

(No Model.)

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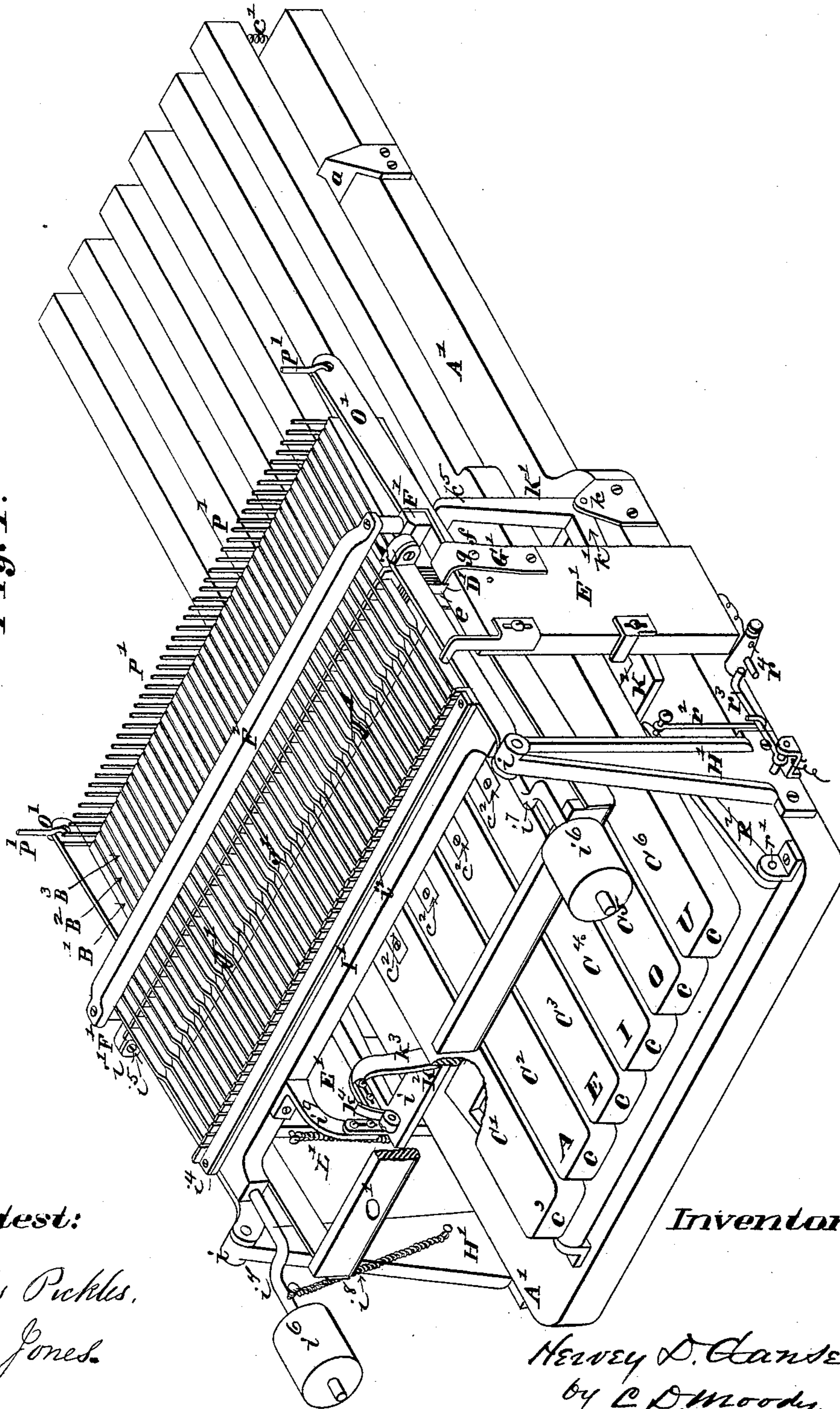
H. D. GANSE.

# DEVICE FOR OPERATING A SET OF LEVERS.

No. 390,768.

Patented Oct. 9, 1888.

**Fig. 1.**



*Attest:*

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T. L. Jones.

*Inventor:*

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by C. D. Moody, atty.

(No Model.)

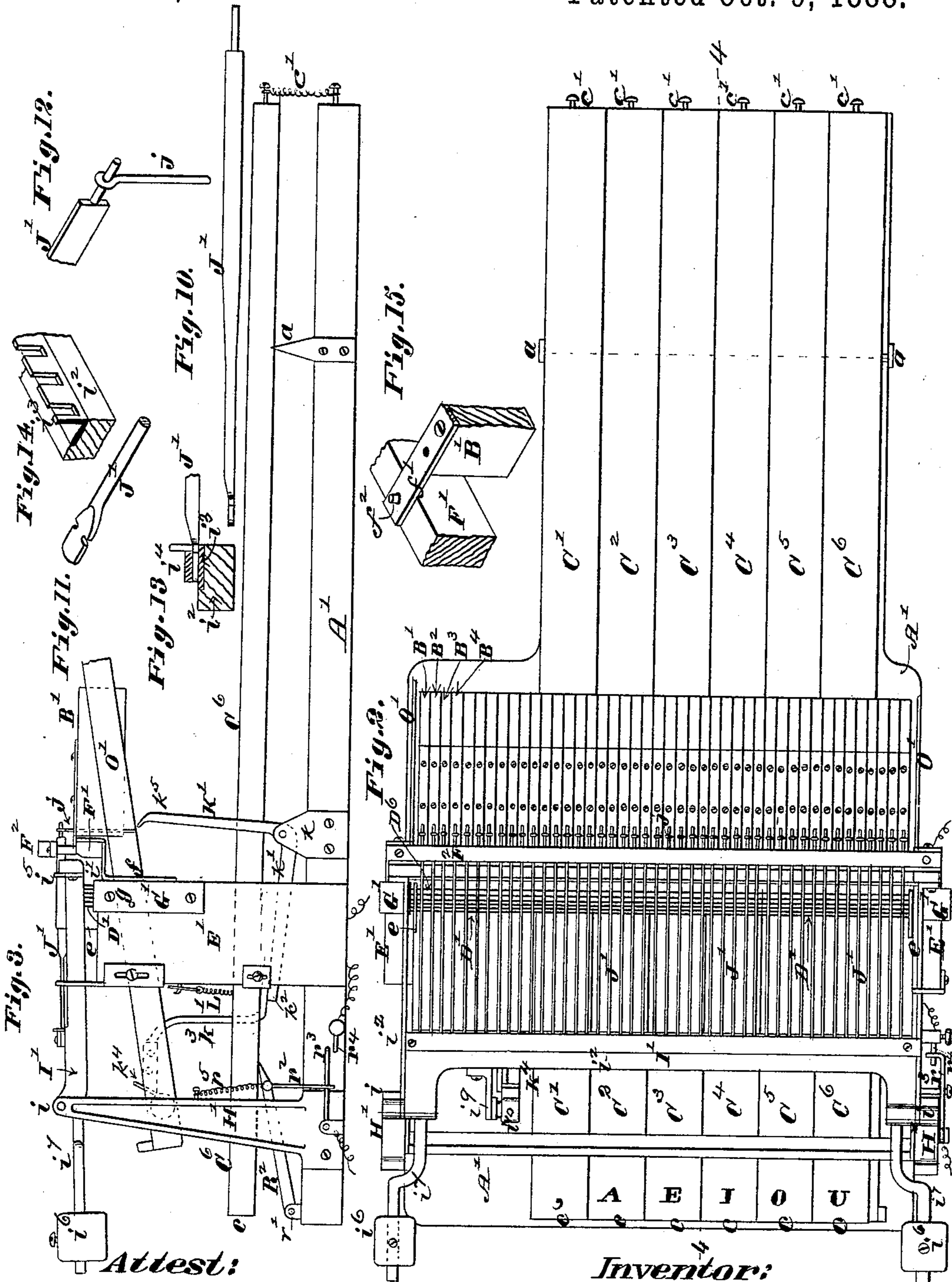
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Fig. 4.

