

(No Model.)

5 Sheets—Sheet 1.

I. D. BOYER.
CASH REGISTER AND INDICATOR.

No. 442,851.

Patented Dec. 16, 1890.

Fig. 1.

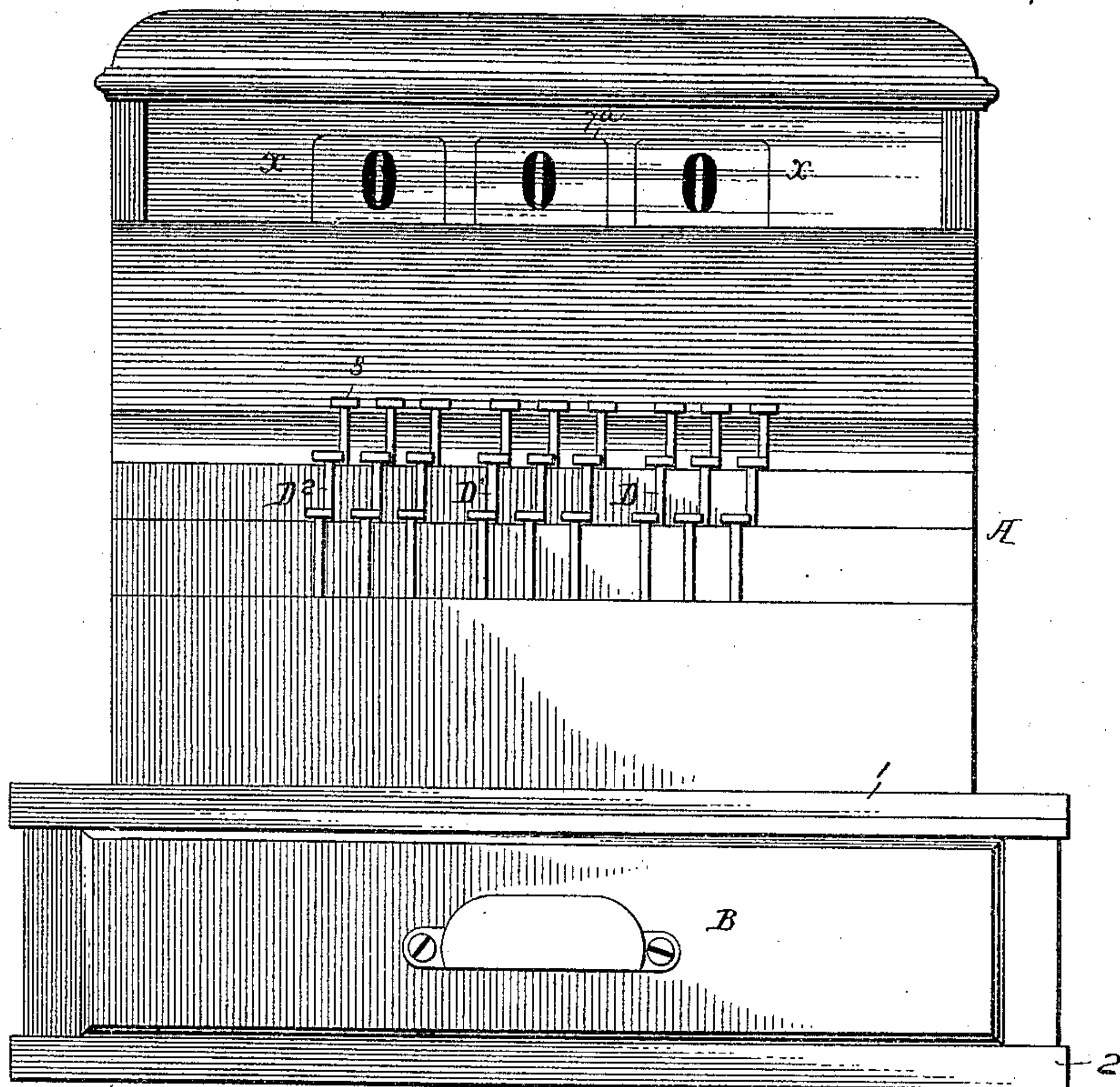
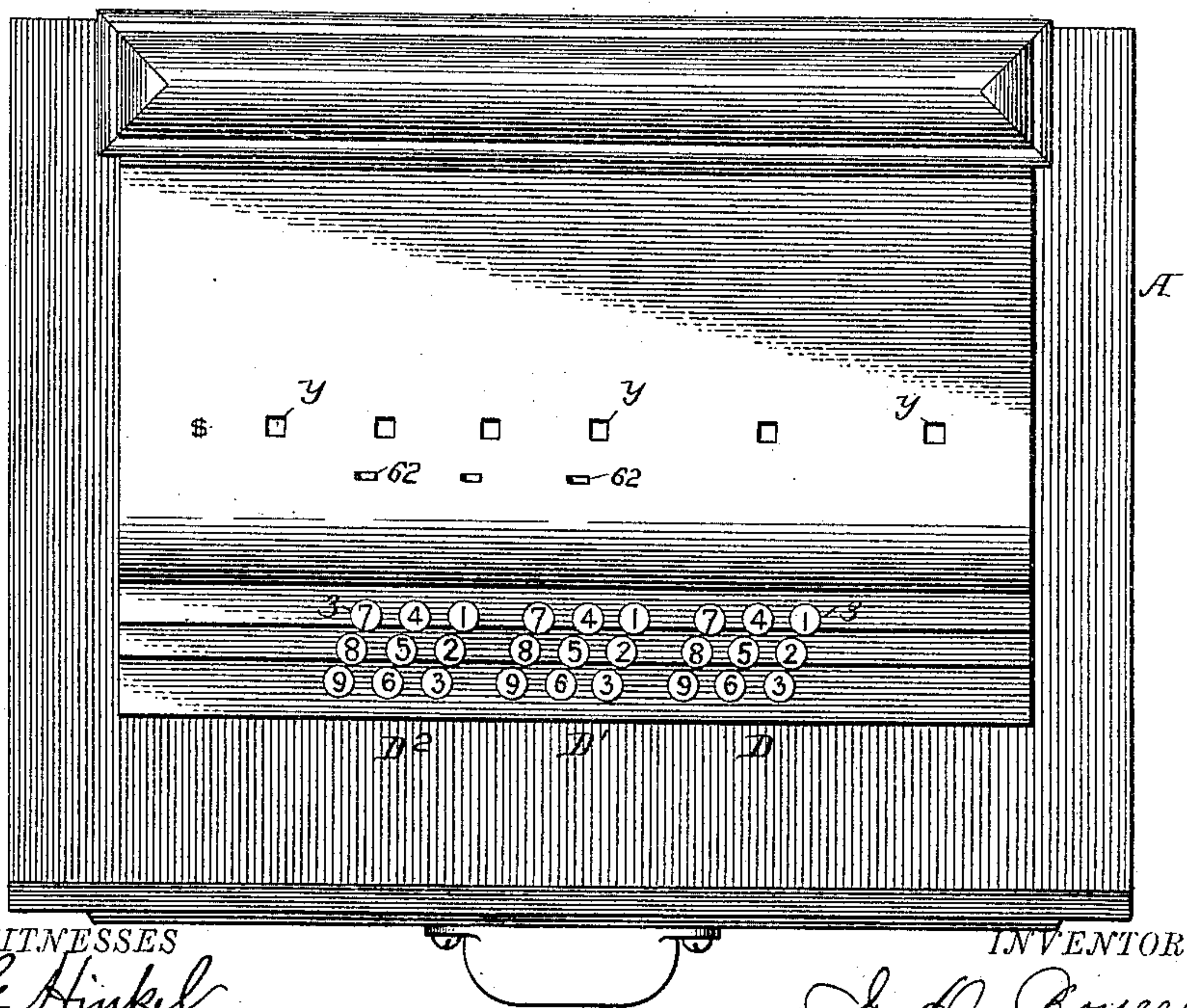


Fig. 2.



