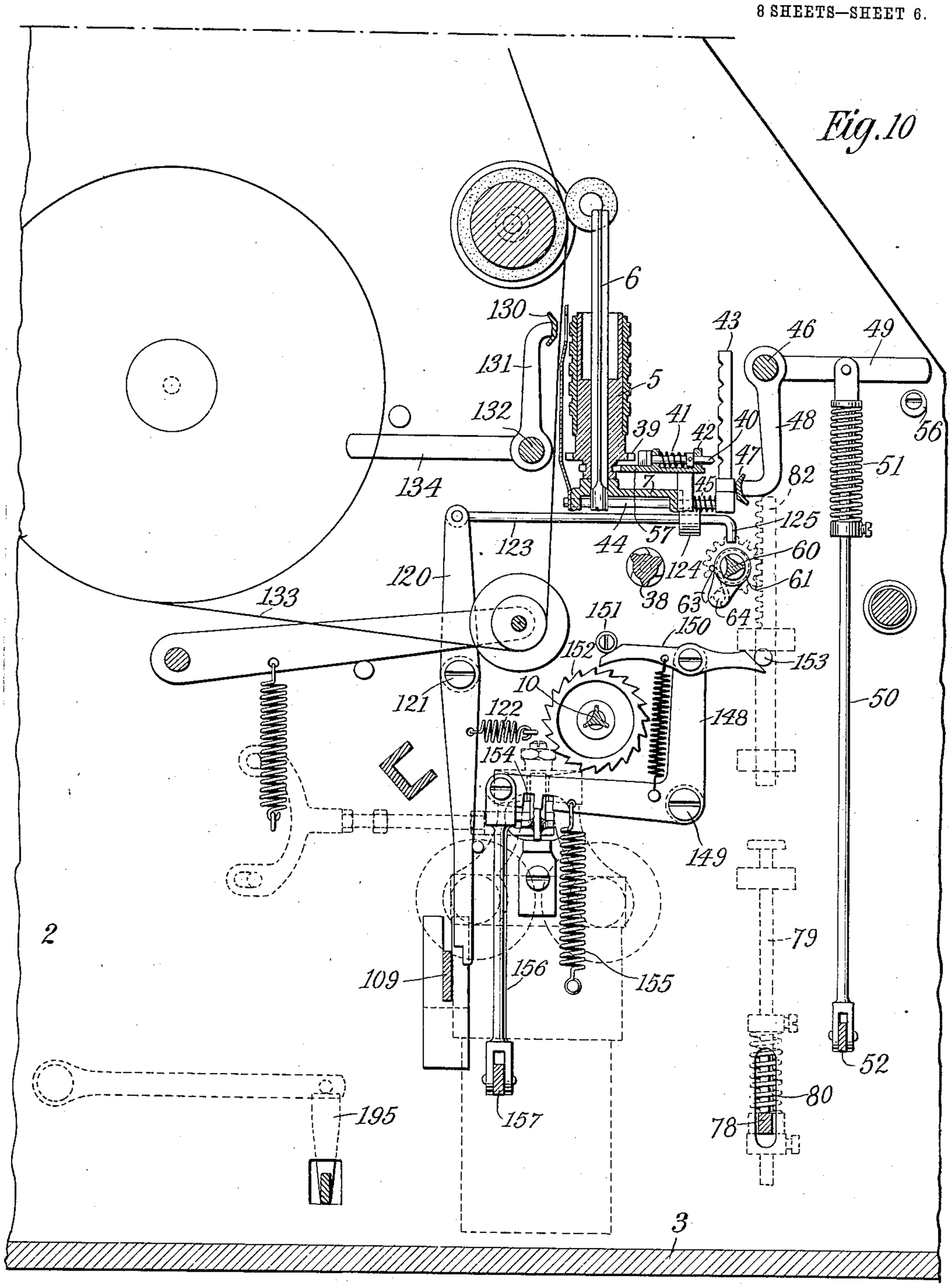
8 SHEETS—SHEET 6.

Fig. 10



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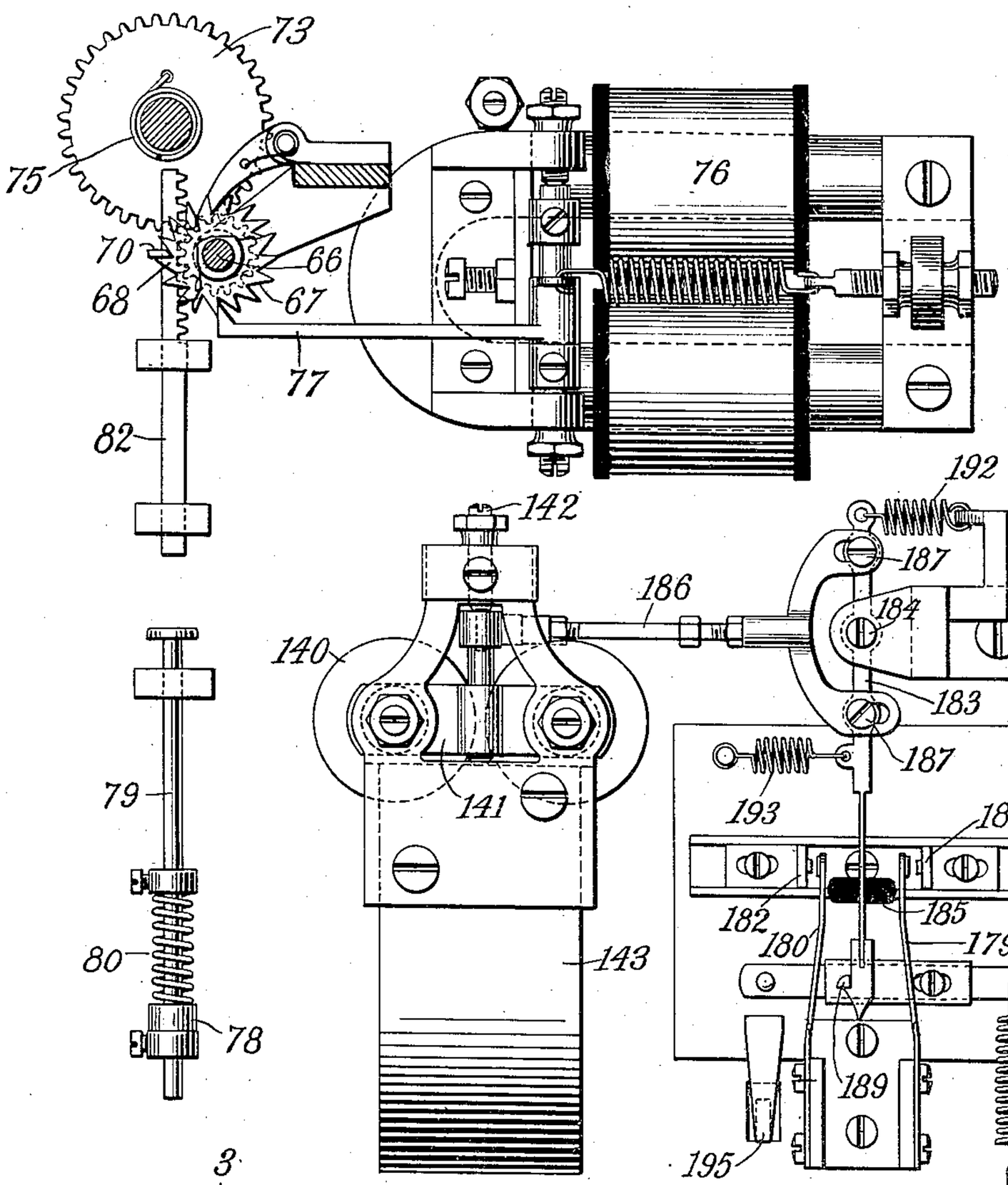
8 SHEETS—SHEET 7.