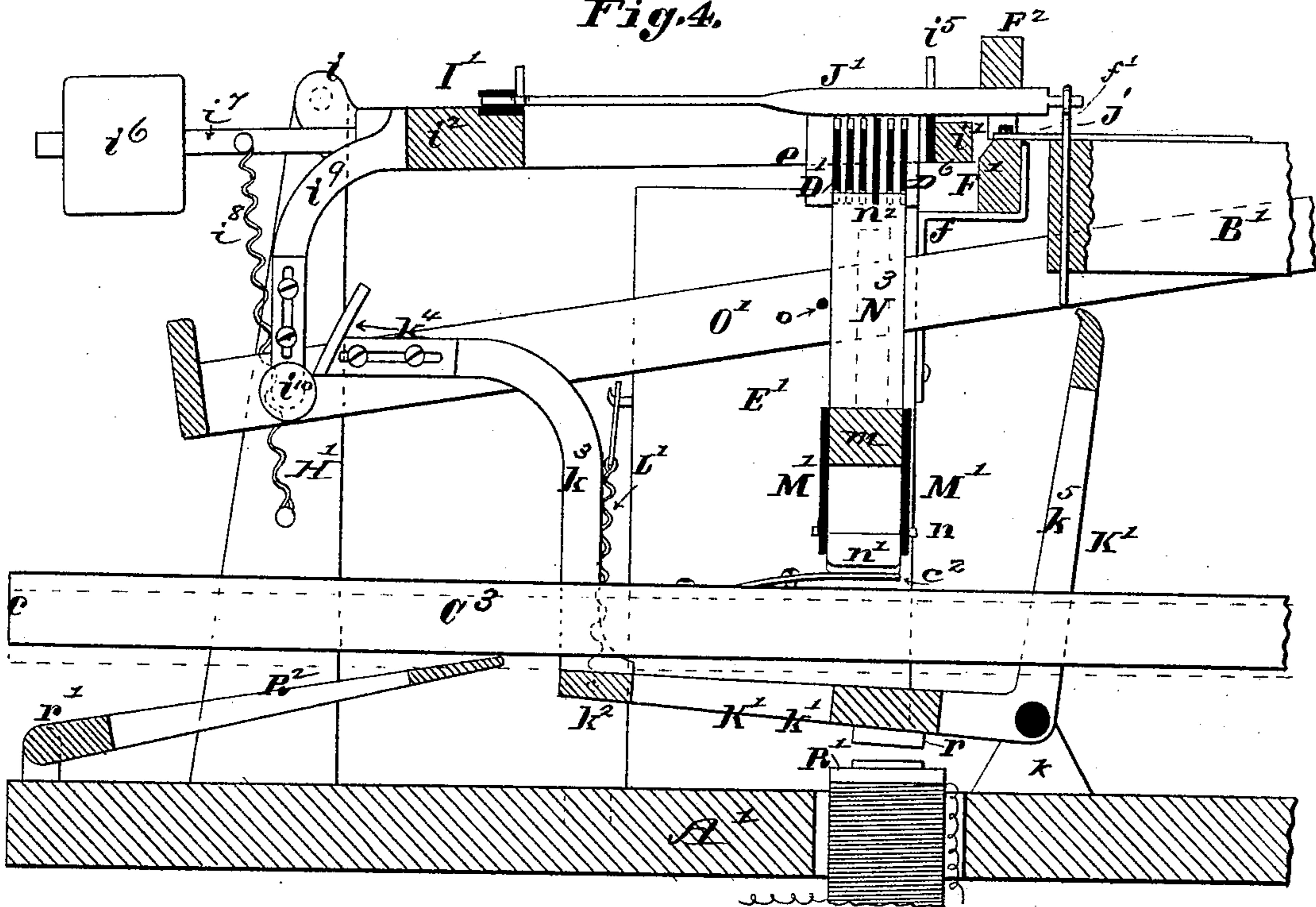
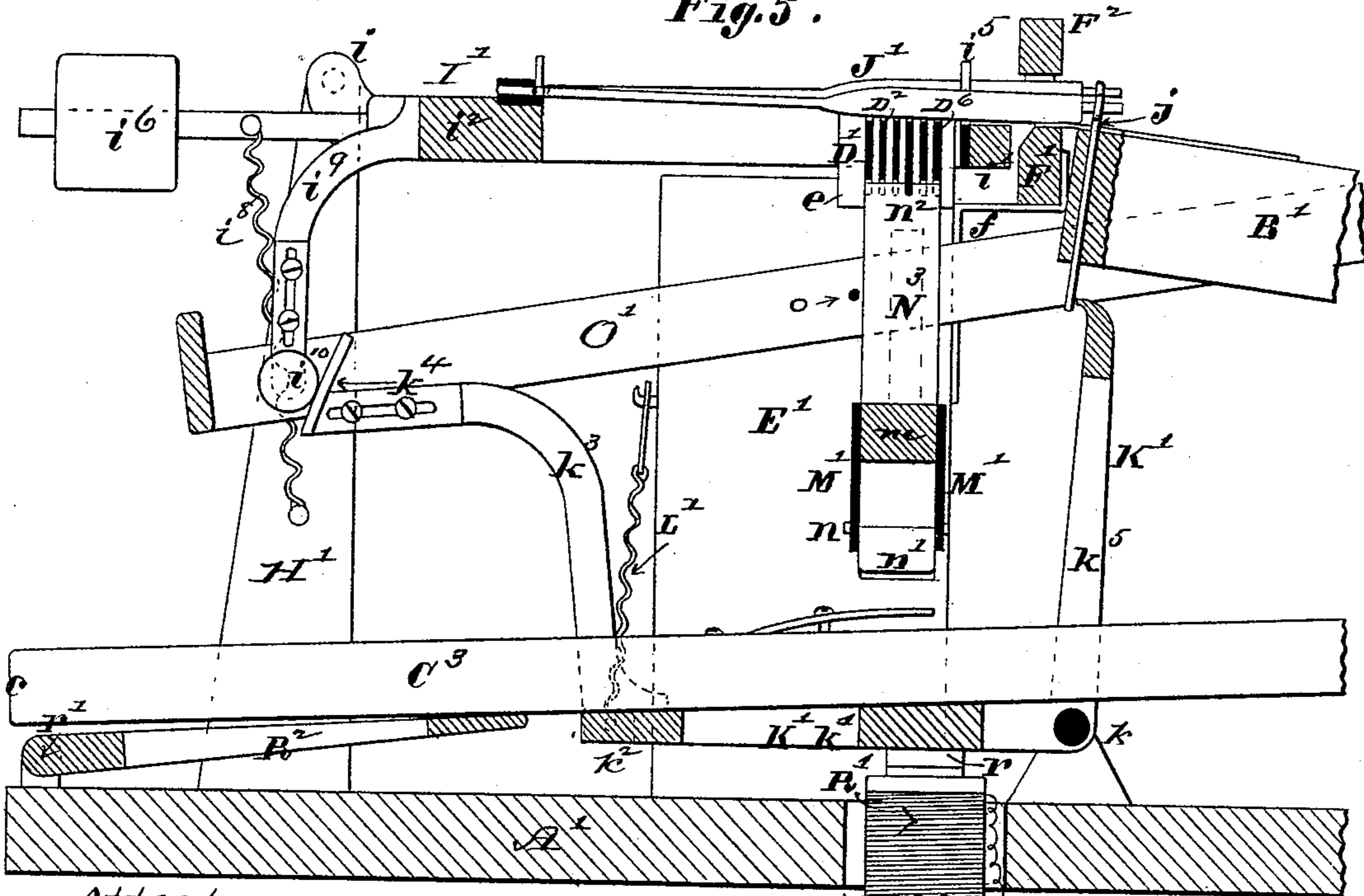


Fig. 5.