WITNESSES

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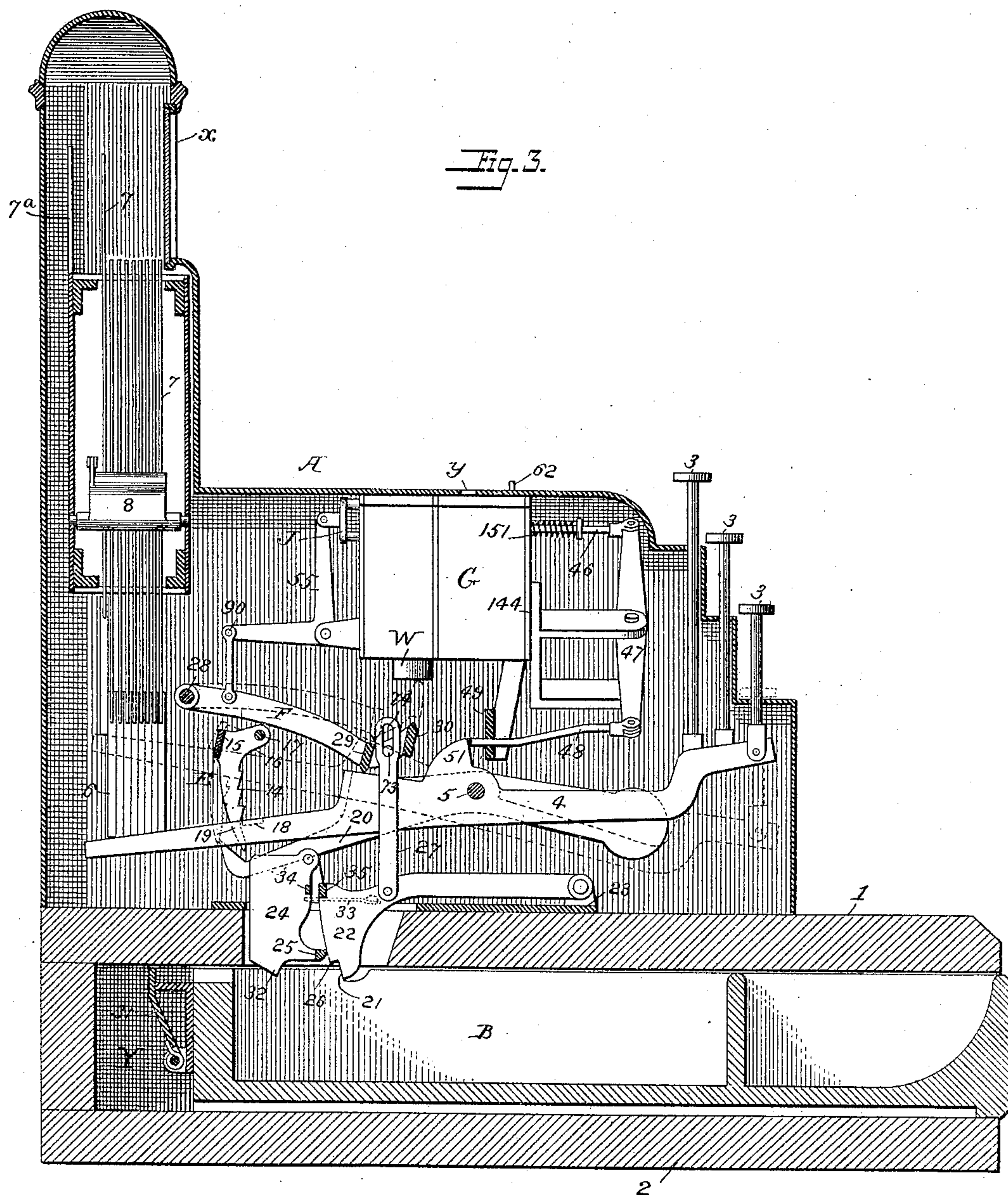
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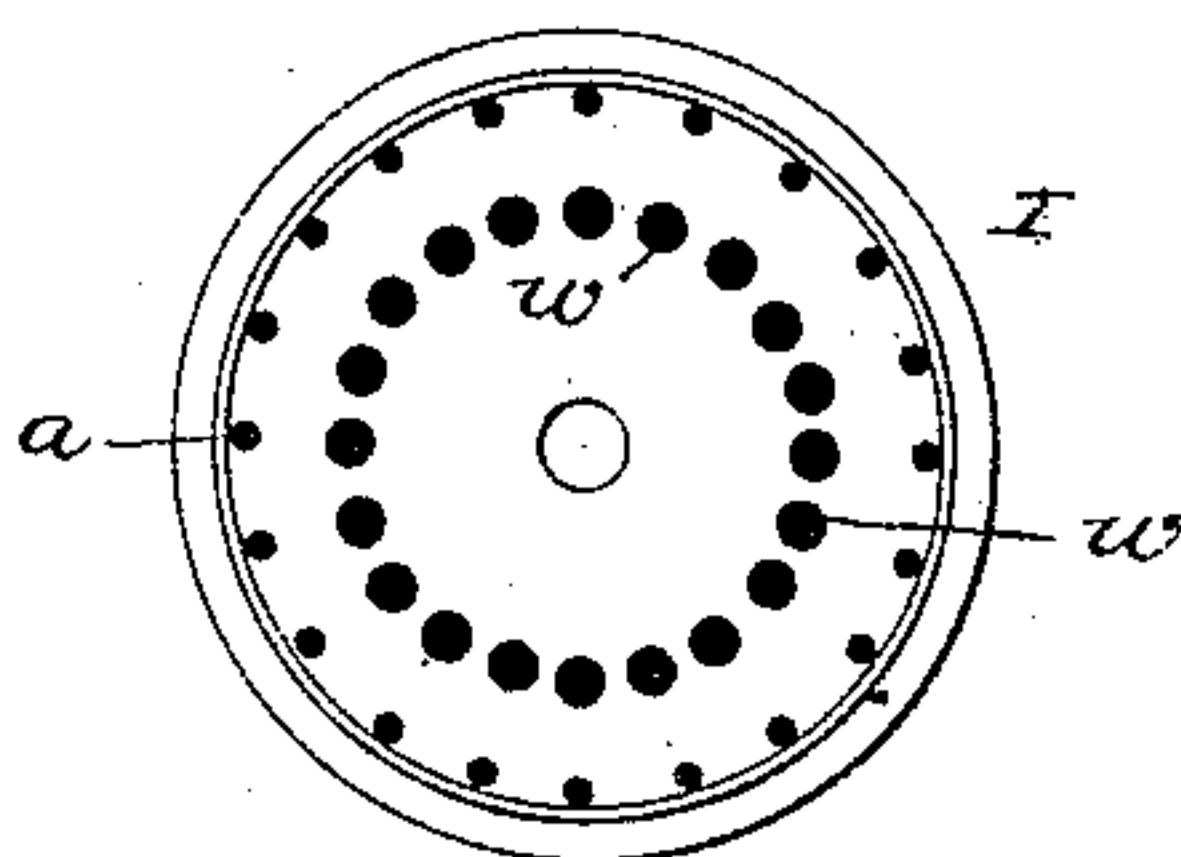
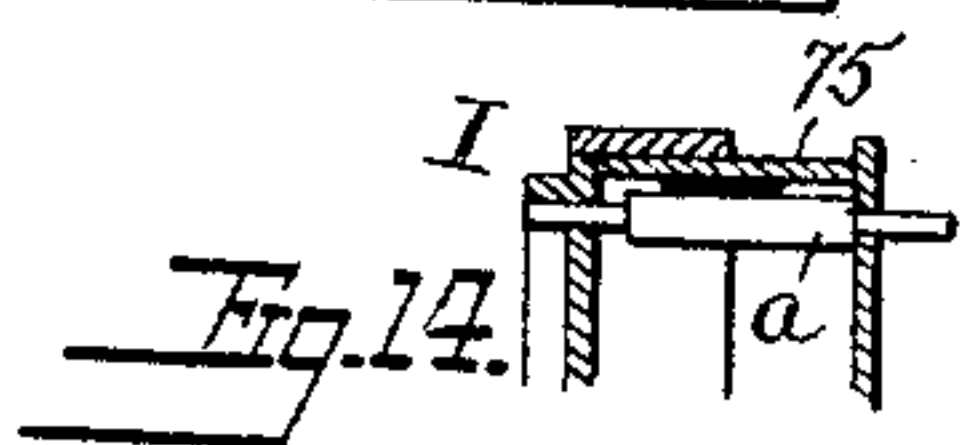
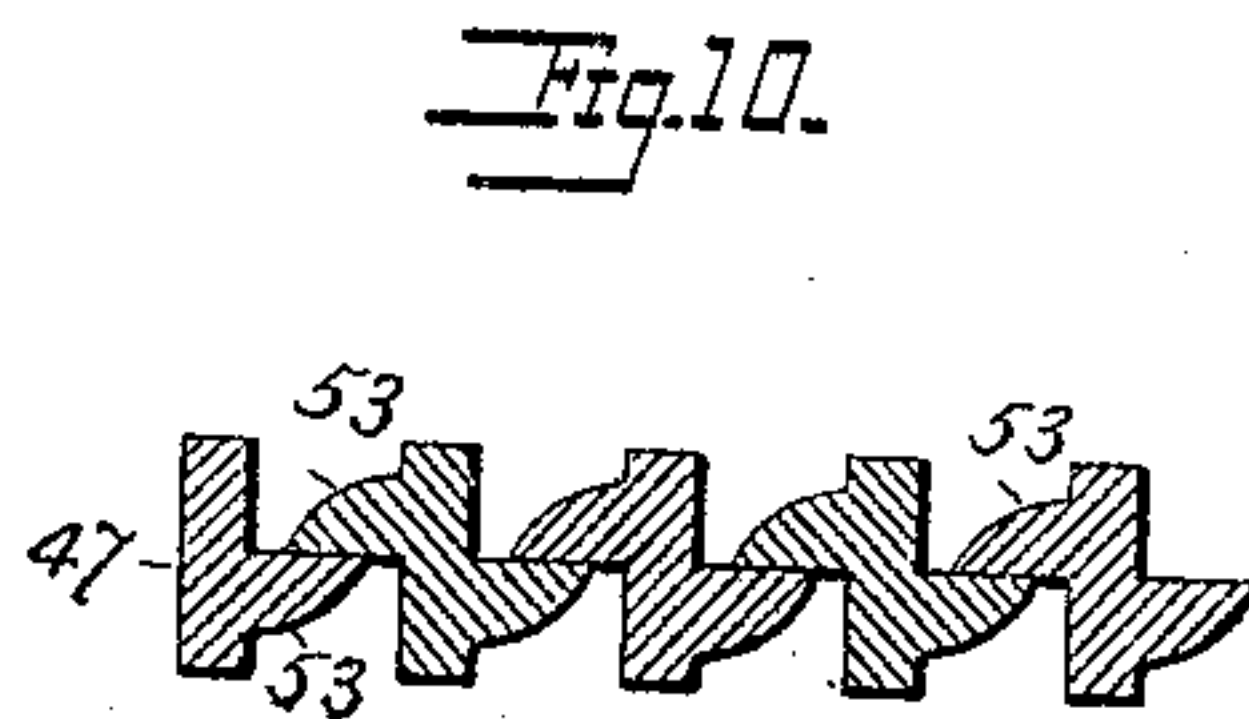