Fig.11



Witnesses

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8 SHEETS—SHEET 8.

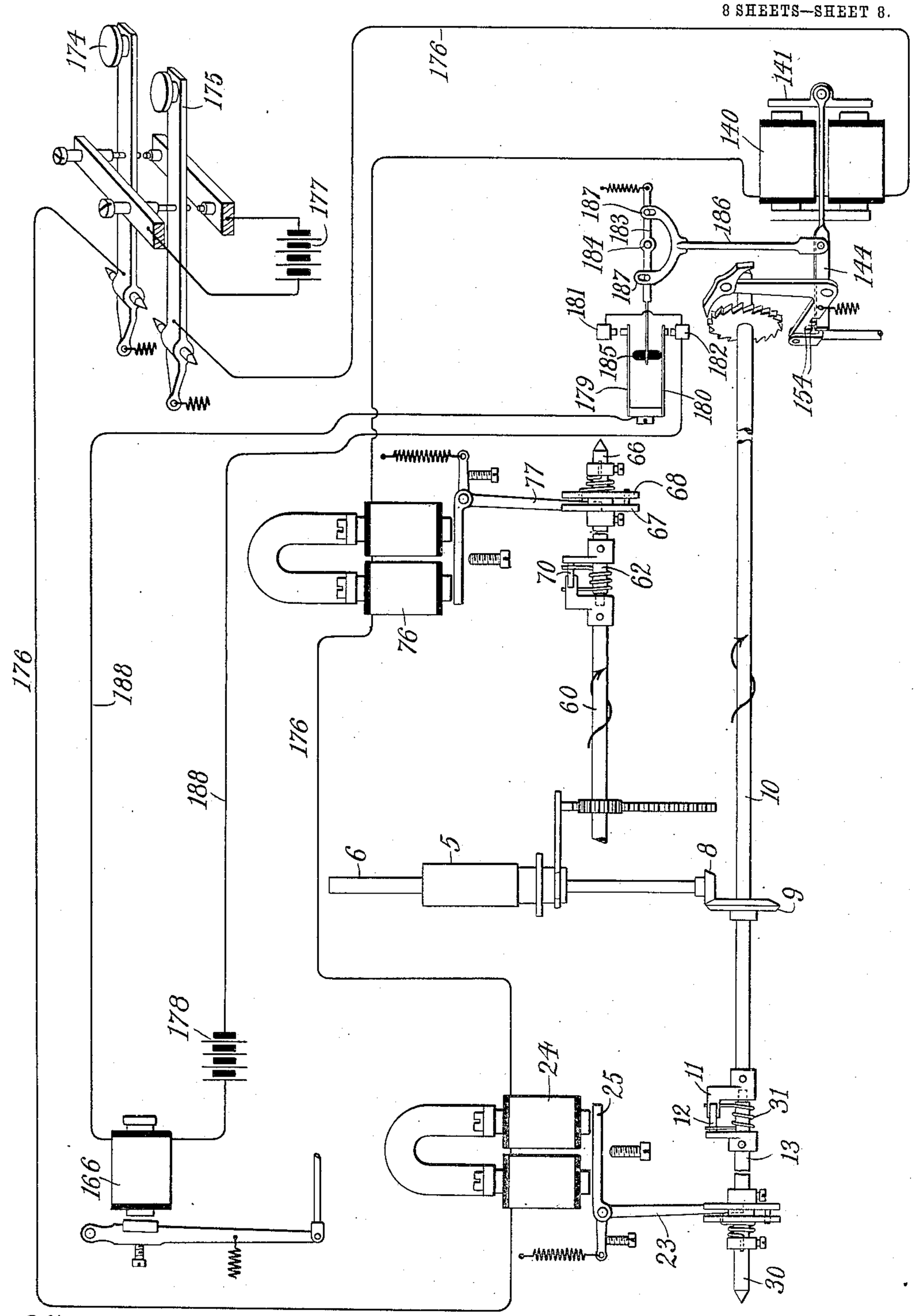

Fig. 12

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UNITED STATES PATENT OFFICE.

JOHN E. WRIGHT, OF NEW YORK, N. Y.

PRINTING-TELEGRAPH.

954,489. Specification of Letters Patent. **Patented Apr. 12, 1910.**

Application filed May 14, 1907. Serial No. 373,543.

To all whom it may concern:

Be it known that I, JOHN E. WRIGHT, a citizen of the United States, residing at New York, in the county and State of New York, borough of Manhattan, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

My present invention is an improvement in column printing telegraphs, a class of telegraphic receiving instruments in which the characters corresponding to current impulses of definite character, order and direction sent over the line, are printed in columns or successive rows on a sheet of paper.

My object in devising the apparatus and mode of operation which distinguish the invention hereinafter set forth, was, primarily to carry out the principles and improve upon the apparatus set forth in the application for patent filed by me May 6, 1904, Serial No. 206,638, and which while designed for the same ultimate purpose, is known as a two wire or two circuit instrument, from the fact that two independent transmission lines are required for its operation.