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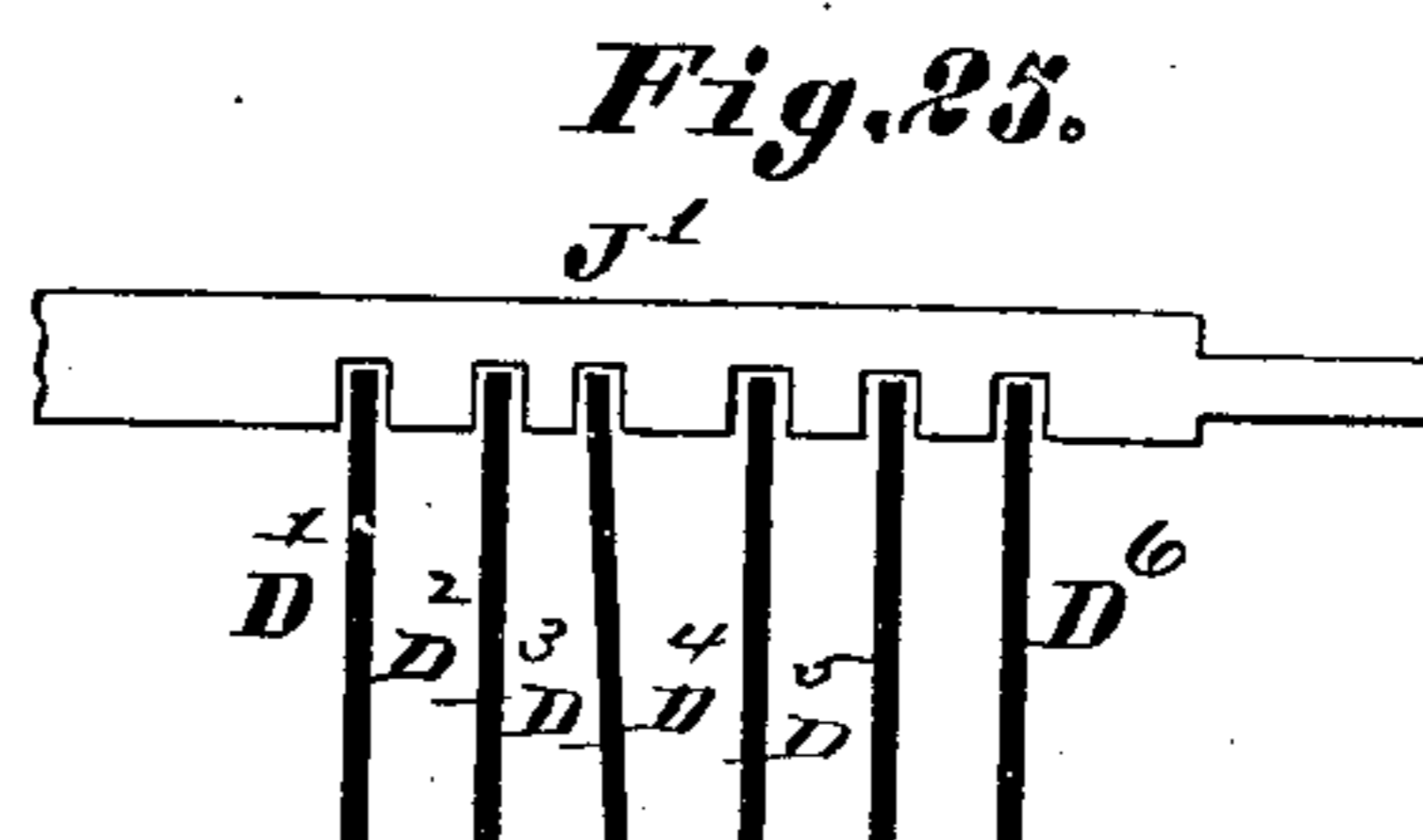
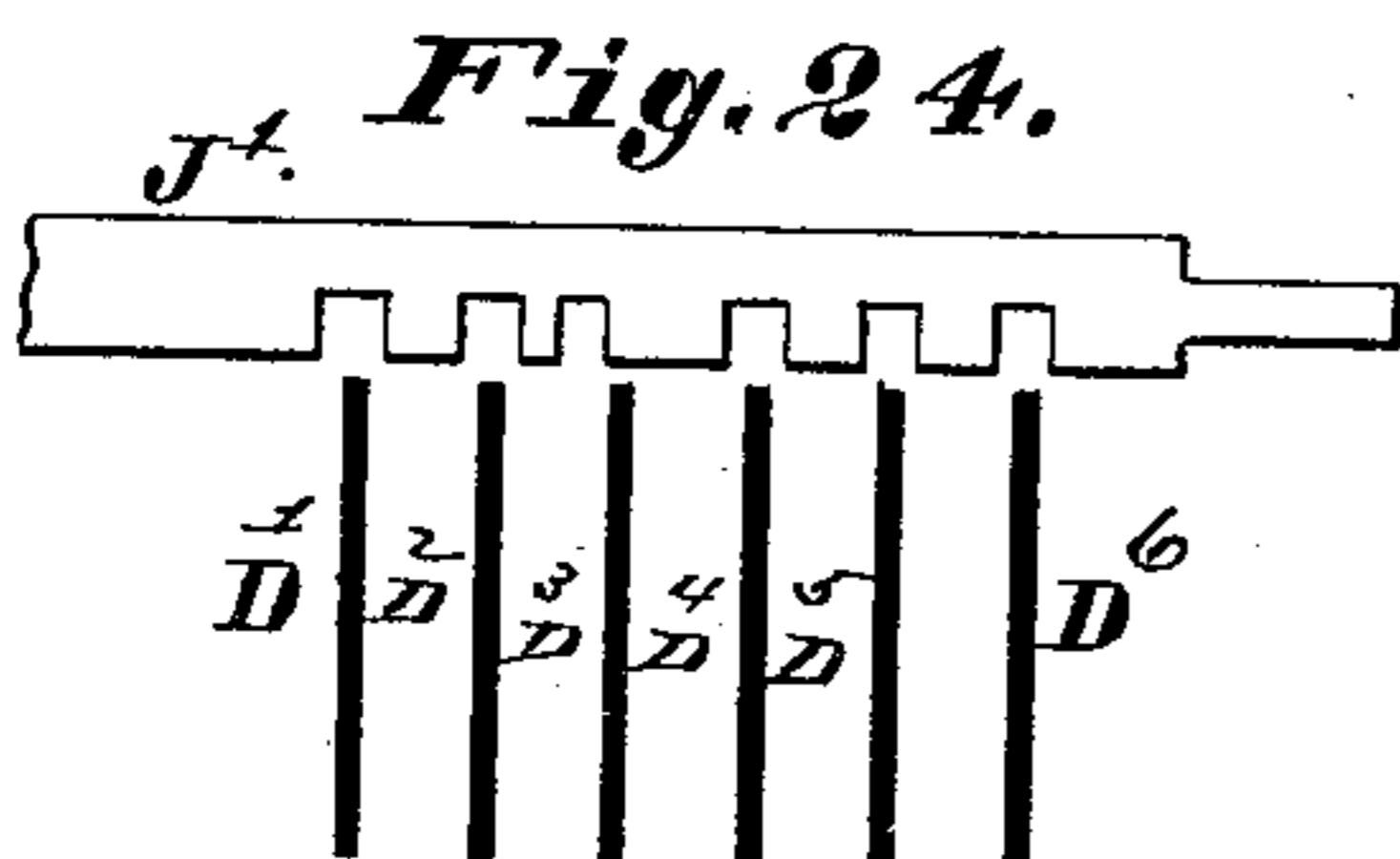