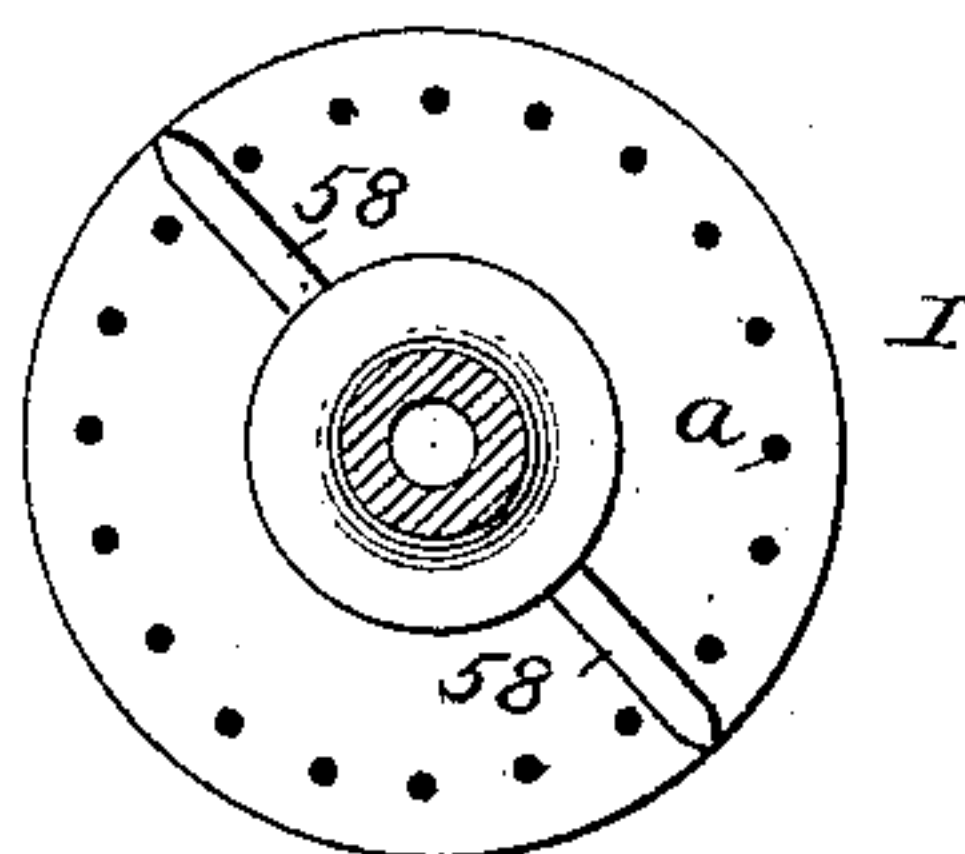
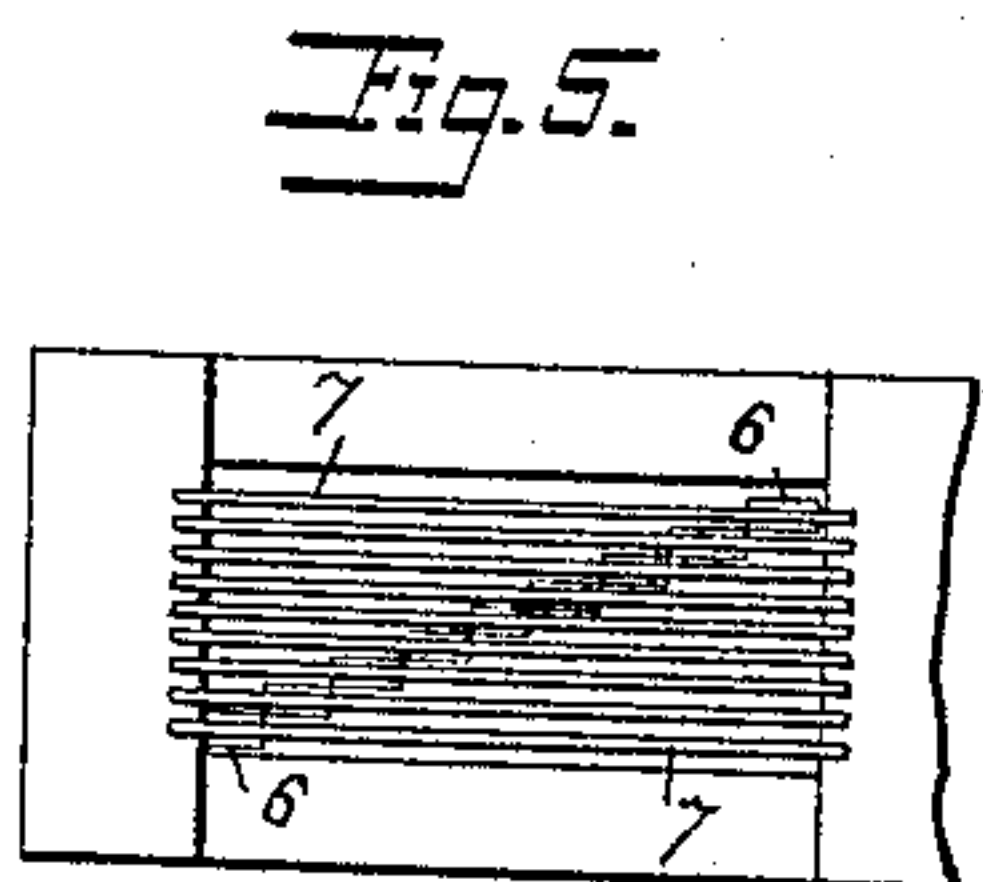
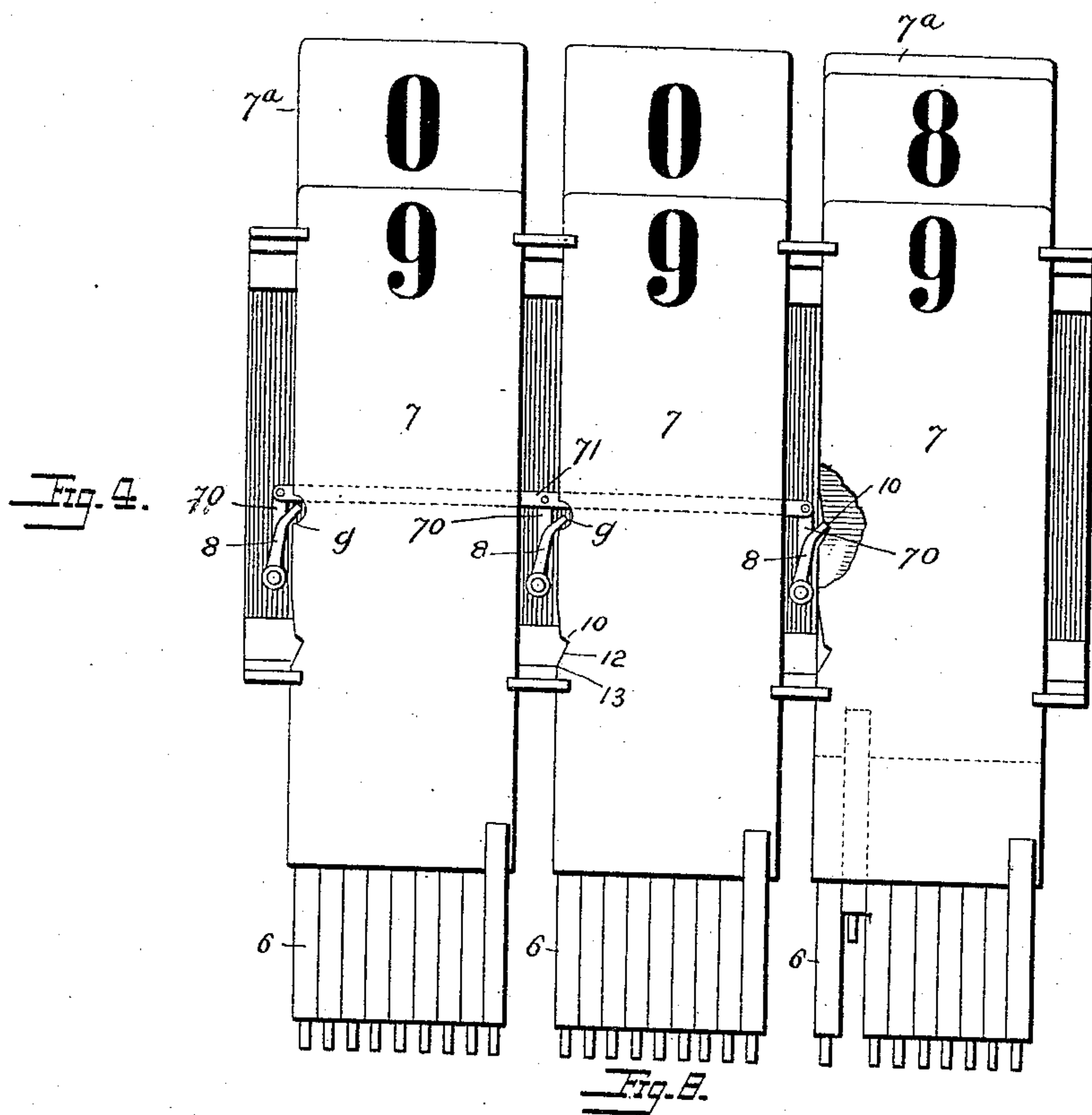
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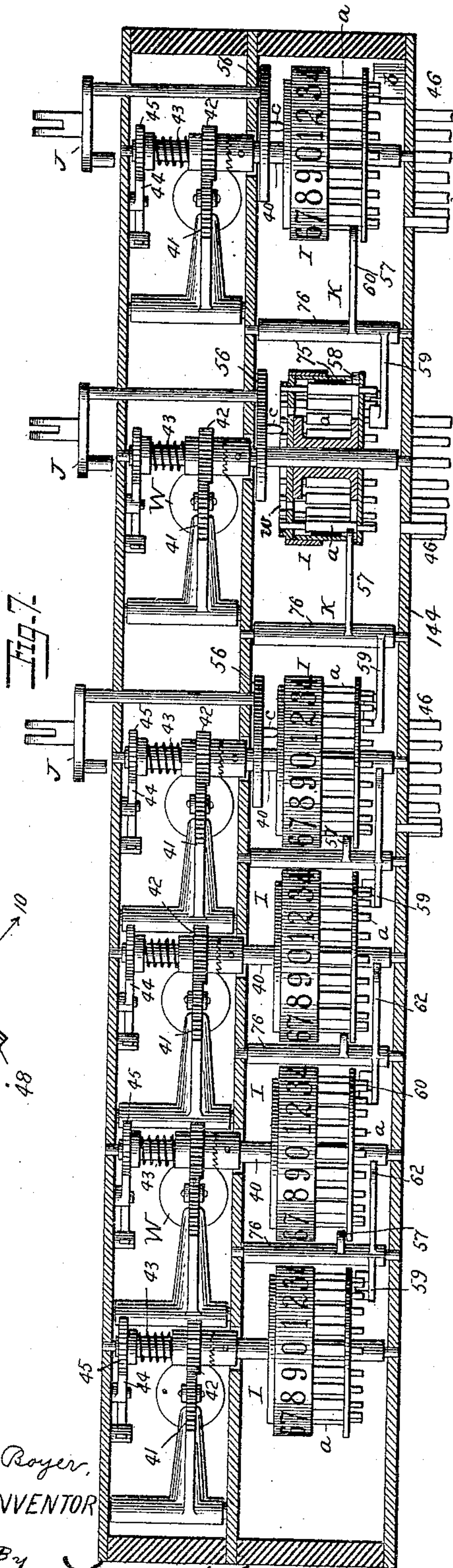
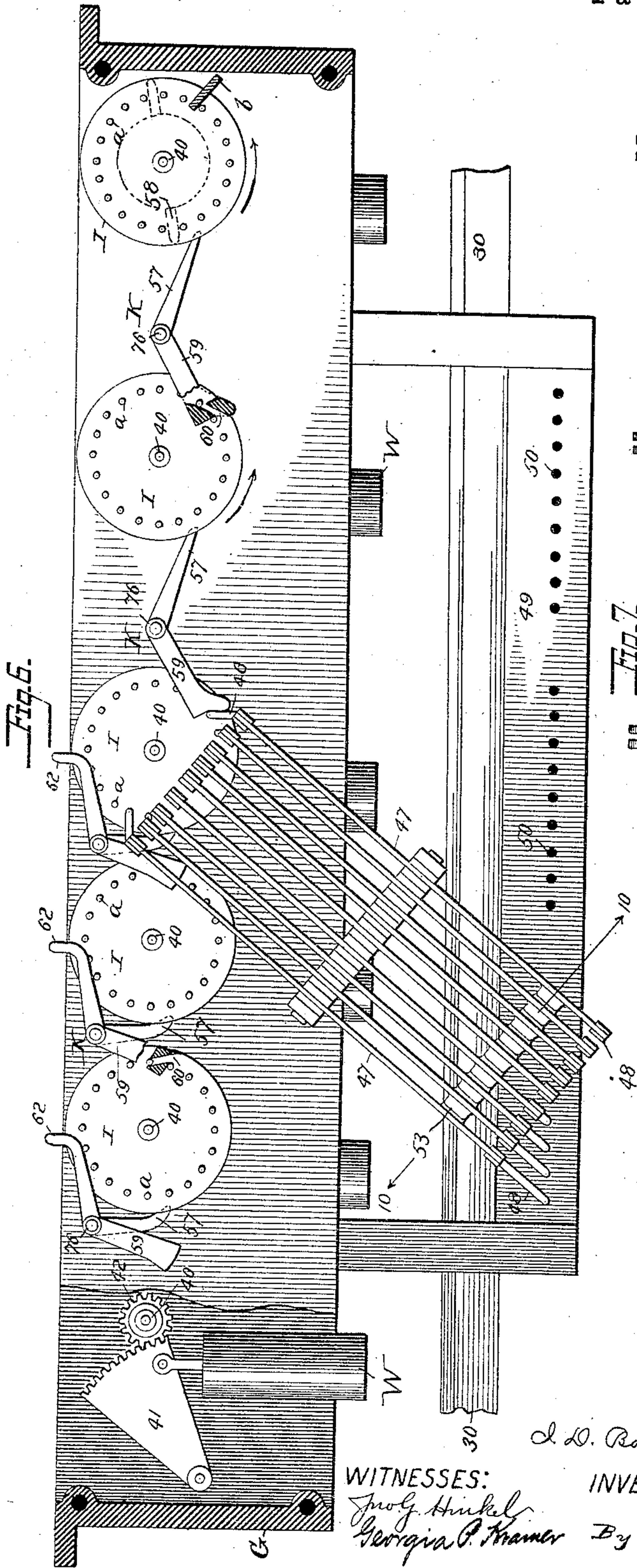
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Fig. 11.