By my improvements which form the subject of the present application, I have dispensed with one of such circuits having reconstructed the former machine to the extent necessary for this purpose. I have also added very greatly to the efficiency and practical value of the instrument by the introduction of certain novel features of construction which will be described in detail by reference to the accompanying drawings.

Figure 1 is a front elevation of the complete instrument. Fig. 2 is a top plan view of the mechanisms in the lower portion of the instrument, that is to say, below the type-wheel shaft. Fig. 3 is a view in elevation looking from the front of the instruments of the parts in the back part of the same. Figs. 4, 5 and 6 are views of detached parts or details of mechanism. Fig. 7 is a sectional view looking from the right, the same being on any plane to the right of the center of the frame, but with the mechanism in the lower forward part of the same omitted. Fig. 8 is a top plan view of the type-wheel and the parts immediately connected therewith. Fig. 9 is a front elevation of but, showing only a portion of the mechanism. Fig. 10 is a vertical view similar to Fig. 7, but looking from the left, and showing a portion only of the mechanism on the right hand side of the frame. Fig. 11 is an end view of the instrument looking from the right and omitting certain parts attached thereto. Fig. 12 is a diagram illustrating the relation of the more essential elements and the necessary circuit connections.

The instrument as a whole comprises several mechanisms which may be regarded, in a sense, as independent instrumentalities, cooperating to the one general purpose of the machine. The most prominent of these are, the type-wheel and its immediate accessories; the means for rotating the type-wheel; the means for raising and lowering the same; the means for shifting the type-wheel from the position to which it has been brought by the above described means, so as to bring the next adjacent character into the printing position; means for printing any character when brought to position; and the means for effecting the various feed movements required in the operation of the machine. I shall therefore describe each of these instrumentalities as far as may be necessary to an understanding of the invention of improvement to which my present application is directed.

The working parts of the instrument are mounted between and on the sides of plates 1 and 2 constituting the sides of a rigid frame on a bed plate 3. In the particular embodiment of the invention herein illustrated, the various features of adjustment, feed, and printing are effected by mechanical power applied through a main driving shaft 4, mounted in suitable bearings on the base 3. The source of power is preferably an electro motor to the shaft of which the counter shaft 4 is geared in the usual manner, with provision for frictional or slipping engagement between the two. The application of the power to the instrumentalities comprising the machine is controlled by the action of electro-magnets.

The type-wheel is of the usual material in the form of a somewhat elongated cylinder 5, which is mounted on a triangular knife edge spindle 6, the lower rounded portion of which is mounted vertically in the carriage

7. At its lower end the spindle 6 carries a pinion 8, meshing with a bevel gear 9.

The type-wheel carriage is laterally movable, and the bevel wheel 9, carried thereby, fits on a triangular knife edge shaft 10, by which it is rotated, but along which it is free to move following the movement of the carriage. By this means a rotation of the shaft 10 will be imparted to the type-wheel, whatever may be the position of the carriage.

Rotation is imparted to the shaft 10, and through it to the type-wheel by the means shown most clearly in Figs. 1 and 2. At the end of the shaft projecting through the side plate 1, is a lug 11, which lies in the path of a dog 12, fixed to a short shaft 13, in line with shaft 10, and having one bearing in the end of the latter and another in a bracket arm 29 rigidly attached to the frame. The parts 11 and 12 are held in yielding engagement by a coiled spring 31 on the shaft 13. On the shaft 13 is also a pinion 14, which meshes with a spur wheel 15 on a shaft 16, which latter is driven by a coiled spring 17. The application of the power of said spring to the rotation of the type-wheel is controlled by an electro-magnet and escapement of special construction illustrated in Figs. 1, 2, 4 and 5.

On a second short shaft 30, in line with shaft 13, and having its bearings in the arm 29, and a rigid portion of the frame, are two escapement wheels 18 and 19, the former fixed to shaft 30, the latter loose thereon, but provided with a laterally extending pin 20, entering a slot 22, in the wheel 18, said slot being of such length that the travel of the pin therein allows the wheels to move through the space of one tooth. A coiled spring 21 intermediate to the wheel 18 and the pin 20, maintains the two scape wheels in the normal position shown in Fig. 5.

The shafts 30 and 13 are connected by a pawl or dog 31ª, pivoted to the end of shaft 13 and engaging with a ratchet wheel 32 on shaft 30. The force of the spring 17 exerted upon shaft 13 through the pinion 14, locks the said shaft 13 to the escapement shaft 30, but a turning force in opposition to the spring carries the pawl 31ª over the teeth of the ratchet 32. To prevent such backward movement being imparted to shaft 30, a locking pawl 33 engages with the ratchet 32.

An intermittent rotation is imparted to the shaft 13 by the oscillation of the right angled extension 23 of the armature of a polarized magnet 24, which may be of any proper character to permit its armature to be moved by the force of a retractile spring 26, when its magnet is weakened by a current in a definite direction. An impulse of current in such direction passing in the magnet 24 so far neutralizes the effect of the permanent magnet as to permit the spring 26 to shift the armature 25 from engagement with scape wheel 18 into engagement with wheel 19. This allows the shaft 13 to turn through an arc dependent upon the width of the teeth on the scape wheels, and such movement is imparted by each succeeding impulse in the same direction.

On the type-wheel proper there are five rows of characters with ten characters in each row, and the parts are so proportioned that a single movement of the shaft 13 turns the type-wheel through an angle which includes two adjacent characters. The type-wheel has, therefore, five positions around its vertical axis, one of which it occupies normally, and to any other of which it may be rotated by not more than four impulses of current through the magnet 24. Thus, by each back and forth movement of the armature 25, one of a pair of characters on the type-wheel will be brought to the printing position. I have devised special means for shifting the type-wheel independently of the escapement mechanism, for presenting the other character of any given pair at the printing position when it, and not that normally presented, is to be printed, and this will be hereinafter more fully described.

The driving spring 17 is wound up at each step of the type-wheel carriage across the paper or printing surface by an amount substantially equal to its unwinding in rotating the shaft 13, so that the spring is always under sufficient tension to perform its function with certainty. This operation is effected by the following devices: In a bracket 27, secured to the side plate 1, is arranged to slide vertically a rack-bar 28, meshing with pinion 14 on shaft 13. As the pinion 14 turns under the propelling force of the spring 17, this rack-bar is lowered, but by the rotation of the driving shaft 4, which occurs whenever a character is printed or the type-wheel carriage is advanced a space, a lever 34, carrying a vertical rod 36 at its end is rocked by means of a cam 35 on the driving shaft, and bringing the rod 36 into engagement with the lower end of the rack-bar raises the latter with the result that the spring 17 is re-wound by the backward rotation of the shaft 13. The rod 36 is connected with the lever 34 by a coiled spring 37, which yields to permit the full travel of the lever should its extent be greater than required for re-winding the spring 17.