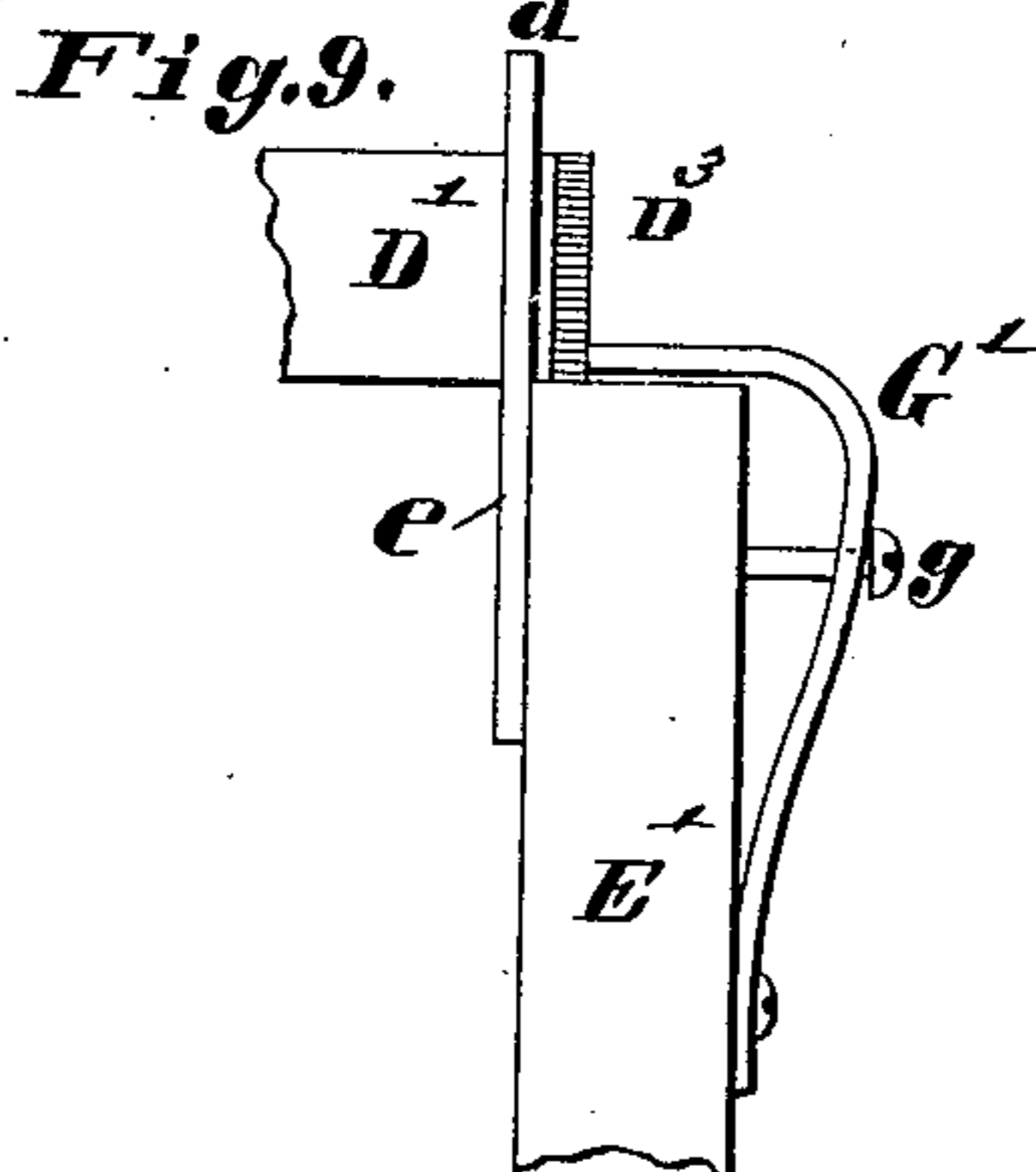
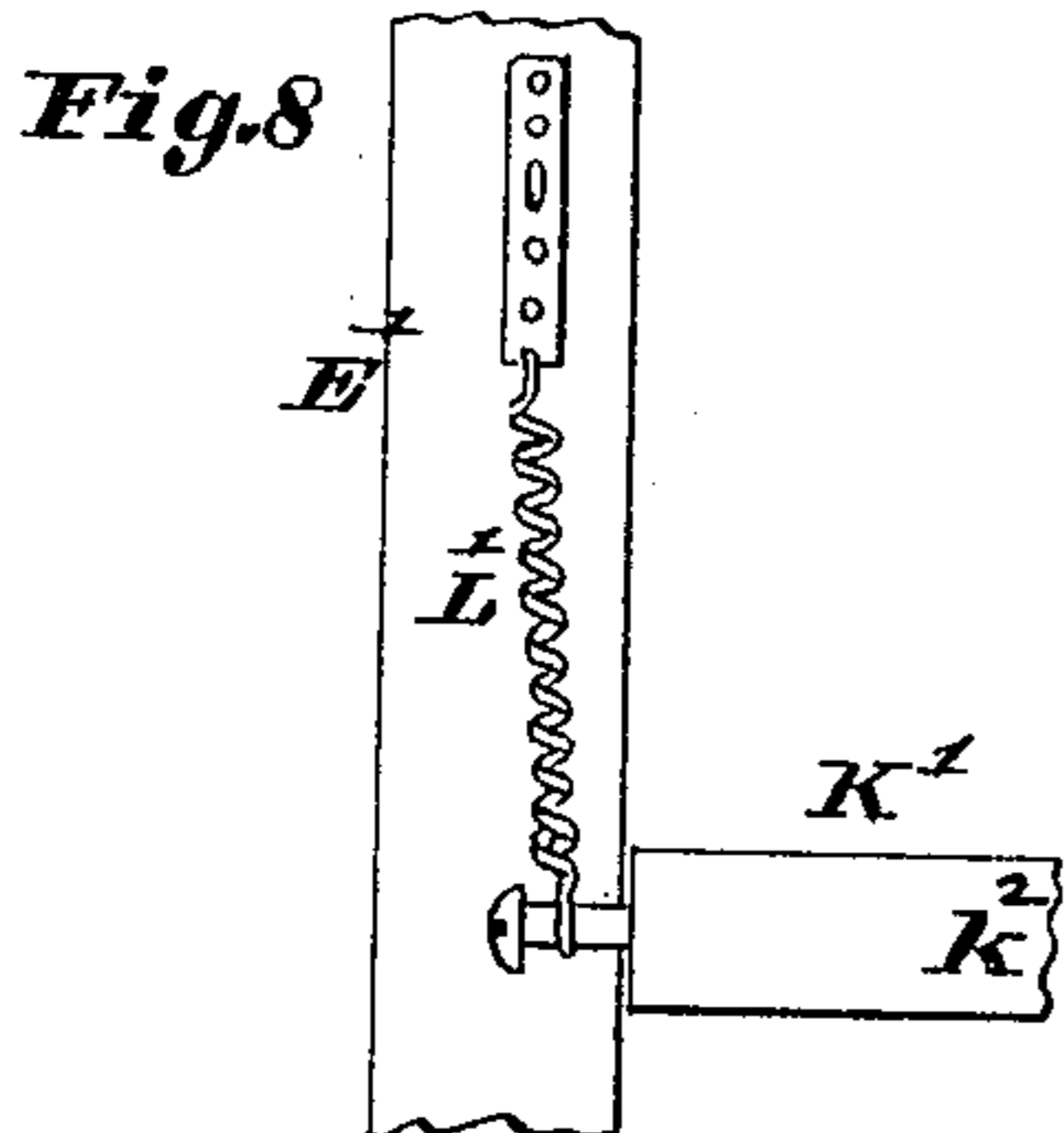
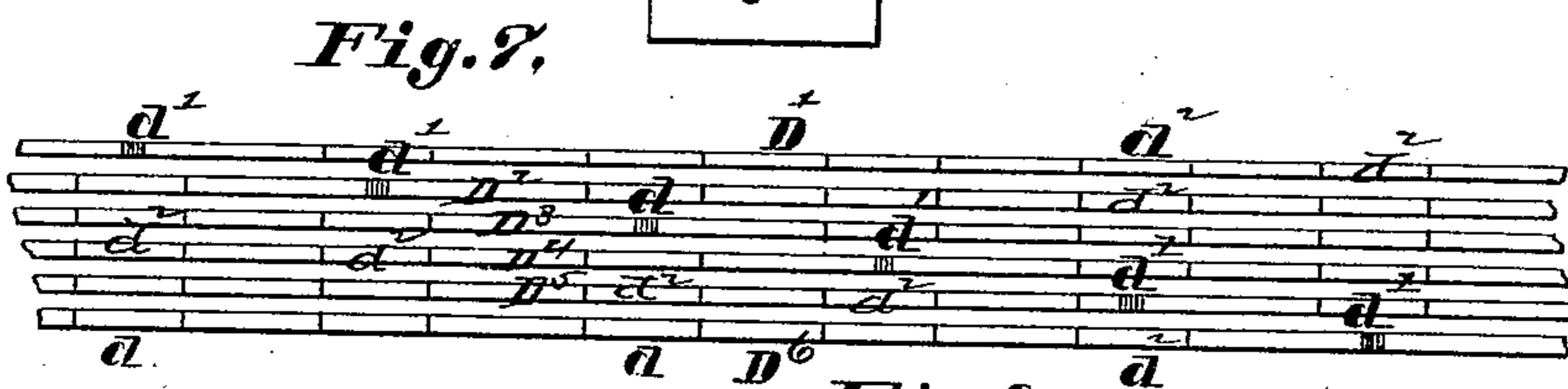
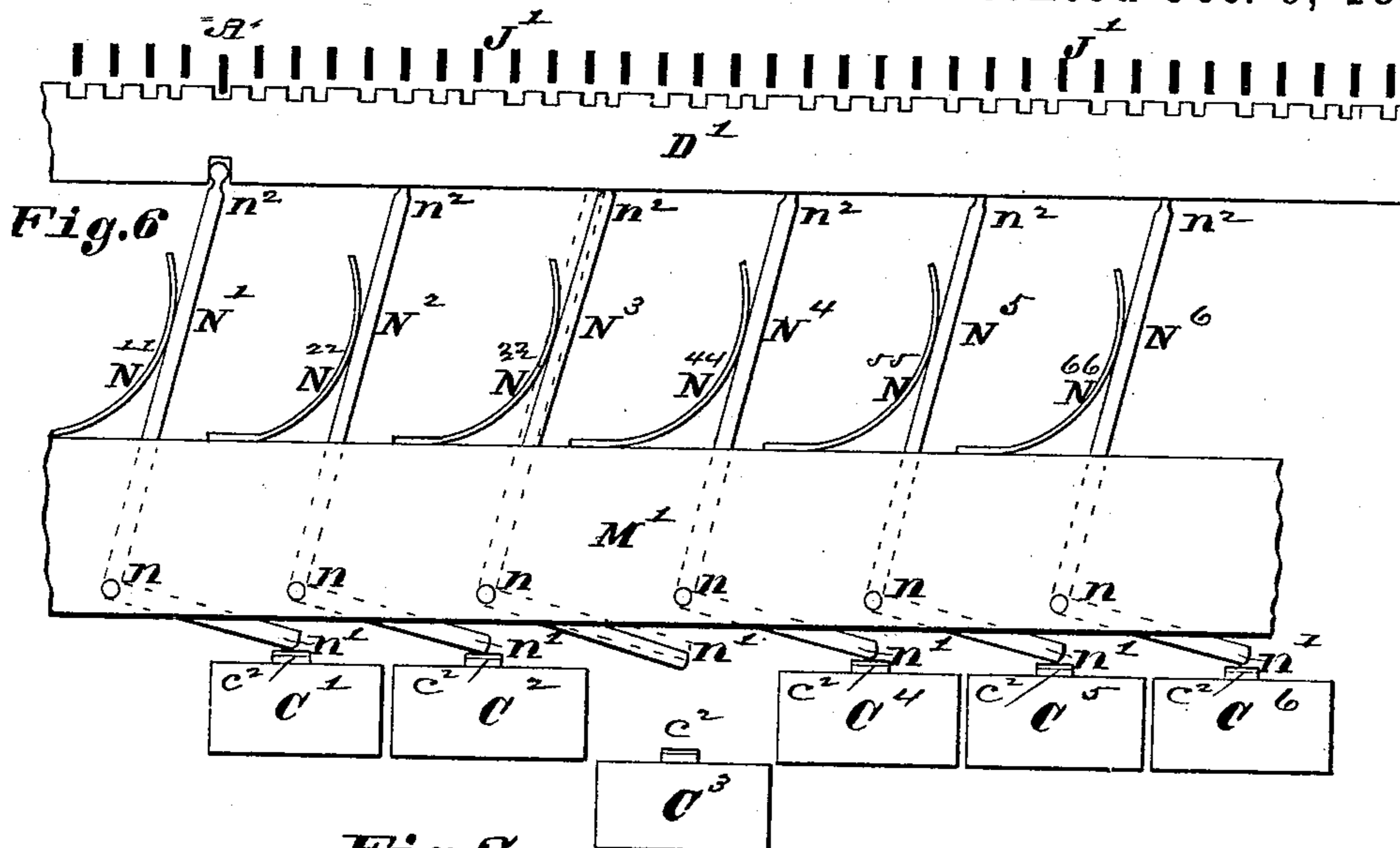