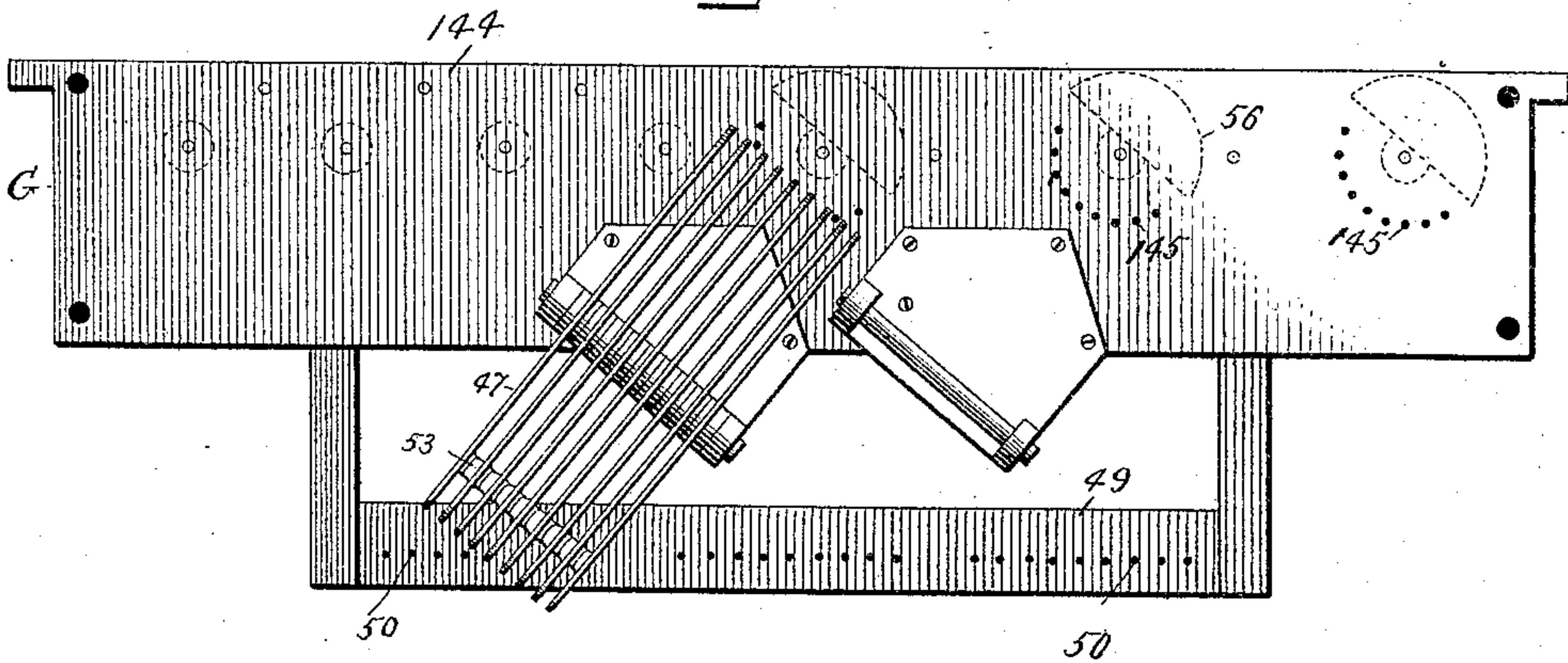


Fig. 12.

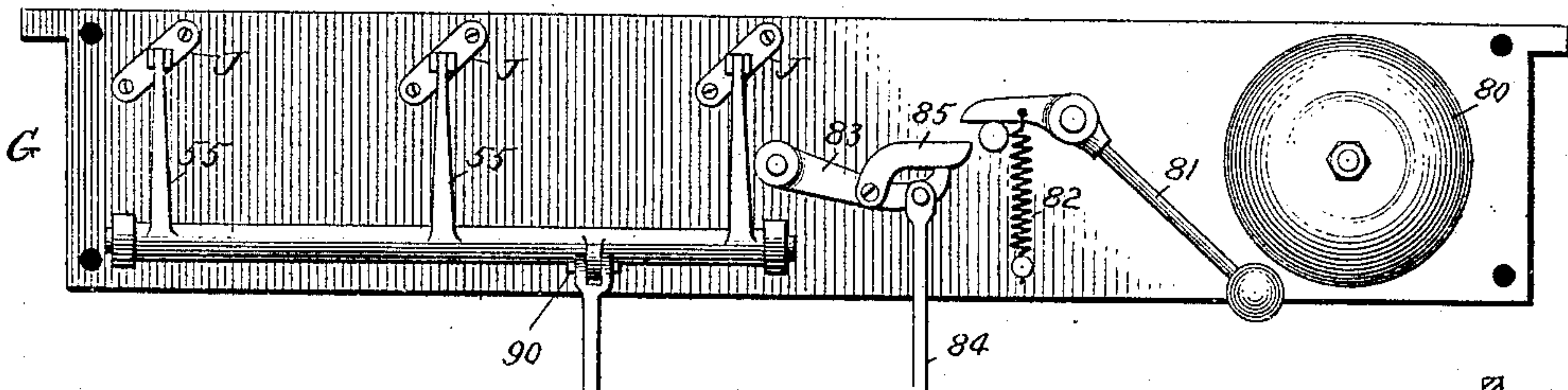


Fig. 13.