The type-wheel carriage 7, which is supported on suitable transverse guides, engages with and works on a worm or screw 38 so that rotation of the latter causes the carriage to advance, as will be readily understood. As above stated, there are ten characters in each row on the type-wheel, and at the bottom of the wheel is a wheel 39, with star teeth (Figs. 7 and 10), arranged with each

space corresponding to a vertical column of characters. In the plane of said wheel is a plunger 40, provided with a pointed head that exactly fits in the spaces between its teeth. This plunger is normally retracted from the wheel by a spiral spring 41 bearing against a stop 42.

Adjacent to the outer end of the plunger is a standard 43, carried by rods 44 which slide in suitable bearings in the carriage 7. Coiled springs 45 surrounding these rods hold the standard out of engagement with the plunger as will be seen. When the standard is advanced against its springs it will push the plunger 40 forward, causing the pointed head to enter the adjacent notch or space on wheel 39. If the wheel has not been correctly set by the rotation of the shaft 10, the head of the plunger will turn the wheel until the head and the notch fit exactly, whereupon the desired character will be in the exact printing position and firmly held there during the operation of printing. These devices are shown in detail in Fig. 8.

To actuate the standard 43 at each printing operation, the following devices are provided. A rock-shaft 46, suitably journaled as in the side plates 1 and 2, carries at the end of arms 48, a presser bar 47, adjacent to the foot of the standard 43. At one end of the rock shaft is an operating arm 49, (Fig. 10) to which is pivoted a link 50. The latter is made in two parts, yieldingly connected together by a spring 51. The lower end of the link 50 is connected to the end of a lever 52, pivotally mounted on the base of the instrument at 53 and bearing upon a cam 54 on the main power shaft 4. A spiral spring 55 holds the lever 52 against its cam, so that a rotation of the power shaft will oscillate the lever 52, thereby drawing down the link 50, rocking the shaft 46, and causing the presser bar 47 to advance the standard against the justifying plunger 40. A stop 56 prevents the arm 49 from being depressed too far. As the type-wheel is vertically movable on its spindle, the standard 43 is made of sufficient length to engage the plunger 40 whatever its position may be, and in order to aid in bringing the type-wheel into any one of its vertical positions to which it may be only approximately set, there is a V-shaped notch in the standard 43, at each point corresponding to the positions of the type-wheel. The end of the plunger 40 is wedge-shaped in form so as to fit into these notches.

The means for raising the type-wheel to its different positions, are as follows: The type-wheel is mounted on a plate or bar 57, which latter is supported by a rack-bar 58 sliding vertically in the carriage and meshing with a pinion 59, mounted on the carriage, but surrounding and sliding on a triangular knife edge bar 60, which imparts motion to it. Hence in any position of the carriage a rotation of the shaft 60 will operate to raise or lower the type-wheel.

The shaft 60 is rotated intermittently in the direction to raise the type-wheel by mechanism illustrated in detail in Figs. 1, 2 and 12. The shaft 60 has a bearing at one end in the side plate 1, and at the other in a sleeve 61, carried by and fixed to a short shaft 62. The sleeve 61 itself turns in a bearing in the side plate 2 and carries a lug 63, with which engages a dog 64 fixed to the shaft 60. A spiral spring 65 maintains these two parts in yielding engagement. In line with the shaft 62 is a second shaft 66 carrying fixed and loose escapement wheels 67, 68, and a ratchet wheel 69, with which engage a pawl 70 on shaft 62, and a pawl 71 pivoted to the frame. On shaft 62 there is also a pinion 72 meshing with a spur wheel 73 on a shaft 74, driven by a coiled spring 75. These parts are substantially the same as those described above as the means for intermittently rotating the type-wheel shaft 10, and require no further detailed description. The movement of the shaft 60 is controlled and rendered intermittent by an electro-magnet 76 and armature 77, but the operation of this magnet is effected by a current impulse in the opposite direction to that which demagnetizes and operates the magnet 24. The parts are so proportioned that each demagnetizing impulse of current that passes through the coils of magnet 76, operates to raise the type-wheel one step, or from one position to its next higher position. It will be observed that although the escapement mechanisms for adjusting the type-wheel are independently controlled, they are of such a nature and so combined that they are capable of simultaneous operation, or in other words are non-interfering so that the two movements of the type-wheel could be imparted simultaneously or successively, or by alternate stages. This capacity of the instrument is an important one as it makes it possible to transmit over the line alternate positive and negative current impulses.

In the operation of this instrument the type-wheel is restored to its normal or lowest position after each impression of a character. This is accomplished by a lever 78, carrying a rod 79 connected to it by a coiled spring 80, the lever being oscillated by a cam 81 on the main power shaft, and caused to raise a rack-bar 82 meshing with pinion 72. These parts, also, are similar to those employed for re-winding the spring 17, above described, and require no further explanation, except that it may be noted that by raising the rack-bar 82, the shaft 60 is turned backward, thus lowering the type-wheel at the same time that the spring 75 is re-wound.

As above set forth, the type-wheel carriage

7 is engaged by the screw or worm shaft 38 so that an intermittent movement of rotation imparted to the latter will advance the carriage step-by-step across the printing surface. Such rotation in a forward direction; that is to say, in a direction to move the carriage from left to right, is accomplished by the following instrumentalities: On the worm shaft 38 is a bevel gear 83, meshing with another 84 on a short intermediate shaft 85, on the opposite end of which is a similar gear 86, meshing with a large bevel gear 87, mounted in stationary bearings on the frame. On the shaft carrying the bevel gear 87 is a ratchet wheel 88, by the actuation of which in the proper direction the worm 38 will be turned and the type-wheel carriage moved from left to right. On an arm 89 (Fig. 7), pivoted at 90, is a pawl 91 engaging with the ratchet 88. A link 92 composed of two parts connected by a spiral spring 93, connects the arm 89 with a bell crank lever 94 (Fig. 2), pivoted at 95, and bearing on a cam 96 on the main power shaft 4, with which it is held in positive engagement by a spring 97. Rotation of the power shaft will therefore oscillate the arm 89 and pawl 91 once in each revolution of the shaft, causing the ratchet 88 to be advanced one step, and a corresponding movement to be imparted to the worm shaft and type-wheel.