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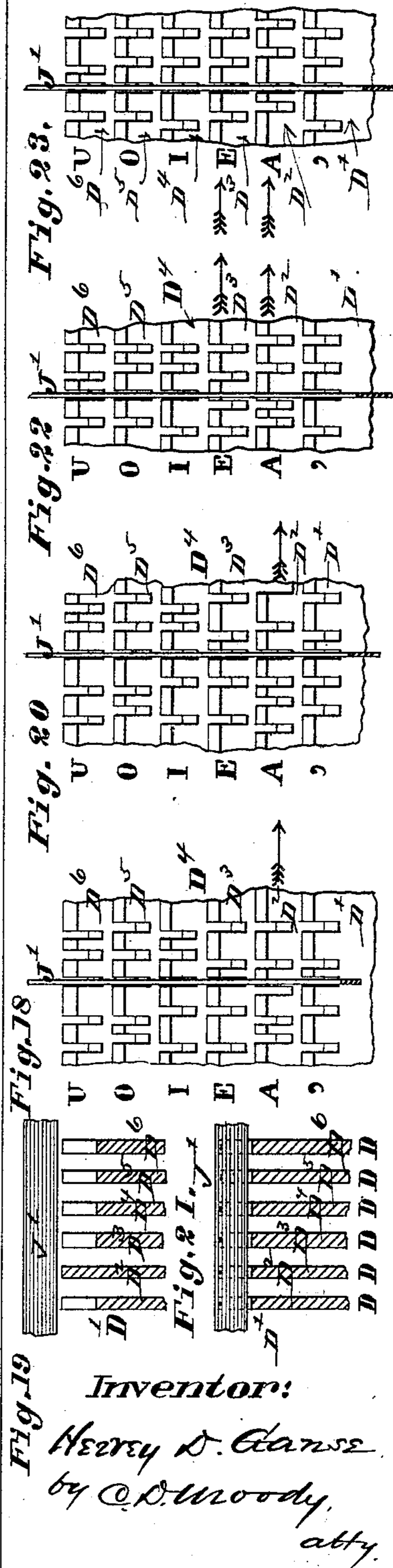
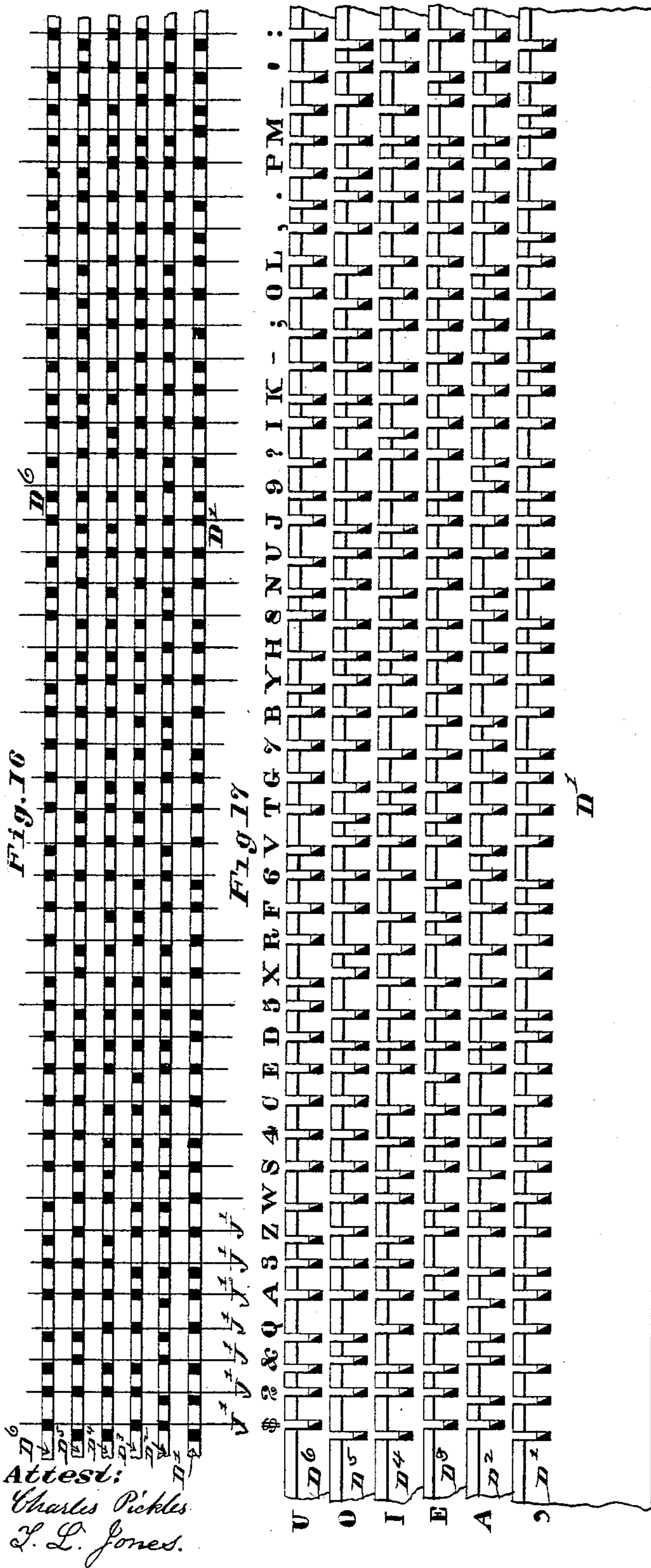
5 Sheets—Sheet 5.