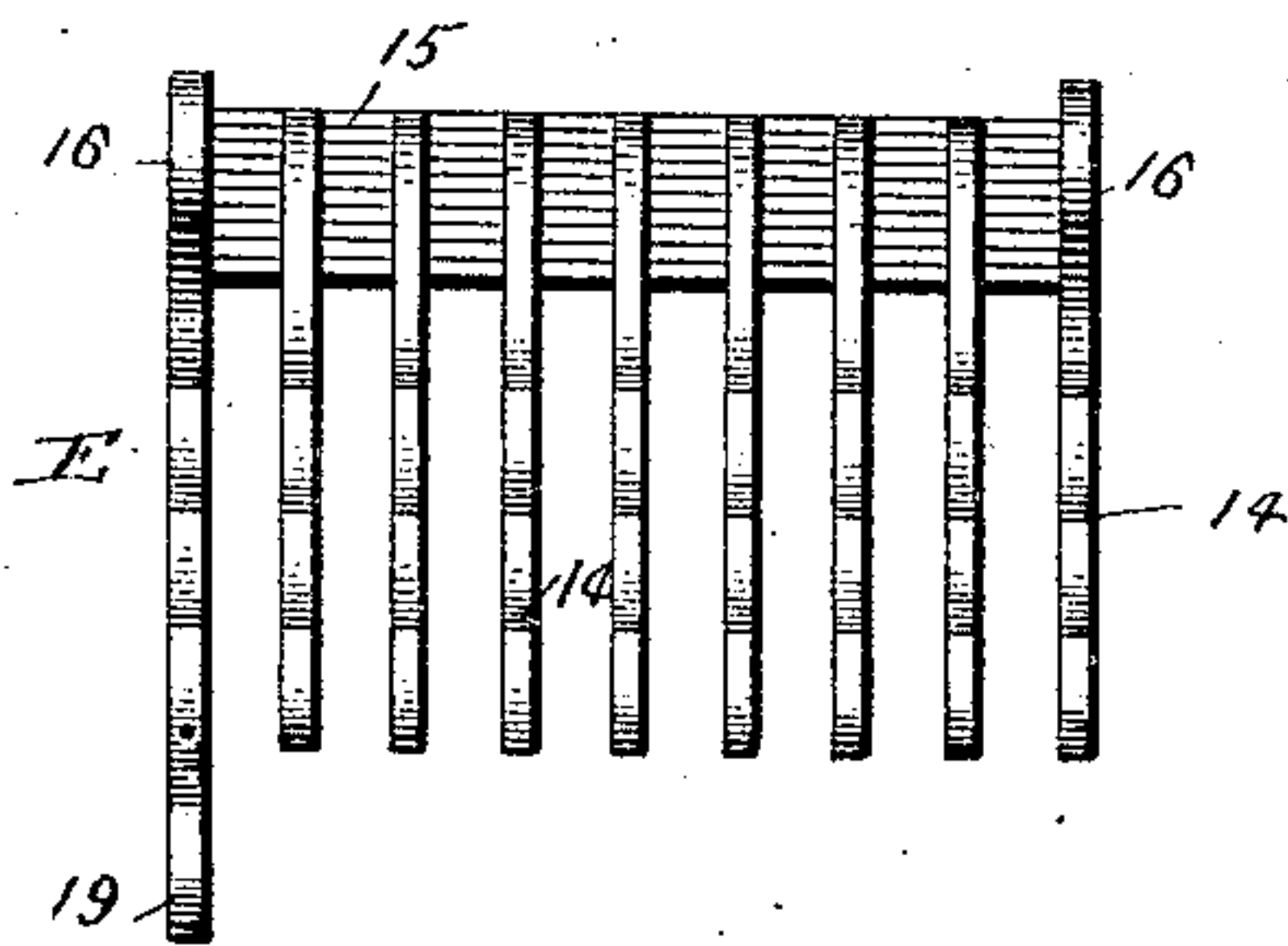
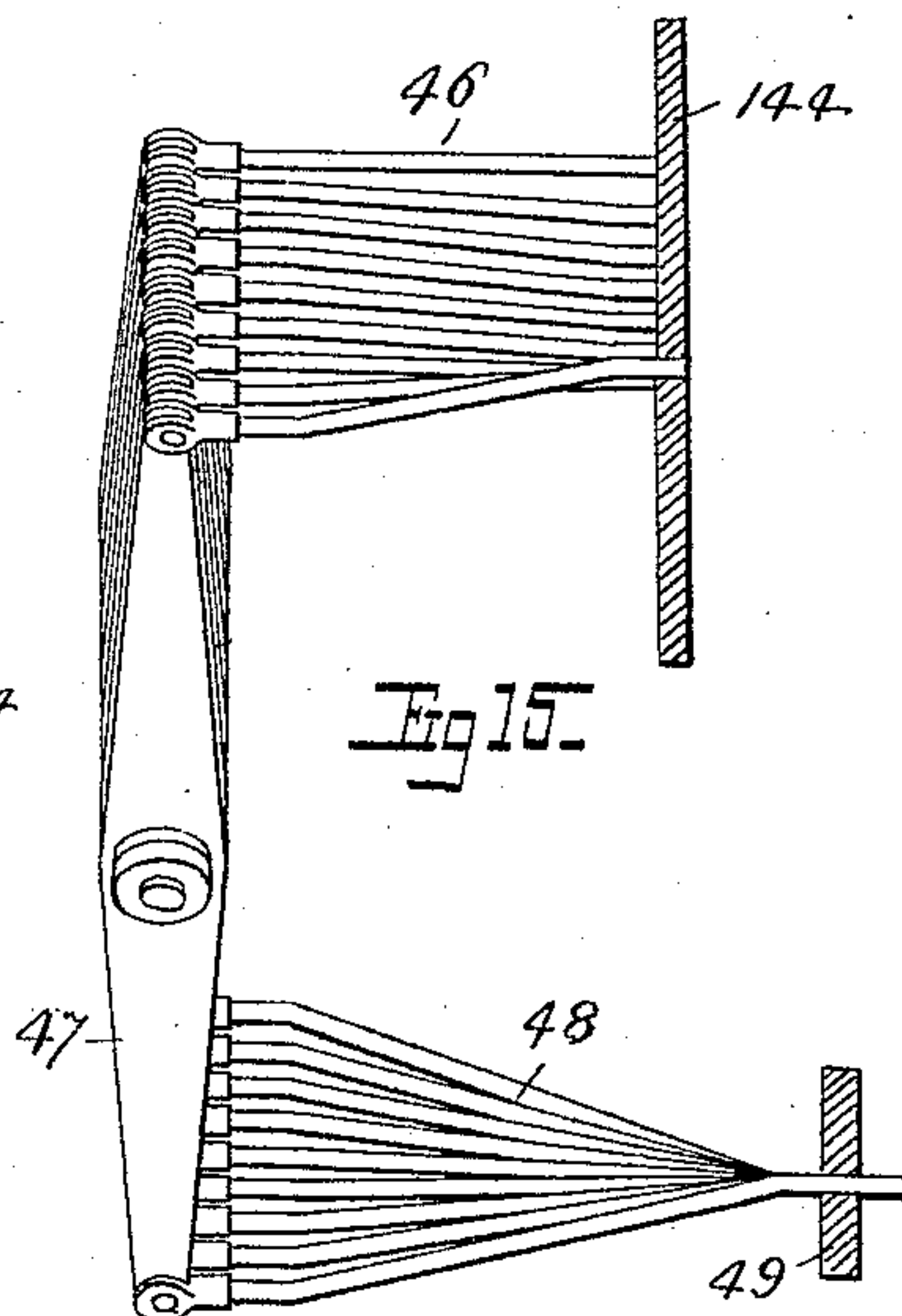


Fig. 15.



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UNITED STATES PATENT OFFICE.

ISRAEL DONALD BOYER, OF DAYTON, OHIO.

CASH REGISTER AND INDICATOR.

SPECIFICATION forming part of Letters Patent No. 442,851, dated December 16, 1890.

Application filed April 28, 1890. Serial No. 349,829. (No model.)

To all whom it may concern:

Be it known that I, ISRAEL DONALD BOYER, a citizen of the United States, residing at Dayton, Montgomery county, Ohio, have invented certain new and useful Improvements in Cash-Registers, of which the following is a specification.

My invention relates to that class of registers commonly employed for indicating and recording the various sums received for the sales of different articles; and my invention consists in certain improvements in such registers and the parts thereof fully set forth hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of a register embodying my improvements. Fig. 2 is a plan view. Fig. 3 is a transverse sectional elevation. Fig. 4 is an elevation of the tablets. Fig. 5 is a plan showing the arrangement of tablets in one set. Fig. 6 is an enlarged part-sectional elevation of the counter mechanism. Fig. 7 is a part-sectional plan of the mechanism shown in Fig. 6. Figs. 8 and 9 are reverse views of one of the counter-wheels. Fig. 10 is a part section on the line 10 10, Fig. 6. Fig. 11 is a reduced front view of the counter-frame, showing one set of levers. Fig. 12 is a reverse elevation of the counter-frame and parts supported thereby. Fig. 13 is a front view of one of the controllers. Fig. 14 is a detached view showing the friction-band in section. Fig. 15 is a side view of part of the pusher mechanism for operating the pins of the register-wheels.

The case A of the apparatus is constructed of suitable shape to inclose the parts hereinafter described, and is provided with a money-receptacle—as, for instance, a sliding drawer B—or with a receptacle Y, provided with a movable lid or cover, and has a number of sight-openings x at the front or back, or both, as may be desired, for the exhibition of the figures upon the tablets C.