The worm shaft 38 extends through the side plate 1 and carries a pinion 98 that meshes with a spur wheel 99 on a shaft 100 which is actuated by a spiral spring 101 to rotate the worm in a direction opposite to that imparted to it by the carriage feed mechanism just described, and therefore tends to bring the carriage back to the position for beginning a line. This is prevented, however, by a pin 102 which engages with the ratchet 88, and is carried by a lever 103 pivoted at 104. The ratchet is therefore engaged by two pawls 91 and 102, both of which must be disengaged before a reverse movement of the worm can occur. To effect this the following devices are provided. Under the rear end 105 of the lever 103 projects a lever 106 pivoted at 107 to the side plate 1, and at 108 to a transverse lever 109 which rides over a cam 110 on the main power shaft 4 and extends to the other side plate of the machine. A spiral spring 111 connected to the lever 109 and the base of the instrument opposes the lifting of the levers 106 and 109 at the left side of the machine so that the rotation of the cam 110 under ordinary conditions will operate merely to raise the right hand end of the lever 109. If however this end be prevented from rising, the cam 110 by its rotation will raise the left hand end of the lever 109 and with it the lever 106, thereby raising the end 105 of lever 103 and lifting the pin 102 out of engagement with the ratchet 88. The latter, however, is still engaged by the pawl 91, which must also be released before reverse rotation of the ratchet can occur. This is effected by the stud 112, (Figs. 2 and 7) on the lever 103, which engages the cam surface of an extension 113 of the pawl 91, thereby lifting the pawl 91 whenever the lever 103 is tilted or rocked to a sufficient extent. The spring 100 which is wound up by the rotation of the worm shaft that advances the carriage will then rotate the said worm in a reverse direction and bring the carriage back to its initial position at the left of the machine.

Since the shaft 4, which operates to lift the pawls 91 and 102 in the manner above described, rotates very rapidly, the carriage might not have time to regain its initial position before said pawls again dropped into engagement with the ratchet 88, I therefore provide the following means to prevent this. A lever 114 is pivoted at 115 (Fig. 3) on one side of the rear end 105 of lever 103, and is forced against said lever by the action of a spring 116. A notch or shoulder 117 is formed in lever 114 with which the lever 105 engages when it is raised to release the pawls, and by which it is held in an elevated position until the carriage has completed its return movement, and strikes the curved end of lever 114, throwing it out of engagement with lever 105, and allowing the pawls to reëngage the ratchet.

As the type-wheel carriage is returned to its initial position with considerable rapidity, it would strike a rigid abutment with such force as to result in injurious shock. I therefore provide a yielding stop to receive its impact, for which purpose I employ a small air dash-pot 118 with a spring seated plunger 119, the end of which projects into the path of some part of the type-wheel carriage. As the spring is somewhat compressed by the impact of the carriage, it continues to exert a light pressure upon the latter, thus facilitating the starting of the carriage on its forward travel.

The return of the type-wheel carriage from any position is placed under the control of the operator at the sending station by the provision of the following means for locking the spring or right hand end of lever 109 against upward movement. As before stated, this end of lever 109 must be prevented from moving upward in order to raise the lever 106, and rock the lever 103 since, if the right hand end of the lever 109 were free, the lever would rise idly on the cam 110, turning about its pivotal connection at the left. A movable abutment for the free end of lever 109 is therefore provided, consisting of a lever 120 pivoted to the side plate 2 at 121, and provided with a step or notch at its lower end that is thrown over into the path of the lever 109

when oscillated, but is normally held away from such position by spring 122.

The upper end of the lever 120 is connected to a rod 123 sliding in a bearing 124 and provided with a downwardly turned projection or hooked end 125 in the path of an arm 126 mounted on the shaft 60 that raises or lowers the type-wheel. This arm is so arranged on the shaft 60 that it reaches the projection or finger 125 whenever the shaft is rotated sufficiently to bring the lowest row of characters to the printing position. If now the magnet 76 receives another operating impulse the shaft 60 will be moved another step as hereinbefore described, raising the type-wheel another step to a non-printing-position, and at the same time engaging the finger 125 with arm 126, drawing the former over and throwing the lever 120 into engagement with lever 109. Rotation of the main power shaft will now raise the other end of lever 129, unlocking the pawls 91 and 102, as above described, and thus permitting the carriage to travel back to its initial position. It is therefore necessary for the operator, whenever he wishes to return the carriage, to deliver sufficient impulses of the proper direction to the magnet 76 to raise the type-wheel to its highest or non-printing position before rotation of the main power shaft will effect the desired result. Raising of the type-wheel to a non-printing position is important, since, as will be seen from the subsequent portion of this description, the platen is thrown forward to print a letter at each revolution of the main power shaft, and if the wheel were in a printing position a superfluous character will be impressed upon the printing surface whenever it is desired to return the carriage.

It is obvious that whenever the carriage is brought back to its initial position, a new line should be started, and for this purpose the paper or printing surface must be advanced one line space coincidently with the return of the carriage. To effect this operation I connect pawl carrying lever 127, that operates upon the ratchet 128 on the paper feed roller (Fig. 7), with the left hand end of lever 109, by means of a rod or link 129, so that whenever the levers 109, 106 and 105 are raised to return the carriage, the paper will be fed forward a line space.

The mechanism for causing an impression to be made on the paper, is, as above stated, brought into operation by the rotation of the power shaft 4. This mechanism consists of a platen 130, which is a bar supported by arms 131 on a transverse rock shaft 132, arranged adjacent to the type-wheel, as shown. To rock the shaft 132 and throw the platen and interposed paper 133 against the type-wheel, an operating arm 134 is provided on the shaft to which is connected a link 135, (Fig. 7), normally drawn upward by a spring 136. The link 135 is also connected to a lever 137 (Fig. 2) pivoted at 138 and bearing on a cam 139 on the main power shaft 4. As the latter rotates it will permit the spring 136 to throw the platen forward, carrying the paper with a quick blow against the type-wheel and causing it to receive an impression. A character would therefore be printed, and it would be impossible to cause the carriage to shift so as to leave a blank space, as between words, but blank spaces are provided for by leaving one of the type spaces blank on the type-wheel, so that when a space is needed in printing the operator first brings the type-wheel to present the blank to the printing position, whereupon the platen moves forward as before, but the paper does not strike a type.

I have explained above that in each row on the type-wheel there are five pairs of characters and five normal horizontal positions of the wheel, to any one of which it could be set by the controlling action of the magnet 24 by the use of not more than four successive impulses of current in the proper direction. By this means alone, therefore, only one half of the characters in any row can be brought to the printing position. But in order to print from any character of a pair adjacent to that which has been brought to the printing position by the escapement, I have provided the following means.