H. D. GANSE.

DEVICE FOR OPERATING A SET OF LEVERS.

No. 390,768.

Patented Oct. 9, 1888.



# UNITED STATES PATENT OFFICE.

HERVEY D. GANSE, OF ST. LOUIS, MISSOURI.

## DEVICE FOR OPERATING A SET OF LEVERS.

SPECIFICATION forming part of Letters Patent No. 390,768, dated October 9, 1888.

Application filed July 17, 1882. Serial No. 66,929. (No model.)

*To all whom it may concern:*

Be it known that I, HERVEY D. GANSE, of St. Louis, Missouri, have made a new and useful Device for Operating a Set of Levers, of which the following is a full, clear, and exact description, reference being had to the annexed drawings, making part of this specification, in which—

Figure 1 is a view in perspective of a device; 10 Fig. 2, a plan; Fig. 3, a side elevation; Fig. 4, a longitudinal vertical section upon an enlarged scale, taken on the line 4 4 of Fig. 2; Fig. 5, a similar section, the parts being as when a key is depressed; Figs. 6 to 23, details upon 15 various scales, Fig. 6 being a front elevation, partly in section, showing the mechanism for operating the slides; Fig. 7, a bottom view of the slides; Fig. 8, a view from the front, showing the means for adjusting the rock-frame; Fig. 9, a view from the front, showing 20 the means for adjusting the slides transversely in the device; Fig. 10, a side view of one of the tumbler-rods; Fig. 11, a view in perspective of the forward end of a tumbler-rod; Fig. 12, a view in perspective of the rearward end of a tumbler-rod, the rod having the pendant attached; Fig. 13, a sectional view of the part to which the tumbler-rods at 30 their inner ends are jointed; Fig. 14, a view in perspective from the rear of the part last referred to; Fig. 15, a view in perspective, showing the mode of hinging the levers; Fig. 16, a top view of the slides upon an enlarged scale, the slides, for the purpose of illustration, being spaced apart more than in practice is necessary, and the positions of the 35 tumbler-rods being indicated by the cross-lines; Fig. 17, a view in perspective of the slides; Fig. 18, a view in perspective showing the slides in part, and showing a tumbler-rod ready to fall when the slide  $D^2$  shall have been moved to the right; Fig. 19, a cross-section of the part shown in Fig. 18; Fig. 20, 40 a view in perspective showing the parts exhibited in Fig. 18, but the slide  $D^2$  is moved to the right and the tumbler-rod is in the notches in the slides; Fig. 21, a cross-section of the parts shown in Fig. 20; Fig. 22, a view in perspective of the slides in part, (two,  $D^2$  and  $D^3$ , of the slides must be moved to the 50 right before the tumbler-rod can fall;) and Fig. 23, a view of the parts shown in Fig. 22,

but the two slides  $D^2$   $D^3$  have been moved to the right and into position for the tumbler-rod to drop. Figs. 24 and 25 illustrate a modification in the construction of the slides and 55 tumbler-rods.

The same letters denote the same parts.

The aim of the present invention is to provide for moving any one, as desired, of a set 60 of levers by means of one or more of another set of levers, the levers of the operating set being less in number than those of the set operated upon.

The invention is adaptable to various mechanisms which have a number of levers or parts requiring to be separately moved—type-setting or telegraphing mechanisms, for instance. It is especially valuable in connection with a 65 type-writing mechanism, as it enables the operator with, say, half a dozen levers to accomplish all that is now feasible with the ordinary type-writer, the key-board of which contains as many levers as there are types to 70 be moved.

Considered generally, the device consists of 75 the set of operating-levers, a set of independently-movable slides, a set of movable tumbler-rods, and the set of levers operated upon. The slides in number correspond to the operating-levers, and the movement of the slides 80 are responsive to the movements, respectively, of the operating-levers. The movements of the tumbler-rods are determined by the positions of the slides. The tumbler-rods in number 85 correspond to the levers operated upon, and the movements of the levers operated upon are dependent on the movements, respectively, of the tumbler-rods.

In the drawings,  $A'$  represents the base of 90 the device.

$B'$   $B^2$   $B^3$ , &c., represent the levers to be moved, and  $C'$   $C^2$   $C^3$   $C^4$   $C^5$   $C^6$  the levers for effecting the movement of the first-named levers. 95

The operating-levers  $C'$   $C^2$ , &c., can be considered and hereinafter will be styled "keys," the operator's hand being applied to the forward ends,  $c$   $c$ , of the keys as to the key-board of a type-writer, causing the ends  $c$   $c$  to be depressed as desired, and through the mechanism 100 hereinafter described producing the desired movements of the levers  $B'$   $B^2$ , &c. The keys  $C'$   $C^2$ , &c., turn upon a fulcrum,  $a$ .

Springs  $c'$  act to recover the keys when the ends  $c$  are released by the operator.

$D' D^2 D^3 D^4 D^5 D^6$  represent a set of slides. They are arranged transversely in the device, and they are supported so that they can be independently moved endwise a short distance to the right. In the present device the slides rest at their ends upon the posts  $E' E'$ . These posts are arranged one at each side of the device, and are attached to and extend upward from the base  $A'$ . The posts also serve, by means of brackets  $f$ , to support a cross-bar,  $F'$ . The slides longitudinally in the device are confined by guides  $e$ . The endwise movement of the slides is limited by the stops  $G' G'$ , Figs. 1, 2, 3, 9. The stops, by means of the screws  $g$ , are made adjustable for the purpose of adjusting the termini of the movement of the slides.

$H' H'$  represent another pair of posts, which are attached to and extend upward from the base  $A'$  at each side thereof.

$L'$  represents an oscillating frame, which at  $i$  is hinged to the posts  $H' H'$ , and which extends thence toward the rear end of the device, the rear end bar,  $i'$ , coming in the rear of the slides  $D' D^2$ , &c. The forward end bar,  $i^2$ , of the frame, in connection with the plates  $i^3 i^4$ , serves to support and hold the forward ends of a set of so-called "tumbler-rods,"  $J' J' J'$ , &c., but in such manner that the rear ends of the tumbler-rods and the rear end of the oscillating frame can, when desired, be opened slightly apart. The tumbler-rods toward their rear ends pass above the slides  $D' D^2$ , &c., and rest in a slotted guide-plate,  $i^5$ , which is fastened to the bar  $i'$ .

The shape of the tumbler-rods is shown in Figs. 10, 11, 12, and the mode of connecting the rods and the parts  $i^2 i^3 i^4$  is shown in Figs. 4, 5, 13. Reference in this respect is also had to Fig. 14. The rear ends of the tumbler-rods project through the slotted guide-plate  $i^5$ , that is attached to the bar  $i'$ , and beyond the plate  $i^5$  the rod ends are extended to project above and beyond the cross-bar  $F'$ , and at their extremities are provided with pendants  $j$ , Figs. 3, 4, 5, 12. The oscillating frame at its forward end is counterbalanced, the counter-balances  $i^6 i^6$  being attached to the arms  $i^7 i^7$ , which project forward from the frame, as shown more distinctly in Figs. 1, 4, 5. The counter-balances are adjusted perfectly, so as to just overcome the weight at the rear end of the oscillating frame and lift the tumbler-rods out of the slides, it being my intention to render the oscillating frame sensitive to the force used in depressing its rear end. Springs, such as  $i^8$ , may be used in connection with or in place of the counter-balances. The springs lead from the posts  $H' H'$  to the arms  $i^7 i^7$ . The oscillating frame is also provided with an arm,  $i^9$ , which extends from the bar  $i^2$  downward, and at its lower end is furnished with a bearing,  $i^{10}$ , which is preferably in the form of a friction-roller and vertically adjustable upon the arm  $i^9$ .

$K'$  represents a rock-frame which is attached to and which rocks upon the bearing  $k$ . The frame is extended from the bearing horizontally and vertically, the horizontal portion  $k'$  being furnished with a cross-bar,  $k^2$ , upon which the keys  $C' C^2$ , &c., when depressed, strike. From the bar  $k^2$  an arm,  $k^3$ , extends upward and forward and so as to encounter the roller  $i^{10}$  as the rock-frame is turned on the bearing  $k$ . The arm at its extremity is supplied with a curved rub plate,  $k^4$ , the rub-plate being adjustable upon the arm  $k^3$  to enable the rock-frame to properly move the oscillating frame, as hereinafter described. The vertical extension  $k^5$  of the rock-frame serves to impart motion to the pendants, as hereinafter described.

Springs,  $L' L'$ , at each side of the device and extending from the bar  $k^2$  upward to the posts  $E' E'$ , serve to uphold the horizontal portion of the rock-frame and to keep parts as shown in Fig. 4. The connection of the springs  $L' L'$  with the posts  $E' E'$  is made adjustable, as shown in Fig. 8.

$M' M'$  represent cross-plates extending crosswise in the device, above the keys  $C' C^2$ , &c., and held in the posts  $E' E'$ .

