

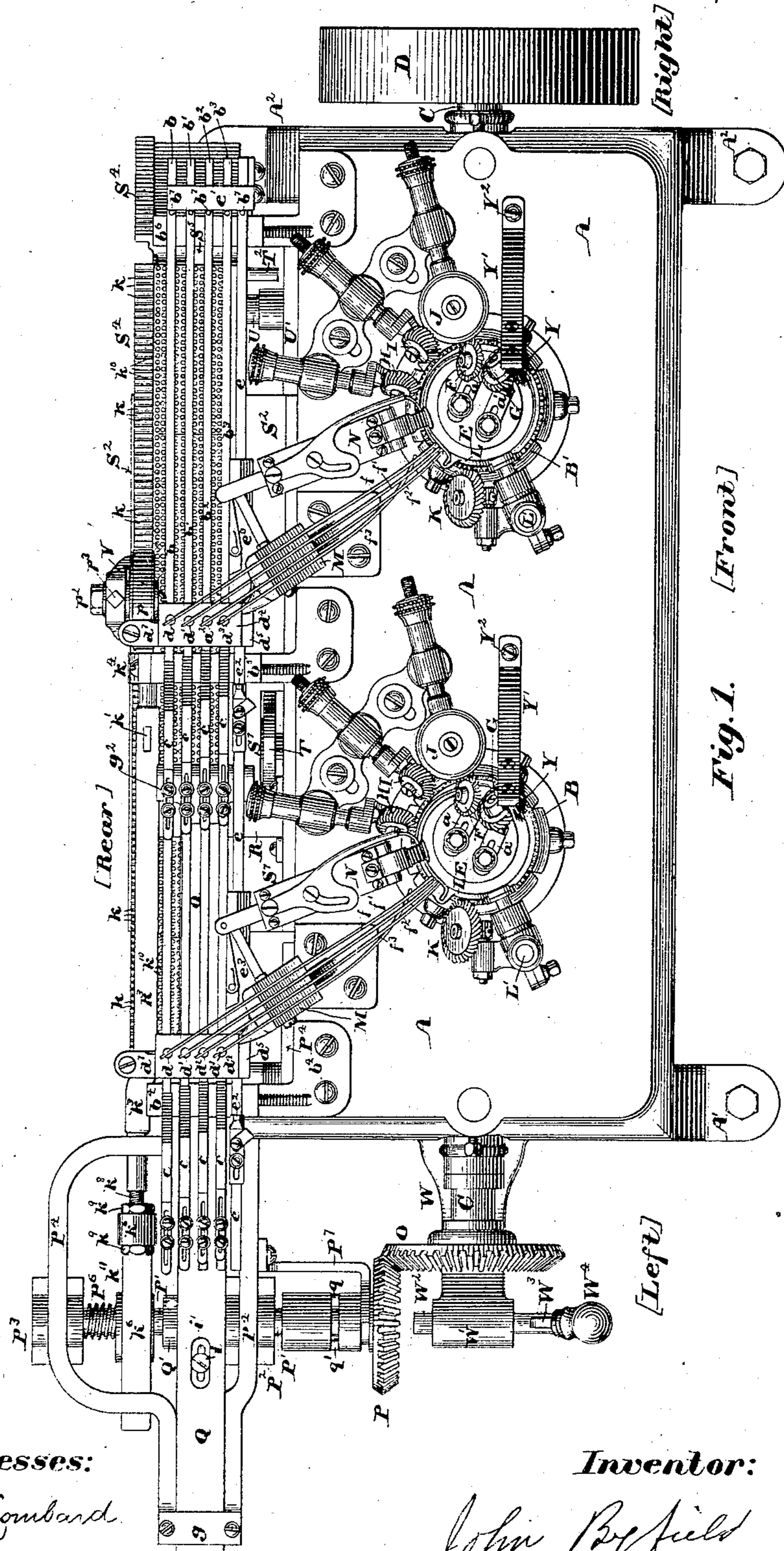
(No Model.)

4 Sheets—Sheet 1

J. BYFIELD.
KNITTING MACHINE.

No. 311,172.

Patented Jan. 27, 1885.



Witnesses:

Halter & Lombard
& A Hemmenway.