At the right of the instrument, and secured to the outer side of the plate 2 is a polarized electromagnet 140, the armature 141 of which is centrally pivoted at 142 on one pole of the permanent magnet 143. Attached to this armature at its pivotal center, and at right angles to the same, is a tongue 144 which extends through an opening in the side plate 2. The armature and tongue are normally held in symmetrical relation with respect to the poles by means of springs 145 secured to a stationary block 146 and bearing on opposite sides of a pin 147, set in the tongue 144. (Figs. 1, 2 and 3.)

The free end of tongue 144 lies immediately under a bell crank lever 148 (Fig. 10), pivoted at 149 to the side frame 2. On the vertical arm of this lever is pivoted a pawl 150, the forward end of which plays between a fixed stop 151 and a ratchet wheel 152 on the knife edge shaft 10. The rear end of the pawl 150 is beveled and bears against a fixed stop 153 so that the depression of the horizontal arm of the lever 148 swings the pawl into engagement with the ratchet 152 and imparts a movement of limited extent thereto. This movement is imparted to the shaft 10 and is of such extent and direction as to turn the said shaft and through it the type-wheel backward through the space of

one letter. When therefore, a character is to be printed which cannot be brought to the printing position by the escapement magnet 24, the latter is operated by the proper number of impulses to bring the character which precedes it on the type-wheel into printing position and an impulse caused to flow through the magnet 140 which will shift the tongue 144 to one side or the other, according to the direction of such impulse. In its normal or neutral position the tongue 144 acts as a stop for the horizontal arm of lever 148, but on each side of the point of normal engagement with said lever is a notch 154 so that when the tongue 144 is shifted to either side and lies directly under one of these notches, the lever 148 under the tension of a spiral spring 155 may be drawn down sufficiently to operate the pawl 150 and turn the type-wheel back the space of one letter to present the desired character in the printing position. In order that this lowering of the lever 148 may occur only at such times as it is desired to shift the type-wheel and not by the shifting of the tongue 144 alone, the bell crank lever 148 is connected by a link 156 with a lever 157, pivoted at 158, and bearing on a cam 159 on the main power shaft 4. This cam is cut away at such point that the end of lever 157 which engages it is free to move and permit the spring 155 to draw down the lever 148 just before the cam which effects the printing, reaches the position which permits the platen to force the paper against the type-wheel, so that the shifting of the latter will always precede the operation of printing. As soon as the character thus brought into position has been printed, the cam 159 raises the lever 148 and permits the tongue 144 to oscillate.

Each complete cycle of operation of the instrument heretofore described in detail, involves a single rotation of the power shaft 4. This latter is therefore normally locked, but at the proper instant released so that by frictional engagement with an electro-magnetic motor, or other suitable source of power, it may turn to perform one or more of the functions necessary for the operation of the machine as a whole. The mechanism for locking and releasing the power shaft is illustrated in detail in Fig. 6.

From the main shaft 4 project two arms 160, between which plays a tongue 161 mounted so as to turn freely about the shaft as a center. Pieces of leather or fiber 162 are secured to opposite sides of said tongue to form cushions, and a spiral spring 163 is connected to the tongue, tending to pull it in the direction of the rotation of the shaft.

To a plate 164 mounted on the base of the instrument, there is pivoted a vertical arm 165 with two beveled bearing surfaces at its free end. Normally, the arm 165 is held in a position in which the end of the tongue 161 engages therewith, and locks the main shaft against rotation, but when the magnet 166, mounted on the base of the instrument, is energized, a bar 167 sliding in guides on the plate 164, is forced forward, or to the right, by the movement of the armature 168, with which said bar is connected by a link 169.

The bar 167 carries a latch 170 that engages with the end of a bell-crank lever 171 pivoted to plate 164 in such position that the end of its horizontal arm engages with the arm 165. By this forward movement of the bar 167 the bell-crank lever 171 is turned sufficiently against the tension of a spring 172 to allow the arm 167 to shift, so that the end of tongue 161 slips out of engagement therewith. But as soon as sufficient movement has been imparted to the lever 171, the latch 170 is disengaged from said lever by the engagement of its forward inclined end with a fixed stop 173, whereupon the end of the lever 171 which carries an anti-friction roller, presses forward the arm 165 into the path of the tongue 161, so that on the completion of a revolution the shaft 4 is arrested by the reëngagement of the tongue 161 with the arm 165.

In the above description of the construction of the instrument, the component mechanisms have been treated as separately operating, but as will be seen by reference to Fig. 12, these different instrumentalities in the case of the present machine, are associated in such manner as to be under the control of a single line circuit.

The transmitter, which in all systems of this kind, forms an important element, is or may be of special construction, but as its functions are to transmit over the line impulses of either positive or negative current, of greater or less duration, in certain predetermined order of succession, it is conventionally represented by two ordinary keys, 174 and 175, one adapted, when depressed, to send positive and the other negative impulses over the line 176. The magnets 24, 76 and 140 are included in series in the main line with the main line battery 177. The magnet 166 is in a local circuit with a battery 178 and a controlling mechanism, to be hereinafter described. Let it be assumed now that a letter on the lowest row on the type-wheel is to be brought to the printing position.

As many positive impulses are sent to line by, say, key 174 as may be necessary to bring the type-wheel to the desired adjustment horizontally. These impulses affect magnet 24, but not magnet 76 as the two are oppositely polarized. Four negative impulses are also sent by key 175 to raise the type-wheel from its normal to its fifth position. These impulses affect magnet 76, but not magnet 24, and, as far as may be, are sent in alter-

nation with the positive impulses so that the horizontal and vertical movements of the type-wheel occur alternately. By each of such impulses, whether positive or negative, the magnet 140 is operated and caused to rock its armature 141 and oscillate the tongue 144, the direction of movement of the tongue depending upon the direction of the impulses. When by this procedure the desired character has been brought to the printing position, the cessation of impulses over the line leaves the tongue 144 in its central position under the lever 148, and the instrument is ready to print. This latter operation is brought about, either by the cessation of impulses, that is to say, on no current, or by a prolongation of the final impulse by means of the following devices illustrated in detail in Fig. 11, and diagrammatically in Fig. 12. On the side plate 2 is a circuit controller consisting of two springs 179 and 180, with contact points 181 and 182, and a lever 183 pivoted at 184 and carrying an insulating button 185 at its end which, by the oscillation of the lever, forces the springs 179 and 180 alternately against their respective stops.