The mechanism of the register is supported upon a platform 1, which is above the base 2 of the case, leaving the interposed space Y, and the working parts hereinafter referred to are supported by a suitable frame resting upon or secured to the platform 1.

There are three banks of keys $D D' D^2$, each bank having nine keys, preferably ar-

ranged as best shown in Figs. 2 and 3. A key-lever 4 is connected with or forms part of each key, all of the key-levers vibrating on a transverse pivot 5, and the rear end of each lever extends beneath or is connected to operate a staff 6, attached to an upright plate constituting a tablet 7, upon which is painted or otherwise indicated a number corresponding to that upon the operating-key. As shown, the tablets are arranged in three sets connected with the three banks of keys. The front tablet of each set is marked with the figure 9, the next with the figure 8, and so on, the last having the figure 1, and back of each set of tablets, so as to be exposed when all are down, is a fixed tablet 7^a, on which is the character 0.

As shown in the drawings, the register is arranged for the tablets to be read from the front.

With each set of tablets is combined a detent 8, of any suitable form; but, as shown, it is in the form of a pawl pivoted to the frame with its end opposite the edges of all of the tablets of a series, each detent connected with the others, and in each tablet is a notch having a shoulder g , into which notch the end of the pawl projects when all the tablets are down, and below the shoulder g is another shoulder 10, which is set in back of the line of the straight edge of the tablet, the latter being inclined at 12. Between the shoulder and the meeting-point of the straight edge of the tablet and below the shoulder 10 is another shoulder or corner 13. This construction insures that when any tablet is lifted all others which are up shall drop. Thus if the pawl be in the position shown at the right in Fig. 4, supporting the tablet 8, and the tablet 9 be raised the pawl will be thrown out by the shoulder g of the rising tablet 9. The tablet 8 will then drop, and the tablet 9 will continue its upward movement until the shoulder 10 is some little above the end of the pawl. When the key is released, the tablet 9 will drop back until the shoulder 10 on the tablet 9 comes to rest on the end of the pawl.

The use of the shoulder 13 may be explained by another operation. Suppose the tablets indicate \$1.99 and the next sale to be registered is nine cents. The action is as follows: When the nine-cent key is pressed, its

tablet, being already up, cannot drop the dollar and dime tablets in the way heretofore explained, because their shoulders *g* are already above the edges of the pawls and of course cannot push the pawls out. In this case, when the nine-cent key nears the top of its stroke, it strikes the staff of its tablet and lifts it a short distance—far enough for the shoulder 13 to strike the pawl and throw it out. This will let the other tablets drop. By setting the shoulder 10 back of the edge-line of the tablet I insure the release of such tablets as have been elevated, even if there should be slight variations in the width or lateral positions of the tablets. If more than one tablet is to be exposed at once, all must be raised at the same time, or at least if one key is pressed first it must be held down until the others have been pressed.

As there are three banks of keys, there are three sets of tablets and three detents, and I provide the shaft or end of each detent with an arm 70 and connect all the arms by a rod 71 or otherwise, so that all will move together. This insures the dropping of all the tablets when a key is depressed, (or when several keys are depressed together,) so that before a new number can be set up that previously indicated will be obliterated. This prevents fraud, for otherwise by altering a single number and recording a small sum a larger number might be indicated. Thus if a sale of one dollar and twenty-five cents has been made and the register shows that sum, and if the next purchase amounts to one dollar and seventy-five cents, the salesman by striking the 7 key of the second bank can cause the register to indicate \$1.75, while registering only seventy cents additional. If all the detents were connected together, the attempt to substitute 7 for 2 in the second bank would drop all the tablets, and a new display and corresponding registration would have to be made. By connecting the detents together I avoid the necessity of using ten keys in each bank and the necessity of operating three keys for each sale. Thus with independent detents to register seven cents it would be necessary to move the keys to show ciphers or 0 in the banks D' D^2 and register 7 in the bank D . To register ninety cents it would be necessary to move the keys to show 0 on the tablets in connection with the banks D D^2 and register 9 in bank D' . By using fixed zero-tablets it is only necessary to drop the other tablets to expose the 0, and even with this arrangement if the detents were independent it would be necessary to operate three keys at each registration in order to drop the tablets indicating the number previously registered.

As it is necessary, in order to insure the effective operation of the tablets, that each key-lever shall move to its full extent at each operation, I combine controllers with the key-levers, one controller E to each bank or set of keys, and constructed in any suitable man-

ner and supported to yield to permit each key-lever to be depressed at the forward end, but preventing any return movement until the first movement is completed to its full extent. As shown, the controller of each bank consists of a connected series of pendent racks 14, Figs. 3 and 13, all secured to a cross-plate 15, having ears 16, hung upon pivots 17, so that normally the racks swing toward lips 18 upon the sides of the key-levers, and when any lever is lifted its lip will engage with the shoulder of the rack, which will prevent its descent, but not its ascent. When, however, the rear end of a key-lever is lifted to its full extent, as shown in dotted lines in Fig. 3, it strikes the cross bearing-plate 15 and swings the controller outward clear of the path of the projecting finger or lip 18 until the end of one of the racks passes the point or end of a retainer in the form of a counterweighted pawl 20, hung upon the pivot 5, when said pawl rises and holds the controller in the position shown in the dotted lines, Fig. 3, so that the key can resume its normal position. The full elevation of each tablet after the movement of the key has begun is thus insured. It will be evident that the controller may be otherwise than pivotally supported to yield on the upward movements of the keys. As the key approaches its normal position, the pawl 20 is thrown down by the contact of a frame F , described hereinafter, and the controller is released, assuming the position shown in full lines, Fig. 3.

The drawer (or the door or cover of the receptacle Y when a drawer is not used) is secured by a single bolt, so that it can only be opened upon the depressing of one of the keys. In the construction shown, in which a drawer is used, the latter has a shoulder 21, in front of which a bolt 22 drops when the drawer is at the limit of its rear movement, said bolt being in the form of a lever extending through a slot in the platform 1 and pivoted at the forward end to a plate 23. In connection with the bolt there is a pivoted catch 24, hung to an ear upon the plate 23, and with a lip 25, which, when the bolt is elevated, catches beneath a shoulder 26 thereof and maintains it in its elevated position. The bolt 22 is connected by a link 27 with the frame F , hung at the rear to a pivot 28, and carrying two cross-bars 29 and 30 at the front, the former resting upon the upper edges of all of the key-levers and the latter occupying a more elevated position, and when a key is depressed the frame F is raised until a pin 73 thereof reaches the end of a slot 74 in the link 27 and lifts the bolt 22 until the catch 24 swings inward, engages the shoulder 26, and holds the bolt in its elevated position when the drawer is released. As shown, the length of the slot 74 is preferably such that the bolt will not be withdrawn until the key depressed approaches or reaches the limit of its movement. At the back of the drawer is pivoted a spring contact-piece 31, which yields

when the drawer is drawn forward, but when the drawer is pushed back the contact-piece passes the bolt 22 at one side and strikes a finger 32 of the catch 24, swings the latter back, and releases the bolt, which then falls opposite the notch 21 and locks the drawer. When the catch 24 is pushed back, it is temporarily held in this position by the end of a detent in the form of a small catch-spring 33, which flies up in front of a lug 34, but which is depressed, so as to release the catch, by the contact of a lug 35 on the bolt as the latter descends to its full extent.

It will be evident that other connections than those described may be used between the key-levers and bolt 22 to move the latter when a key is depressed.

The device as above described may be used in connection with any of the ordinary or suitable counting mechanisms; but I have devised a special construction of counter adapted for use in connection with such devices or with other devices, and which I will now describe. The said counter mechanism is arranged within a frame or case G, contained within the main case A and above the key-levers, the main case having a series of openings *y*, through which the figures upon the movable portions of the counter can be seen.

Before describing in detail the construction of my improved counting mechanism I will refer to those of the ordinary construction and to difficulties incident to their use, which difficulties it is my object to overcome.

Total-adding cash-registers have generally either positively-actuated counters, in which the keys directly move the counting mechanism, or they are provided with counters operated at proper intervals by weights or springs. Cash-registers are subjected, as a general rule, to rough usage by clerks and attendants who are opposed to their use and do their utmost to damage them, and it therefore follows that registers of the first-mentioned class must be made very strong and heavy to prevent damage from the rough blows given to the keys which impart momentum to the registering devices, and this also renders it difficult to arrest the counting mechanism at the proper point. Efforts have been made to overcome such momentum by means of a heavy brake or the resistance of springs to the blows of the keys; but where the results are effective there is too much resistance to permit the keys to be operated with the desired facility. Dash-pots of different kinds have been used to overcome momentum from rough usage; but these necessitate slow movements which are annoying to the operator. Further efforts to obviate this difficulty have consisted in the use of mechanical stops thrown into engagement with the counting-wheels as the keys complete their stroke. The results in such case are not satisfactory, as a rapid initial movement of the key will throw the counting-wheel beyond its proper position. In other instances the initial move-

ment of the key has been made to lock the counting mechanism fast, and when all parts are locked together the registering is effected. In such case the mechanism required is quite complicated, and the results thus far obtained have not been satisfactory.

In that class of registers in which the counters, instead of being moved directly by the keys, are operated by weights or springs the parts receive no objectionable impetus from the keys themselves; but if the weights or springs are heavy the momentum of the parts results in imperfect registration; while if they are light the mechanism is too delicate for practical use. In registering amounts which require a movement of nine or more notches even a light spring will produce a high velocity, and when the spring is made so light that its maximum velocity is not great then it is likely to be deficient in power in registering low amounts. As a general thing the regulating mechanism of the counters has been separate from the counting-train, so that the difficulties incident to stopping the counting-train have been experienced in all of this class of devices.