Inventor:

John Byfield

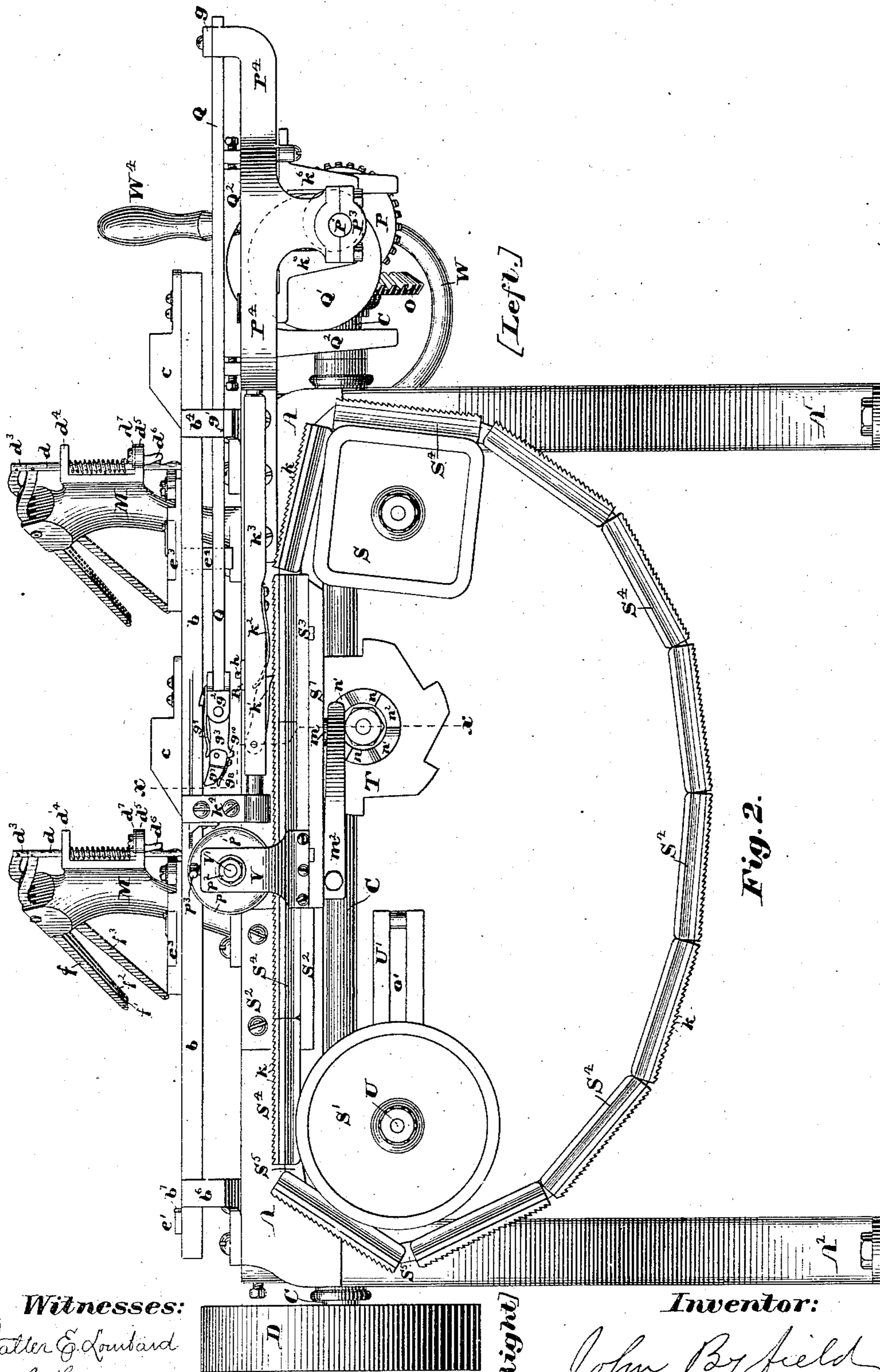
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E. A. Hemmingsway