$N' N^2 N^3 N^4 N^5 N^6$  represent a set of L-shaped levers, journaled at  $n$  in the plates  $M' M'$ , and at one end,  $n'$ , bearing upon the keys  $C' C^2$ , &c., respectively, and at the other end,  $n^2$ , connected with the slides  $D' D^2$ , &c., respectively. Springs  $N^{11} N^{12}$ , &c., supported upon bearings  $m$  between the plates  $M' M'$  and pressing against the ends  $n^2$  of the levers  $N' N^2$ , &c., act to turn the levers  $N' N^2$ , &c., on their bearings  $n$  whenever the forward ends of the keys  $C' C^2$ , &c., are depressed and when the levers  $N' N^2$ , &c., are thus turned the slides  $D' D^2$ , &c., are moved endwise (to the right as seen) upon their bearings, and, when the keys  $C' C^2$ , &c., rise again the slides are moved endwise to the left, or back again to their original position—that is, each of the keys  $C' C^2 C^3 C^4 C^5 C^6$  is, through the levers  $N' N^2 N^3 N^4 N^5 N^6$ , respectively, connected with the slides  $D' D^2 D^3 D^4 D^5 D^6$  in such manner that when any one of the keys is moved upon the fulcrum  $a$  the particular slide with which the key moved is connected is moved endwise upon the posts  $E' E'$ , the depression of the key allowing the slide to be moved in one direction—namely, to the right—and the spring  $c'$  at the rear end of the key being of sufficient strength to overcome the spring  $N^{11}$  and cause the slide to be moved in the opposite direction.

The keys  $C' C^2$ , &c., are preferably provided with adjustable plates  $c^2 c^2$ , to make the contact of the keys with the levers  $N' N^2$ , &c., exact and uniform, and the ends  $n^2 n^2$  of the levers are connected with the slides  $D' D^2 D^3 D^4 D^5 D^6$  preferably as shown in Figs. 4, 5, 6, the slides in the edges toward the levers being notched at  $d'$  and also at  $d^2$ , and the ends  $n^2$  engaging in the notches  $d'$ —that is, each slide has a single narrow notch  $d'$  to receive its particular lever end  $n^2$ , and, in addition to the

narrow notch, has other and wider notches,  $d^2 d^2$ , the object of which wider notches is as follows: It is desirable to have the lever ends  $n^2$  at their extremities wider than the thickness of the slides they are respectively moving; but when thus made each end  $n^2$  would interfere with the other slides were it not for the wide notches  $d^2$  in the other slides. The notches  $d^2$ , however, and which are suitably arranged and of suitable width therefor, provide room for each lever end  $n^2$  to move its respective slide without striking or interfering with the movement of any other slide.

The slides in the edges opposed to the tumbler-rods are notched, as seen more distinctly in Figs. 16 to 23. The object of these last-named notches is as follows: For each of the levers  $B' B^2$ , &c., there is a corresponding tumbler-rod,  $J' J'$ , &c., and the desired movement of the levers  $B' B^2$ , &c., is effected by previously moving the tumbler-rods  $J' J'$ , &c. The movement of the tumbler-rods is accomplished by means of the notches referred to in the upper edges of the slides, the notches providing spaces into which the tumbler-rods can drop. It only remains to control the dropping of the tumbler-rods, so that they shall be dropped in the proper order, as desired. This is determined by the location of the notches in the upper edges of the slides  $D' D^2 D^3 D^4 D^5 D^6$ .

The distribution of the notches along the several slides is made upon the following principle: In order to allow any tumbler-rod to fall, six notches, (there being six slides in the present case,) one in each slide, must be in line beneath the rod. As many keys as are depressed to allow that rod to fall, so many notches must, before the depression of the keys, have stood, not beneath the rod, but a little to the left thereof, ready to be brought to their place beneath the rod when the keys shall be depressed and the slides moved by them to the right; but as many keys as are not depressed for the production of the movement of the tumbler-rod, so many notches are already standing under the tumbler-rod, waiting to have those others just named brought into line with them. For example, the letter A (the present invention being here illustrated as an attachment to a type-writer) is commanded in this device by the depression of the single key marked A in Fig. 1 of the drawings. Accordingly beneath the A tumbler-rod (meaning the tumbler-rod which is connected with and effects the movement of that one of the levers  $B' B^2$ , &c., marking the letter A in the type-writer) all the five slides that respond to the other keys  $C^2 C^3 C^4 C^5 C^6$  must have their notches standing ready while the notch of the slide of that one A key stands out of line to the left. Fig. 16 of the drawings shows the slides in plan view, the place of each tumbler-rod being indicated by a cross-line, and the slides are shown as they stand when no key is depressed. In this figure the fifth line of notches, coming from the left, belongs to the

letter A, as above described. Next, on the right, come the notches of the numeral 3, whose lever comes in that order in the Remington typewriter, to which this form of device is adapted. The numeral 3 is commanded in my system, to be hereinafter explained, by the three keys at the left of the key-board. Accordingly the three slides which respond to these keys (these are the three lower slides, as shown in Figs. 16, 17) are seen to have their notches to the left of the line of the tumbler-rod. Next come the notches of the letter Z, which letter is commanded by the two keys marked in Fig. 1 I and U. The notches of the corresponding slides (designated by the letters I and U at the left of the slides in Fig. 17) accordingly are seen to stand at the left of the Z rod. The remainder of Figs. 16, 17 shows in the different combinations the two classes of notches that have now been described—namely, those which stand in the line of the tumbler-rod, ready to receive it, and those which must be moved up into line by the depression of the keys  $C' C^2 C^3 C^4 C^5 C^6$ . The endwise movement of the slides is in the present case about one-sixteenth of an inch. That, therefore, is the distance to the left at which the out-of-line notches must stand in order that the depression of the proper keys may bring them into line.

It will be seen, that since each notch, which, so long as its key is untouched, stands in line under a given tumbler-rod, itself moves to the right, when its key is touched, that movement breaks up the line of notches for that tumbler-rod, and prevents it from falling. For example, the letter B in this device is commanded by the key marked A, in connection with the next key to the right of it. An examination of the A row of notches in Figs. 16, 17 will show that, although the combination of keys used in producing B will bring the one A notch up into place for producing A, that combination will at the same time draw the notch on the next slide to the right and out of place, so that while the B tumbler-rod can fall the A rod cannot. In this way throughout the system the combination that produces any one line of notches under its proper tumbler-rod breaks up every other.

The system of combinations used in this device is found very convenient; but I do not limit myself to it. It is shown in full in Figs. 16, 17. Its main features are as follows: The key marked  $C'$ , Fig. 1, is not used at all for the production of letters, but comes into combination for producing punctuation-marks and numerals. The remaining five keys produce the letters, as follows: The keys marked A E I O U produce each by itself the vowels with which they are marked—that is, the key marked A produces A, the key marked E produces E, and so on. For the production of the consonants, keys are combined according to the following plan: Any vowel-key that is simultaneously depressed with the key next to the right of it will produce the consonant which in the alphabet stands next after that vowel,

the A key with the next producing the letter B, the E key with the next producing F, the I key with the next producing J, and so on.

In making addition to the U key, since there is none beyond it, the five lettered keys are used in a circle—that is, the operator adds to the U key the A key, going round from the top of the key-board to the bottom. Thus the U key with the A key produces V. By extension of this system any vowel key in combination with the two keys next above it produces the second letter after that vowel. So A with two additional keys produces C, E with two additional keys G, and so on. A with three additional keys produces D, E with three additional keys produces H, and so on. This system, by using the keys in a circle, provides for nearly the whole alphabet, as appears from Figs. 16, 17. Those figures will also show what departures from this system have been made from necessity or for convenience of fingering. The combinations used for punctuation will appear from the same figures. The numerals are produced as follows: Number 1 is the same as the letter I. Number 2 is produced by combining the two keys at the extreme left of the key-board, number 3 by three keys, and so on up to 5. After this the first key on the left combined with the third—that is, skipping the A key—produces 6. These same with another key on the right produce 7, and on to 9. The letter O is the cipher.