In another class of machines the regulating mechanism forms a part of the counting-train, the wheels of which work between escapements, permitting a definite part of a revolution at each movement of the key, so that it is impossible for the train to acquire movement in advance of the regulating mechanism. Such devices, however, can only be employed in connection with complicated mechanism not practically applicable to machines where less than five cents must be registered at one time.

My improved counting mechanism, which I will now describe, effectually overcomes the difficulties of the various plans above referred to, so that in a machine having four banks of keys any amount from one cent to ninety-nine dollars and ninety-nine cents may be positively registered at one operation, the entire key-board being within easy reach of the fingers of the two hands. In said improved mechanism (best illustrated in Figs. 6 to 11) there is a counting-train consisting of a series of wheels or disks I, six being shown, each mounted upon a horizontal shaft 40 and all of the wheels being in line with each other, one beneath each of the series of openings *y* in the outer case. Each wheel has two series of digits, from 0 to 9, upon its periphery, and in connection with each wheel there is a motor, which may be in the form of a spring, weight, or piston operated by compressed air or otherwise. As shown, the motor of each wheel is a weight W, which is pendent from a sector 41, pivoted to the frame and having rack-teeth engaging those of a clutch-pinion 42, which turns the shaft with it as the weight descends, but which turns on the shaft when the weight rises, a spring 43, Fig. 7, tending to keep the parts of the clutch in engagement and a pawl 44 engaging a ratchet 45

upon the shaft 40 and preventing the latter from turning back when the weight and sector are raised. The bar 30 of the frame F extends under all of the weights, and as this bar is raised on depressing any key the maximum power is stored in the motors at each movement of each key, so that the power of each motor is always available to turn the counter-wheel I whenever the latter is released by the action of a key or keys.

In order that each wheel may be turned to an extent to record the number indicated by the key that operates it without any direct connection between the wheel and the key and without possibility of the wheel being thrown beyond the proper point by momentum, and in order that each wheel may be locked until the key has performed its operation, I combine with each of the wheels operated from each of the banks of keys a bolt and a series of movable pins constituting, with the parts hereinafter described, a releasing or escape device, the pins being carried by the wheel or another disk, so as to turn with the wheels. As shown, each wheel I carries twenty pins *a*, one to each of the numbers upon the periphery, all arranged in a circle and parallel to the shaft. In the three left-hand wheels these pins are fixed, projecting beyond the front faces of the wheels; but in the three right-hand wheels they are free to slide longitudinally with sufficient friction to retain them in any position in which they are placed. This friction is secured in any suitable manner. In the construction shown it is effected by means of a flat spring-ring 75, with an inner rubber facing encircling the series of pins and bearing upon all, as shown in Figs. 7, 9, and 14. Adjacent to the right-hand or "cents" wheel is secured a fixed stop *b*, which projects into the path of the pins projecting from the front face of the wheel, and the latter can only be turned by the motor after one or more of the pins is pushed back, when the wheel will be turned as many steps or parts of a revolution as corresponds to the number of pins pushed back. The pins are pushed back by the action of the bank of keys connected with the wheel and are operated through the medium of any suitable intermediate devices so arranged that when the key marked 1 is depressed the pin next adjacent to the stop *b* will be pushed back, allowing the wheel to turn one step, exhibiting the figure 1 opposite the opening *y*; but if a higher key, as 6, is depressed six pins will be pushed back and the wheel will move six steps and exhibit the figure 6 opposite the opening. One construction of connections whereby this result is effected is illustrated in the drawings. In the front plate 144 of the counter-casing opposite each wheel and in a half-circle concentric with the shaft of the wheel is a series of openings 145, through each of which extends a pusher, (shown in the form of a

rod 46,) each connected to or forming part of a lever 47, the rods being so arranged upon the levers as to be immediately opposite said openings and bent to conform to the circular arrangement thereof, as best shown in Fig. 15. To the lower end of each lever 47 is connected a rod 48, which passes through an opening 50 in a cross-bar 49 of the frame to a position opposite a shoulder 51 upon one of the key-levers, the parts being so arranged that when a key is depressed the shoulder 51 will force outward the rod 48, vibrate the lever 47, thrust in the rod 46, and the latter will strike the end of one of the pins *a* and push it back out of the path of the projection *b*. When the key-lever assumes its normal position, a spring 151 throws out the lever 47 and the rods 46. Each of the levers 47 or of the key-levers or other adjacent parts has a lip 53, Figs. 6 and 10, that overlaps the lip of the adjacent levers or parts of lower denomination, so that when any key is depressed and the lever connected with said key is vibrated all the levers connected with the keys below that vibrated will move with it, while the levers connected with the keys having numbers above that which is being depressed remain stationary. Thus if the key 6 is depressed the levers connected with the keys 7 8 9 will remain stationary, while all the other levers connected with the keys 6 5 4 3 2 1 will be vibrated, the corresponding six pins *a* will be pushed in, and the motor will move the wheel six steps. If desired, the ends of the levers 47 might make direct contact with the shoulders 51.

The counter-wheel is preferably locked as soon as any key begins its movement by means of any suitable locking-bolt—as, for instance, a bolt *c*, carried by a sliding frame J and adapted to a series of openings *w* in the back face of the wheel, Fig. 9, the frame being moved forward by intermediate connections with the key as soon as the latter is depressed. Thus the frame J is connected with a crank-lever 55, Figs. 3 and 12, which is also connected with the frame F, and is vibrated when the frame F is raised by depressing a key, so as to push forward the frame J and thrust the bolt *c*, Fig. 7, into the opposite opening *w*, Fig. 9, of the counter-wheel. When the key-lever and frame F assume their normal positions, the frame J and the bolt are drawn out, and the wheel I can turn a number of steps, corresponding to the number of pins *a* which have been pushed inward. The bolt *c* is not essential; but it is preferable to lock the counter-wheel while the devices that regulate its movement are being set into position and to restrain the action of the motor until this is effected.

At the forward end of the frame J is a segmental plate 56, which, when the frame moves forward, makes contact with the inner ends of any of the pins *a* that were previously pushed back and thrusts them forward, the segment

being so arranged as to operate only upon the pins of the upper section of the wheel that have passed the stop *b*.

Other means of shifting the pins back to position might be employed—as, for instance, an inclined bearing over which the pins travel after they pass the stop. The pins *a* may be carried to turn with the counter-wheel, but upon another wheel or disk instead of on the counter-wheel.

In order to “carry” decimally from one wheel to the other, so as to accumulate the totals upon the higher wheels, I place between each wheel and that above it a suitable transfer device *K*, constituting a temporary stop for the higher wheel. As shown, the transfer device consists of a shaft 76, provided with an arm 57, in position to be struck by two blades or pins 58 58 upon the next lower wheel (one to each series of numbers) and with a stop or escapement arm 59, having a stop-lug at the outer end with an inclined slot 60 in such position as to be entered by the pins of the next upper wheel when the shaft is rocked to one position by the contact of the pin 58 with the arm 57 of the lower wheel. Normally the parts are in the position shown at the right in Fig. 6, one of the pins bearing against the lug of the arm 59, which holds the wheel in position. As soon, however, as the lower wheel has completed a semi-revolution (completing the highest record and requiring the transfer of 1 to the next wheel) the pin 58 rocks the shaft 76 by contact with the arm 57, and the slot 60 in the arm 59 is brought with its outer open end in the path of the next pin of the higher wheel, when such pin is free to enter the slot and the wheel will be moved by its motor one step, acting as an escapement, the passage of the pin through the angular slot 60 swinging the arm 59 slightly until the lug thereon is in the path of and will make contact with the next pin, arresting the further movement of the wheel. The higher wheel is thus automatically advanced one step at each operation of the transfer device. This automatic transfer or carrying from one wheel to the next higher wheel will not only result when the lower wheel is actuated, but will also take place if the keys in both the banks are operated at the same time. This results from the fact that whatever may be the number of pins of the higher wheel pushed back by the action of its key the transfer device will be in such a position that the pin of the higher wheel next to the last pin pushed back will enter the slot 60 and automatically advance one step, but in so advancing will set the arm 59 back to prevent the next pin from entering the slot. The escapement or transfer lever has such a frictional bearing that it will remain where left, but can be readily shifted.

Each of the three right-hand wheels is operated from one of the three banks of keys; but the three left-hand wheels are actuated

only by the transfer devices, and, owing to the absence of the levers 47, these upper wheels may be placed in closer proximity than the lower ones.

To set the train to zero the proper key of the cent-bank is first operated to bring the cent-wheel to zero and then the key of the dime-bank, and then the key of the dollar-bank, and then each one of the succeeding wheels may be set to zero by vibrating the transfer device step by step. This may be done without difficulty by means of an arm 62, extending from the shaft 76 of the transfer device through the top of the case.

The apparatus is provided with a gong 80 and with a striker 81, pivoted to any suitable portion of the frame. As shown in Fig. 12, both are mounted at the back of the counter-frame, a spring 82 carrying the striker toward the gong, and a lever 83, connected by a rod 84 with the frame *F* or any other moving portion of the machine, carries a loose pawl 85, which makes contact with the end of the striker-arm and retracts the latter as the lever 83 is raised, but passes loosely over the end of the arm when the lever 83 is depressed.

The key-levers may carry the keys directly upon their ends, and thus constitute the keys themselves, and they may be weighted at the inner ends, so as to insure their automatic return to their normal position.

By arranging the levers 47 in sets each inclined, as shown in Figs. 6 and 11, I am enabled to increase their length and at the same time bring the counting mechanism close to the key-levers, thereby rendering the machine more compact.

The levers 47 might be connected with the keys in other ways than shown; but by providing the counter mechanism with operating devices in position to be actuated by contact with shoulders of the key-levers I am enabled at any time to separate the counting mechanism from the keys without the necessity of loosening a series of separate connections. In the constructions shown the counter may be removed by simply disconnecting the pin 90.

It will be evident that many of the devices above described may be used in connection with machines of different constructions.