The tongue 144 is connected with the lever 183 by a bifurcated link 186, the branches of which contain slots in which work pins 187 on lever 183 on opposite sides of its fulcrum 184. In the normal position of these parts, and when the tongue 144 is in its central position, the pins 187 are at opposite ends of their respective slots so that a movement of the tongue in either direction, by pushing on one pin or by pulling on the other, tends to move the lever 183 in the same direction, that is, so as to force the spring 179 against its stop 181. The spring contacts 179 and 180 are connected with one terminal of the local circuit 188, and the stops 181 and 182 are connected with the other terminal.

The local circuit 188 is normally open and springs 179 and 180 are out of contact with their respective stops, this condition being maintained by the engagement with the lower end of lever 183 of a stud 189 on a lever 190 pivoted to the side frame 2 at 191. Two springs 192 and 193 are connected to lever 183 at points on opposite sides of its pivot 184, but spring 192 is the stronger and tends to pull the lever over to a position in which it forces the spring 180 into contact with stop 182. So long, however, as the lever 183 is engaged by the stud 189 on the spring-actuated lever 190, the lever 183 is held in a central position, as shown in Fig. 11.

By the first current impulse sent over the line for adjusting the type-wheel, the tongue 144 is moved to one side and the lever 183 shifted in the direction to force spring 179 against its stop 181. This movement disengages the lever from the stud 189 which instantly drops out of the path of the lever under the action of the spring 194 connected with lever 190. With the cessation of the impulse, therefore, lever 183 under the predominating influence of spring 192 will move back and force spring 180 into contact with stop 182, but the next impulse over the line, whatever its direction, will shift the lever 183 back to close contact between spring 179 and stop 181. Thus, so long as impulses are being transmitted over the line, the local circuit will be alternately closed and opened, but as the impulses are of very short duration, and are sent with great rapidity, the local circuit is not closed for a sufficient length of time to enable the somewhat sluggish magnet 166 to respond. When the impulses cease, however, with the bringing of the desired character to the printing position, the contact between spring 180 and stop 182 is prolonged. This energizes the magnet 166, releases the power shaft 4 and effects the printing and the other operations hereinbefore described.

In order that the lever 183 may be restored to its normal position, corresponding to which the local circuit is open, a lever 195 pivoted at 196 and bearing on a cam 197 on the power shaft, engages lever 190 and lifts it to bring the stud 189 into engagement with the shoulder on lever 183. The end of the last named lever is beveled on one side, as shown, so that it is readily forced aside by the stud 189 as the lever 190 is raised.

The series of operations above described presupposes that the desired letter on the type-wheel has been brought to the printing position by the two escapement magnets 24 and 76, but it remains to consider the operation which occurs when the type-wheel must be shifted back the space of a letter before the printing operation is effected. In such operation the proper impulses are transmitted to bring the pair of characters including the one desired, to the printing position. The last impulse of the series necessary for effecting this shifts the tongue 144 to one side of its central or normal position, and, through the lever 183 and link 186, forces the spring 179 into contact with stop 181. Instead of interrupting this final impulse, it is prolonged sufficiently to enable magnet 166 in the local circuit to become energized, whereby the power shaft is released, the lever 148 operated to shift the type-wheel, because the tongue 144 lies under one of the notches 154 therein, and the other operations above described carried out. Thus by the cessation of impulses, or on "no current", as well as by the prolongation of the final impulse of any series that adjusts the type-wheel, the printing is effected.

It will be understood that the order of the

several operations hereinbefore described will be predetermined by the design and by the configuration of the operating cams. It is sufficient to observe that in general the bringing of the type-wheel into the proper position for printing precedes all other operations. This is followed by the release of the cam shaft the first effect of which, when the final impulse is prolonged, is to shift the type-wheel back. The next operation is to justify and lock the type-wheel by the plunger 40; the next, to throw forward the printing bar or platen; the next, to raise the lever 195 engage the lever 183 and open the local circuit 188; the next, to restore the type-wheel to its normal position, and the last to feed the type-wheel carriage the space of a character.

As the type-wheel is restored to its normal or initial position after each operation or cycle of operations of the machine, no special unison device or other accessories commonly employed in instruments of this character, is required. It is hardly necessary to call attention to the fact that it may be operated either by direct connection with the main line, or by the interposition of suitable relays.

Having now described my invention, what I claim is:

1. In a printing telegraph receiver, the combination with a type-wheel having a plurality of circular rows of characters thereon, an escapement mechanism for rotating the type-wheel step by step, a second escapement for raising the type-wheel step by step in line with its axis, the two escapement mechanisms being capable of simultaneous or non-interfering operation, independent electromagnets one responsive to positive and the other to negative current impulses only, for controlling the operation of said escapements, and included in the same circuit, whereby the positive and negative impulses of any series required for a given adjustment of the type-wheel may be sent to line, alternately, as set forth.

2. In a printing telegraph receiver, the combination with a type-wheel having a plurality of circular rows of characters thereon, means for adjusting the type-wheel in line with its axis to bring a desired row to the printing position, a quick acting magnet responsive only to current impulses in one direction for controlling said adjusting means, devices for rotating the type-wheel step by step through spaces corresponding to two characters, a quick acting magnet responsive only to current impulses in the opposite direction to those that operate the first named magnet, for controlling said rotating devices, mechanism for shifting the type-wheel a limited extent from any position to which it may be brought by the said rotating devices, and a polarized magnet responsive to all current impulses for bringing said shifting mechanism into operation when energized by a prolonged impulse, as set forth.

3. In a printing telegraph receiver, the combination with a traveling type-wheel carriage, a type-wheel thereon and capable of rotation about a central axis, and of vertical adjustment in line with its axis, of an escapement mechanism in gear with the type-wheel shaft and adapted to rotate the same, a second escapement mechanism operatively connected with the type-wheel to adjust the same step by step in line with its axis, the said escapements being capable of simultaneous or non-interfering operation, and independent electromagnets one responsive only to positive and the other only to negative current impulses for actuating the respective escapement shafts, as set forth.

4. In a printing telegraph receiver, the combination with a type-wheel, of means for shifting the same in line with its axis, an electromagnet responsive to currents in but one direction only for controlling said shifting means, an electromagnet responsive to currents in an opposite direction only, mechanism under the control of second magnet for rotating the type-wheel step by step, devices for turning the type-wheel a half step from any position to which it may be brought by said rotating mechanism, and a third magnet responsive to all current impulses for bringing said devices into operation when energized by a prolonged impulse, as set forth.