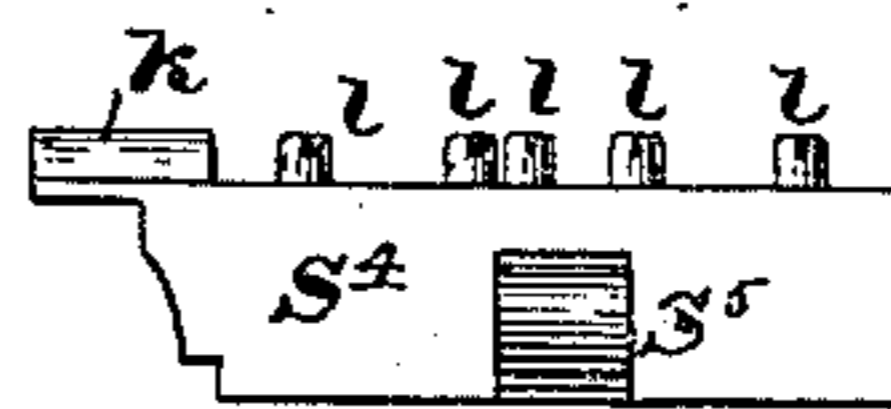
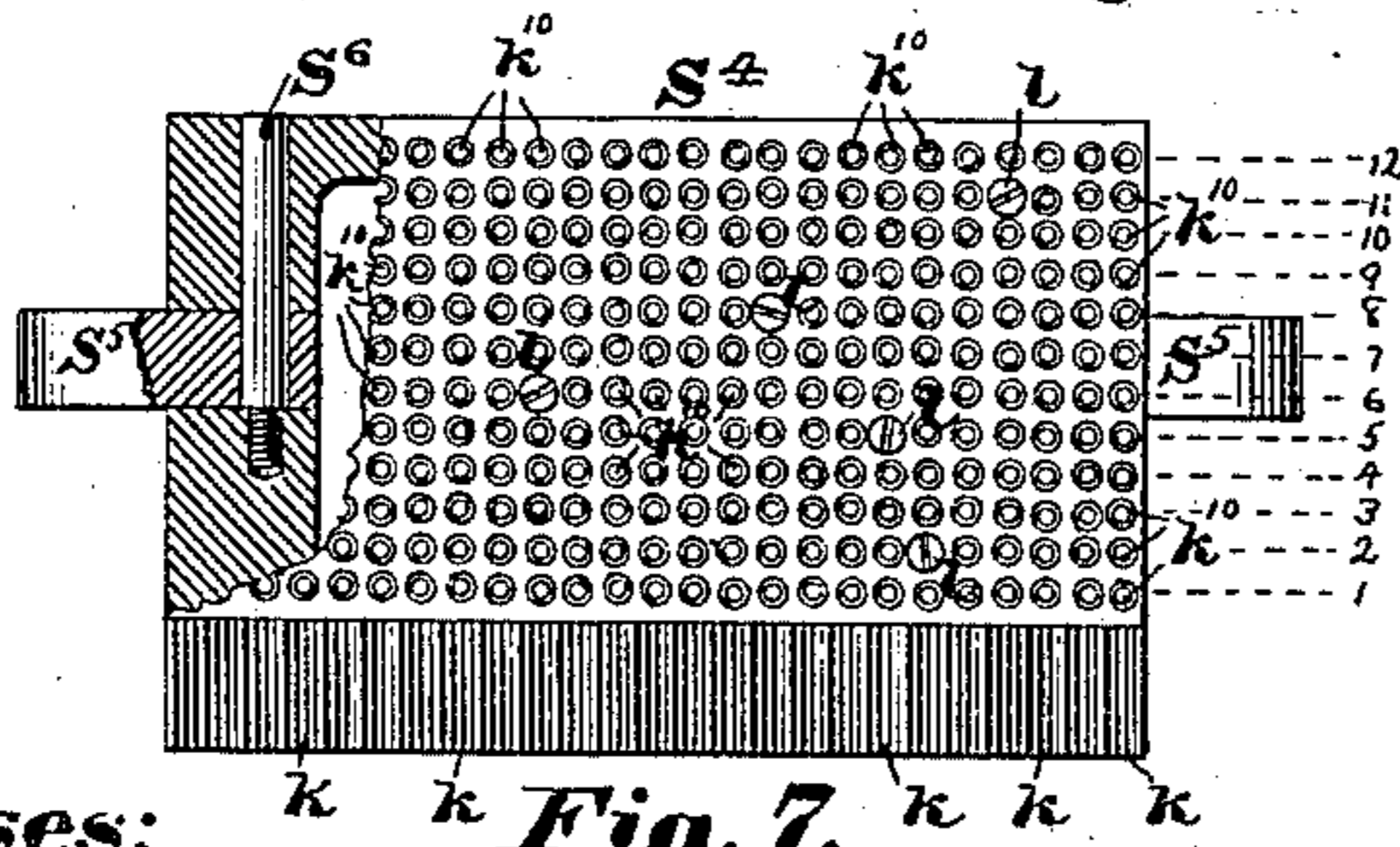