Without limiting myself to the precise construction shown, what I claim is—

1. The combination, with a bank of nine operating-keys of a register, of a corresponding number of movable tablets each marked to correspond with the key by which it is operated, the tablets consisting of plates arranged one in front of the other, with the keys extending between the lower ends of the plates and each plate having a bearing on one of the keys, and a fixed tablet marked with a cipher in position to be covered by the other tablets when moved by the depressing of a key, substantially as set forth.

2. The combination, in a register, of two or

- more banks of keys, two or more corresponding series of tablets, a detent arranged to engage a shoulder of each tablet and support the same when elevated, a second shoulder upon each tablet arranged to engage the detent and throw it out as the tablet is elevated, and connections between the detents whereby they move together, substantially as and for the purpose set forth.
3. The combination, with two or more series of nine movable tablets each, of a fixed tablet marked with a cipher in position adjacent to each series of tablets, a detent arranged to lock each tablet when elevated and to engage the same to release the tablet previously elevated, and connections between the detents, substantially as set forth.
4. The combination, with the keys of a register, of a series of movable tablets, one arranged in front of the other and each having a shoulder at the edge, and a detent arranged opposite the edges of the tablets to engage the shoulders thereof, substantially as set forth.
5. The combination, with the series of sliding tablets, each having shoulders 10 and 13 and an inclined edge 12, of a detent consisting of a pivoted plate 8, arranged opposite the edges of the tablets to engage therewith, substantially as set forth.
6. The combination of the different series of sliding tablets, each with shoulders, as described, a pivoted detent arranged to engage the edge of each series of tablets, and connections between the detents, substantially as set forth.
7. The combination, with the different banks of keys, of a series of tablets for each bank, those of each series arranged to slide vertically one in front of the other, and a detent arranged to engage with the edges of all the tablets of a series, substantially as set forth.
8. The combination, with the parallel key-levers provided with lips, of yielding controllers independent of the levers and suspended to engage each lever and prevent its descent until the lever reaches the limit of its movement in one direction, and provided with a bearing for engaging the lever as the latter reaches the said limit of its movement, and a retainer for engaging and holding the controller when swung back by the contact of the lever, substantially as set forth.
9. The combination, with the key-levers, of controllers provided with pendent racks for engaging lips upon the levers and with bearings for engaging the levers, and a retainer for engaging each controller, substantially as set forth.
10. The combination, with the key-levers, of pendent controllers independent of the key-levers, retainer, and frame bearing upon the key-levers in position to contact with the retainer as the levers assume their normal position, substantially as set forth.
11. The combination of the key-levers, vibrating frame adapted to be moved by the levers, movable drawer or cover for the money-receptacle, bolt for said drawer or cover, and a loose connection between the frame and bolt, whereby the bolt is withdrawn only as a key approaches the limit of its movement, substantially as described.
12. The combination, with the drawer or cover, bolt, and key-levers, of a frame F and link 27, loosely connecting the bolt and frame, whereby the bolt is withdrawn only as a key approaches the limit of its movement, substantially as set forth.
13. The combination, with the bolt, of a catch arranged to engage a shoulder upon the bolt and to be engaged by a contact-piece upon the movable drawer, substantially as set forth.
14. The combination, with a sliding drawer provided with a shoulder and a spring contact-piece 31, of a bolt for engaging said shoulder and a catch for engaging a shoulder upon the bolt, arranged to be struck by said contact-piece, substantially as set forth.
15. The combination, with the bolt 22 and catch 24, of the detent 33, substantially as set forth.
16. The combination, with the series of counter-wheels, of independent motors for moving each counter-wheel automatically, a series of operating-keys to each wheel, and devices between the keys and motors whereby upon the depression of any key the power in all the motors is restored and the key resumes its normal position independent of the motor, substantially as set forth.
17. The combination, with the counter-wheels, of keys for releasing the same, devices limiting the movements of the wheels, mechanism between the different counter-wheels for automatically actuating the said devices, and independent motors for actuating the wheels, substantially as set forth.
18. The combination of independent counter-wheels and a series of keys for each wheel, a stop for limiting the movement of each wheel, mechanism for shifting the position of said stop on the completion of a revolution or partial revolution of the next lower wheel, and a motor for actuating each wheel automatically after the stop is shifted, substantially as set forth.
19. The combination of independent counter-wheels, keys for actuating each wheel, a stop for limiting the movement of each wheel, and mechanism for shifting the position of said stop on the completion of a whole or part revolution of the next lower wheel, a motor for actuating each wheel, and connections between the motor and the keys for restoring the power of the motor upon the movement of each key, substantially as set forth.
20. The combination, with the adjacent counter-wheels and operating-keys and with pins projecting from each wheel, of an intermediate escapement constituting a stop and provided at one end with an inclined slot for the passage of the pins of one wheel, the

other end extending into position to be struck by projections on the other wheel, substantially as set forth.

21. The combination, with the wheels of a counter and intermediate stop devices, of keys, weighted racks engaging the ratchet-wheels clutching with the shafts of the counter-wheels, and means for raising the said racks on the movements of the keys, substantially as set forth.

22. The combination, with the counter-wheels, actuating-keys, and motors, of an intermediate transfer device consisting of a lever, one end arranged to engage projections upon one wheel and the other with a projection having an inclined slot adapted to receive pins upon the other wheel, for the purpose set forth.

23. The combination of the counter-wheels and the intermediate transfer devices K, provided with actuating-arms 62, extending to the outside of the case, whereby the wheels may be returned to zero, substantially as described.

24. The combination, with a counter-wheel and with the actuating-keys thereof, of a series of movable pins carried with the wheel, a stop arranged in position to make contact with the pins, and connections between the keys and the pins for moving the latter out of the way of the stop by the operations of the keys, substantially as set forth.

25. The combination of the series of keys, series of tablets, said tablets having shoulders 13 below retaining-shoulders 10, and a detent for each series of tablets, the detents being connected to move in unison, substantially as and for the purpose set forth.

26. The means described for controlling the connecting-wheels of calculating-machines, consisting of the counting-wheel or part geared therewith provided with movable pins, a stop for making contact with said pins and keys, and connections for shifting the pins, substantially as set forth.

27. The counter-wheel or part connected therewith provided with shifting-pins, substantially as and for the purpose set forth.

28. The combination, with a counter-wheel, a series of movable pins, and series of keys and connections, whereby one or more pins are shifted according to the key depressed, of a stop arranged in position to make contact with the pins until the latter are shifted, substantially as set forth.

29. The combination, with two or more counter-wheels, of a series of movable pins carried by said wheels, a series of keys to each wheel, with connections for shifting one or more pins according to the key depressed, a fixed stop in position to make contact with the pins of the lower wheel, movable stops to make contact with the pins of the other wheels, and devices whereby each movable stop is shifted out of the path of the pins as the next lower wheel completes a revolution or part revolution, substantially as set forth.

30. The combination of a counter-wheel, a series of movable pins carried therewith, a stop for making contact with said pins, connections with the keys for shifting the pins to positions out of the way of the stop, and a motor for turning each wheel, substantially as set forth.

31. The combination, with the counter-wheel, movable pins, actuating-keys, and stop, of a motor for moving the wheel and a bolt for locking the wheel, and connections whereby said bolt is thrown into locking position until the pins are shifted, substantially as set forth.

32. The combination, with the counter-wheel and its motor, of actuating-keys and appliances for regulating the extent to which the wheel is turned according to the key depressed, and a bolt for locking the wheel, and connections between the keys and the bolt for withdrawing the latter after the keys have been operated to move said appliances, substantially as described.

33. The combination, with the counter-wheel, pins carried therewith, keys and pin-shifting devices, and stop, of means, substantially as described, for restoring the pins to position after they have passed the stop, substantially as set forth.

34. The combination of the counter-wheel having two series of numbers from 1 to 0, a movable pin to each number, a stop, a series of keys and connections for shifting the pins out of the way of the stop, and means for resetting the pins after they have passed the stop, substantially as set forth.

35. The combination of a counter-wheel, a series of movable pins carried therewith, a stop, a series of levers and connections whereby one of the pins may be shifted on moving each lever, and a projection upon each lever overlapping the next lower lever, whereby the depressing of any lever carries with it all the levers below it, for the purpose set forth.

36. The combination, with the connecting wheels and pins, of operating devices, each having a lip overlapping a part of the adjacent device, whereby when one device is moved it will move with it all the devices below it without disturbing the higher devices connected to indicate higher figures, substantially as set forth.

37. The combination, with a counter-wheel and a series of movable pins carried therewith, of a series of rods arranged in position, each to be opposite one of the pins when the counter is in its normal position, and connections between each of the rods and one of the keys, substantially as set forth.

38. The combination, with a counter-wheel and movable pins carried therewith, of a series of rods 46, carried by levers 47, and a series of keys and connections for operating said levers, substantially as described.

39. The combination, with the counter-wheel, pins, stop, keys, and intermediate pin-actuated devices, of a frame J, provided with

a bolt *c* and plate 56, substantially as set forth.

40. The combination of two or more series of keys, corresponding counter-wheels, movable pins carried therewith, and stops and levers 47, arranged in inclined positions and connected with rods for making contact with said pins, and with parts arranged to contact with shoulders upon the key-levers, substantially as set forth.

41. The combination of the series of parallel key-levers, controllers *E*, drawer-bolt, counters, motor devices therefor, bolts *c*, and a frame *F*, and connections between the latter and the bolt *c*, controller, and drawer-bolt, said frame carrying a cross-bar arranged to actuate the said motors, substantially as set forth.

42. The combination of the series of counter-wheels, escape devices between the different wheels, a series of operating-keys to each wheel, mechanism between the keys and the escape devices for actuating the latter to release the wheels upon the movement of the keys, and independent motors for automatically operating the different counter-wheels when released, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ISRAEL DONALD BOYER.

Witnesses:

C. W. DUSTIN,

FRED W. GEBHART.