5. In a printing telegraph receiver, the combination with a type-wheel capable of rotary movement about its axis and vertical movement in line therewith and mechanism for turning the type-wheel backward a limited extent, of three electromagnets included in the same circuit, the first adapted to be operated by current impulses in one direction to control the horizontal adjustment of the type-wheel; the second adapted to be operated by current impulses in the opposite direction to control the vertical adjustment of said type-wheel, and the third adapted when operated by a prolonged impulse in either direction to set in operation the mechanism for turning the type-wheel backward, as set forth.

6. In a printing telegraph receiver, the combination with a type-wheel, of two escapement mechanisms and electromagnets for controlling the same, each of said magnets being responsive to a current in one direction only, one adapted to rotate and the other to vertically adjust the type-wheel step by step, a constantly driven power shaft, a releasing mechanism therefor, an electromagnet in a local circuit for controlling the releasing mechanism, and a third magnet in

the main circuit responsive to current impulses in either direction for energizing the local magnet, as herein set forth.

7. In a printing telegraph receiver, the combination of a type-wheel, escapement mechanisms for adjusting the same horizontally and vertically, electromagnets for controlling said escapements, a local circuit, a printing magnet in said local circuit, a normally restrained circuit controller interrupting the local circuit and an electromagnet independent of the type-wheel controlling magnets, adapted, when energized by a prolonged current impulse, or when de-magnetized by the cessation of a single or of a series of short impulses, to operate said circuit controller, as set forth.

8. In a printing telegraph receiver, the combination with a type-wheel capable of rotation about its axis and vertical movement in line with its axis, of means for rotating and raising the same by successive steps, electromagnets responsive to positive and negative currents respectively for controlling said means and included in a single circuit, a third magnet in the same circuit responsive to currents in either direction, a printing magnet and a circuit controller in a local circuit the operation of which is dependent upon the cessation of impulses through the said third magnet, as set forth.

9. In a printing telegraph receiver, the combination with a type-wheel and means for adjusting the same to bring any desired character to the printing position, of a normally open local circuit, a printing magnet and a circuit controller included therein, a magnet in the main circuit responsive to all current impulses sent over the line, and adapted when energized, to release the circuit controller, and effect the closing of the local circuit on the cessation of current impulses by which it is actuated, as set forth.

10. In a printing telegraph receiver, the combination with a type-wheel and means for rotating the same, of mechanism for imparting a backward movement of limited extent to the type-wheel from any position to which it may have been adjusted, of a polarized magnet in the main circuit of the receiver, an armature therefor adapted to be shifted in opposite directions from a normal position by positive and negative impulses of current, but which, in its normal position prevents the operative movement of the mechanism for imparting a backward movement to the type-wheel, and means for setting in operation said mechanism dependent upon the prolongation of the current in either direction through the said polarized magnet, as set forth.

11. In a printing telegraph receiver, the combination with a type-wheel of means controlled by current impulses for effecting the proper adjustments of the same, a local circuit, a slow acting printing magnet and a circuit controller included therein, the latter comprising a pivoted lever, two contacts and stops therefor adapted to be brought into engagement by the oscillations of the lever, a spring acting on said lever to shift it to a position to close one of said contacts, a connecting link between said lever and the armature of a controlling magnet, having two points of connection with said lever on opposite sides of its fulcrum whereby a movement of the armature of the controlling magnet in either direction will shift the lever against the force of said spring and cause it to close the opposite contact, and the said controlling magnet and a polarized armature therefor adapted to be shifted in opposite directions by positive and negative impulses of current in the main line of the receiver, whereby the local circuit will be operatively closed either by a prolonged impulse or by the cessation of impulses of current on the main line, as set forth.

12. The combination with a type-wheel, of an escapement mechanism comprising a power actuated shaft, a fixed and a loose scape wheel with limited play thereon, a polarized electromagnet, a spring retracted armature normally drawn up to the poles of the magnet by the force of the permanent magnetism and having an arm adapted to engage alternately with the scape wheels when the magnet is actuated by current impulses in one direction, as set forth.

13. In a printing telegraph receiver, the combination with a type-wheel having a plurality of circular rows of characters thereon, an escapement mechanism for rotating the type-wheel step by step, a second escapement mechanism for raising the type-wheel step by step in line with its axis, the two escapement mechanisms being capable of simultaneous or non-interferring operation, and electro-magnets capable of independent operation for controlling the operation of said escapements respectively, as set forth.

14. In a printing telegraph receiver, the combination with a type-wheel having a plurality of circular rows of characters thereon, means for adjusting the type-wheel in line with its axis to bring a desired row to the printing position, an electro-magnet responsive to currents in one direction only, for controlling said adjusting means, devices for rotating the type-wheel step by step through spaces corresponding to two characters, an escapement for controlling said devices, an electro-magnet responsive only to currents of opposite direction to those to which the first named magnet is responsive and capable of operation independently of the said first named magnet for operating the said escapement, mechanism for turning the type-wheel a limited extent

from any position to which it may have been rotated, an escapement for controlling said mechanism, and an electro-magnet for operating the last mentioned escapement, as set forth.

15. In a printing telegraph receiver, the combination with a traveling type-wheel carriage, a type-wheel thereon capable of rotation about a central axis, and of vertical adjustment in line with its axis, of an escapement mechanism in gear with the type-wheel shaft and adapted to rotate the same, a second escapement mechanism operatively connected with the type-wheel to adjust the same step by step in line with its axis, and electro-magnets capable of independent operation for controlling the operation of the respective escapements, as set forth.

16. In a printing telegraph receiver, the combination with a type-wheel of means for effecting its rotation, means for adjusting it to given positions in line with its axis and means for shifting it backward a limited extent from any position to which it may have been turned, two electro-magnets capable of independent operation for controlling respectively the operation of the means for rotating and the means for vertically adjusting the type-wheel, and a third electro-magnet adapted when energized by a prolonged current to control the means for shifting the type-wheel backward, as set forth.

17. In a printing telegraph receiver, the combination with the type-wheel of two escapement mechanisms under the control of line electro-magnets capable of independent operation, one adapted to rotate and the other to vertically adjust the said type-wheel step by step, the said escapement mechanisms being capable of simultaneous or non-interfering operation, a constantly driven power shaft, a releasing mechanism therefor under the control of a third electro-magnet and printing and feeding mechanism operated by the rotation of said shaft, as set forth.

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