As above stated, the various tumbler rods J' J', &c., are respectively connected with the various levers B' B', &c., and the dropping of the tumbler-rods is a condition precedent to the movement of the levers. The particular mode of operating the slides D' D', &c., in order that the tumbler-rods shall drop, and the means for connecting the tumbler-rods with and for operating the levers B' B', &c., are as follows: As a key—say the key C<sup>3</sup>—is depressed, as in Fig. 6, the lever N<sup>3</sup> at once acts to shift the corresponding slide, D<sup>4</sup>, endwise to the right, as described. The tumbler-rod J' as yet has not dropped, as it cannot drop until the oscillating frame I' has turned downward on its hinges *i i*. By continuing to depress the lever C<sup>3</sup>, however, it encounters the rock-frame K' (the forward edge of which stands a little below the lower surface of the keys) and bears the forward end of the rock-frame downward, as seen in Fig. 5. This downward movement of the rock-frame brings the rub-plates *k<sup>4</sup> k<sup>4</sup>* against the rollers *i<sup>10</sup> i<sup>10</sup>* and causes the oscillating frame to be turned downward, as desired, upon its hinges. The set of tumbler-rods moves with the frame I'; but that tumbler-rod J' that is over the coincident notches drops therein, as seen in Fig. 5. The pendant *j* upon the end of the rod has dropped with the rod and sufficiently to bring its lower end in front of the vertical extension *k<sup>5</sup>* of the rock-frame. The pendant and the extension are so relatively adjusted as to provide for the descent of the pendant before the upper end of the extension moves forward to encounter the

pendant, for by rocking the rock-frame forward, as described, by means of the key C<sup>3</sup> the extension *k<sup>5</sup>* is caused to strike and bear against the lower end of the pendant *j*. The pendant works up and down without friction in a perforation in the lever B'. The levers B' B', &c., as seen in Figs. 4, 5, 15, are attached to the cross-bar F' by means of the straps *f'*, which in turn hang somewhat loosely upon pins *f<sup>2</sup>* on the bar F'. This allows the rear ends of the levers B' B', &c., by the application of a slight force, to be sprung downward, as in Fig. 5, and when the force is removed the type-writer (or other) levers with which the levers B' B', &c., are connected act to draw the rear ends of the levers B' B', &c., up again into their original positions, as in Fig. 4. Now, when the frame K' is rocked forward, as described, the lower end of the pendant *j* is swung forward and the lever B' thereby inclined, as shown in Fig. 5, and the desired movement of the lever B' thereby obtained. On releasing the key C<sup>3</sup> it, by reason of the action of the spring *c'*, rises, the rock-frame, being actuated by the springs L' L', rocks backward, the oscillating frame, by reason of the counter-balances *i<sup>10</sup> i<sup>10</sup>*, is turned upward upon its hinges, the tumbler-rod is lifted out of the slides, the lever B' is allowed to spring upward, and the slide D<sup>3</sup> is caused to slide back again into its original position, when the operation can be repeated.

To facilitate the working of the device, an electrical attachment may be annexed to the device.

R' represents an electro-magnet suitably supported in the device, and so as, when the electrical connection is established, to act upon an armature, *r*, which is attached to the rock-frame K', and thereby draw the part of the rock-frame with which the armature is immediately connected toward the magnet. The operation of this feature of the device is as follows:

R<sup>2</sup> represents a frame arranged beneath the key-board and turning upon the bearings *r'*. When any key is depressed, it encounters the frame R<sup>2</sup> at its rear end and bears it down. A hook, *r<sup>2</sup>*, Figs. 1, 3, which is suspended from the frame R<sup>2</sup>, drops with the frame. The hook upholds a rod, *r<sup>3</sup>*, that is in the circuit of the magnet, and when the hook drops the rear end of the rod *r<sup>3</sup>* also falls, and so as to come in contact with the pin *r<sup>4</sup>*, which is also in the circuit of the magnet. The circuit now being completed, the magnet acts upon the rock-frame and supplements the force applied to the key. As soon as the key is released and rises a spring, *r<sup>5</sup>*, acts to lift the rear end of the frame R<sup>2</sup>, whereupon the circuit of the magnet is broken and the rock-frame is free to be rocked backward.

O' represents the spacer. It is pivoted at *o*. It is operated simply by throwing the hand upward from the key-board and lifting the forward end of the spacer.

In Fig. 1 the rods P' are shown to illustrate

the connection of the levers  $B' B^2$ , &c., with the mechanism of a type-writer, the rods extending from the levers  $B' B^2$ , &c., upward, suitably to form the connections with those  
 5 levers of the type-writer which move the types. The type-writing mechanism is not here shown. Its construction is well understood, and it can be used with the present device by simply hooking the upright rods  $P'$   
 10 over those levers of the type-writer which terminate in the several keys of that instrument and in the spacer. When the device is employed to operate the levers of other mechanisms, the connections leading from the levers  
 15  $B' B^2$ , &c., are suitably modified to suit the special mechanism in question.

In thus employing but few levers to operate many all the various parts of the mechanism above described are of value; but the principal feature of the device I consider to be the combination of the slides and tumbler rods, for, while the other features of the device can be more or less varied, these two features must be retained. The slides and tumbler-  
 20 rods as a combination, however, can be modified in this: the notches can be made in the tumbler-rods and the place of the slides can be taken by straight edges of thin metal, which are made by their respective keys to move or  
 25 tilt forward to suit the notches of the tumbler-rods, as shown in Figs. 24, 25.

I am aware that heretofore in type-writing devices there has been used the combination of movable plates having perforations, so that  
 35 each change in position shall present a different opening through the entire series of plates, and I make no claim thereto.

I claim—

1. The combination of the slides  $D' D^2 D^3$ , &c., and the tumbler-rods  $J' J' J'$ , &c., for the purpose described.

2. The combination of the keys  $C' C^2$ , &c., the slides  $D' D^2 D^3$ , &c., and the tumbler-rods  $J' J' J'$ , &c., the movements of the slides answering the movements of the keys, for the purpose described.

3. The combination of the slides  $D' D^2 D^3$ , &c., the posts  $E' E'$ , the adjustable stops  $G' G'$ , and the tumbler-rods  $J' J'$ , &c., substantially as described.

4. The combination of the slides  $D' D^2 D^3$ , &c., the posts  $E' E'$ , the guides  $e e$ , and the adjustable stops  $G' G'$ , substantially as described.

55 5. The combination of the oscillating frame  $I'$ , the tumbler-rods  $J' J'$ , &c., and the slides  $D' D^2 D^3$ , &c., substantially as described.

6. The combination of the frame  $I'$ , the tumbler-rods  $J' J' J'$ , &c., and the slotted guide-plate  $i^5$ , substantially as described.

60 7. The combination of the slides  $D' D^2 D^3$ ,

&c., the tumbler-rods  $J' J' J'$ , &c., and a frame for lifting said rods out of engagement with said slides when desired.

8. The combination of the slides  $D' D^2 D^3$ , 65 &c., the tumbler-rods  $J' J' J'$ , &c., and a frame for supporting said tumbler-rods, said frame being movable toward and from said slides.

9. The combination of the keys  $C' C^2$ , &c., the rock-frame  $K'$ , having the arms  $k^3 k^3$ , and 70 the oscillating frame  $I'$ , having the arms  $i^9 i^9$ , substantially as described.

10. The combination of the base  $A'$ , the cross-bar  $F'$ , the hinged levers  $B' B^2 B^3$ , &c., the rock-frame  $K'$ , the keys  $C' C^2$ , &c., the 75 posts  $E' E'$ , and the springs  $L' L'$ , substantially as described.

11. The combination of the keys  $C' C^2$ , &c., the fulcrum  $a$ , the springs  $c' c'$ , &c., the plates  $M' M'$ , the levers  $N' N^2$ , &c., the springs  $N^{11} N^{22}$ , 80 &c., and the slides  $D' D^2$ , &c., substantially as described.

12. The combination of the slides  $D' D^2$ , &c., having the notches  $d'$  and the notches  $d^2$ , and the lever ends  $n^2 n^2$ , substantially as described. 85

13. The combination of the bar  $F'$ , the strap  $f'$ , the lever  $B'$ , the pendant  $j$ , and the rock-frame  $K'$ , substantially as described.

14. The combination of the keys  $C' C^2 C^3$ , &c., the rock-frame  $K'$ , the bar  $F'$ , the hinged 90 levers  $B' B^2 B^3$ , &c., and the pendants  $j j j$ , substantially as described.

15. The combination of the oscillating frame  $I'$ , the tumbler-rods  $J'$ , the rock-frame  $K'$ , the levers  $B' B^2 B^3$ , &c., the pendants  $j j j$ , &c., 95 the bar  $F'$ , and the keys  $C' C^2 C^3$ , &c., substantially as described.

16. The combination of the tumbler-rods  $J' J' J'$ , &c., the pendants  $j j j$ , the hinged levers  $B' B^2 B^3$ , &c., and the rock-frame  $K'$ , substan- 100 tially as described.

17. The combination of the hinged levers  $B'$ , &c., the rock-frame  $K'$ , having the armature  $r$ , and the magnet  $R'$ , substantially as described.

18. The combination of the hinged levers  $B'$ , 105 &c., the keys  $C^2 C^3$ , &c., the rock-frame  $K'$ , the armature  $r$ , and the electro-magnet  $R'$ , substantially as described.

19. The combination of the hinged levers  $B'$ , &c., the keys  $C' C^2 C^3$ , &c., the rock-frame  $K'$ , 110 the armature  $r$ , the electro-magnet  $R'$ , the oscillating frame  $R^2$ , and the connections  $r^2 r^3 r^4$ , substantially as described.

20. The combination of the oscillating frame having the arm  $i^9$ , with the rub-plate  $k$ , re- 115 sponding to the depression of the keys, for the purpose described.

HERVEY D. GANSE.

Witnesses:

C. D. MOODY,

CHARLES PICKLES.