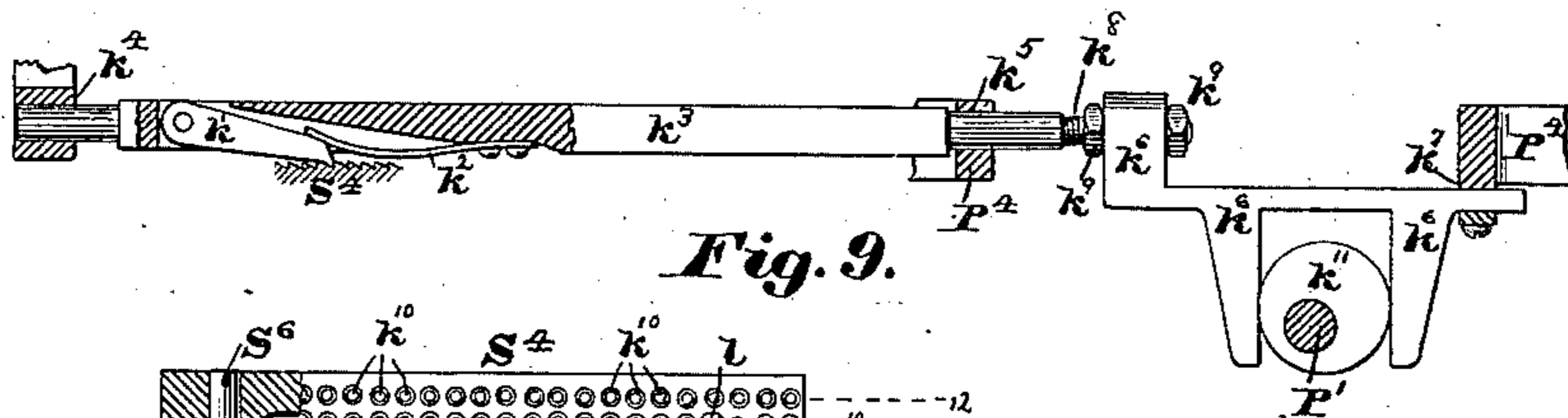
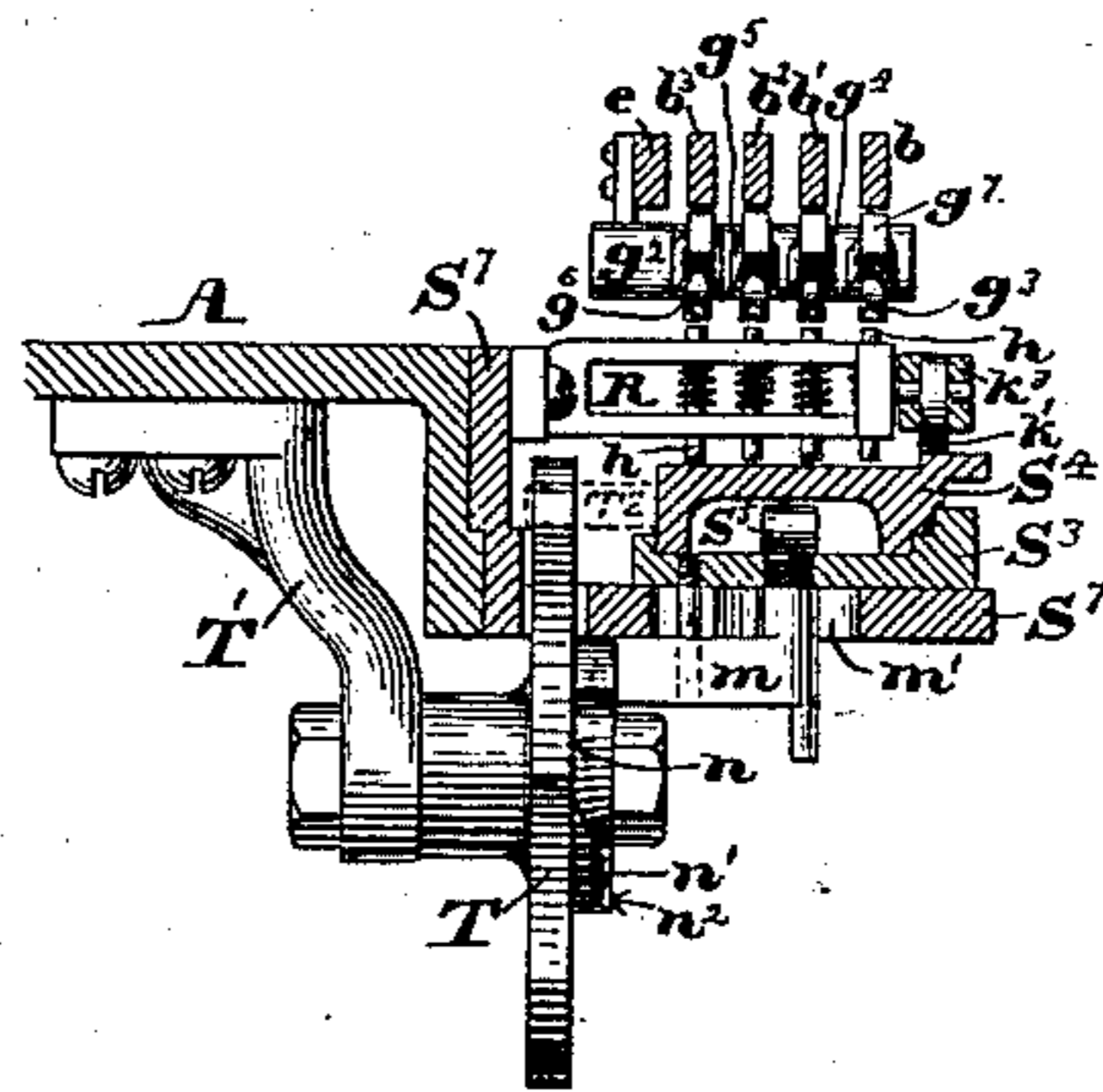
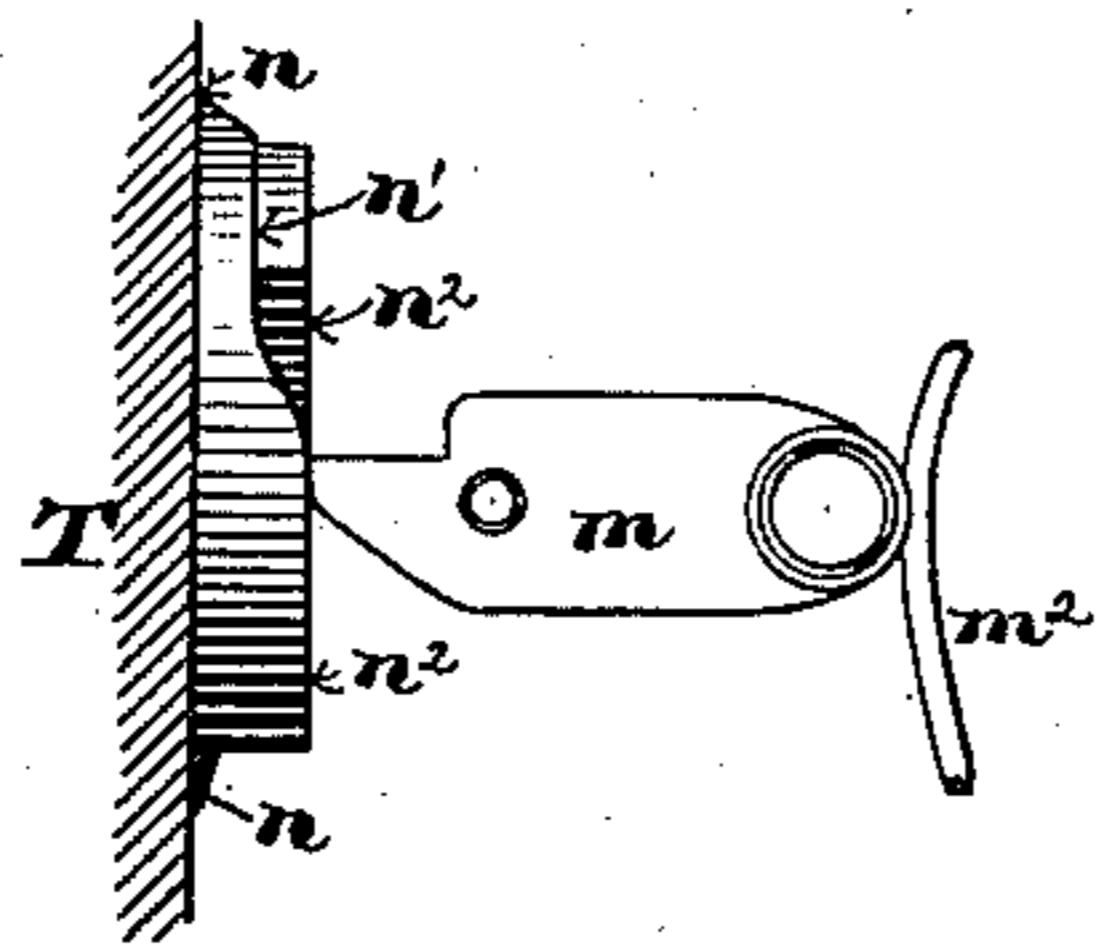
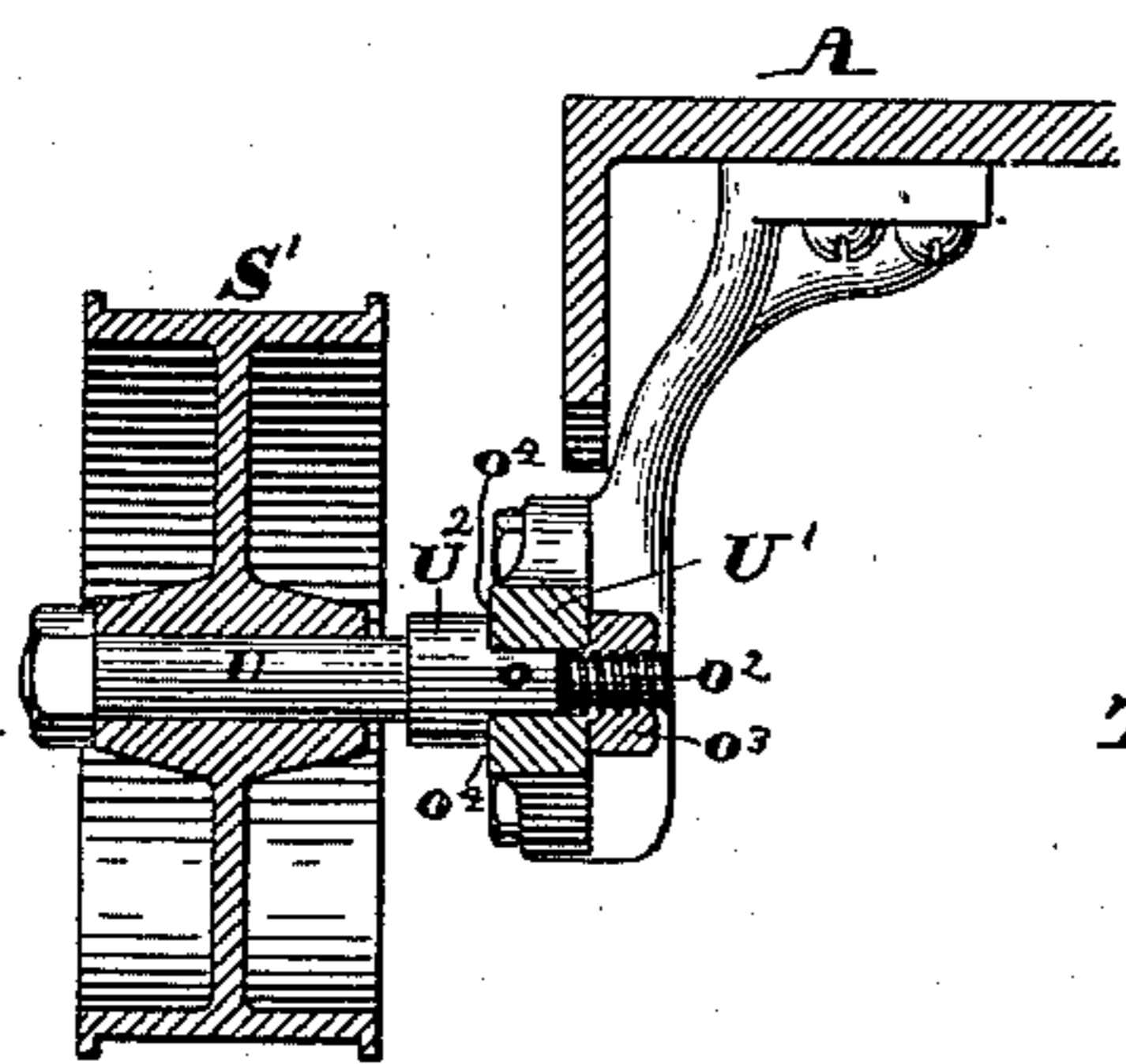
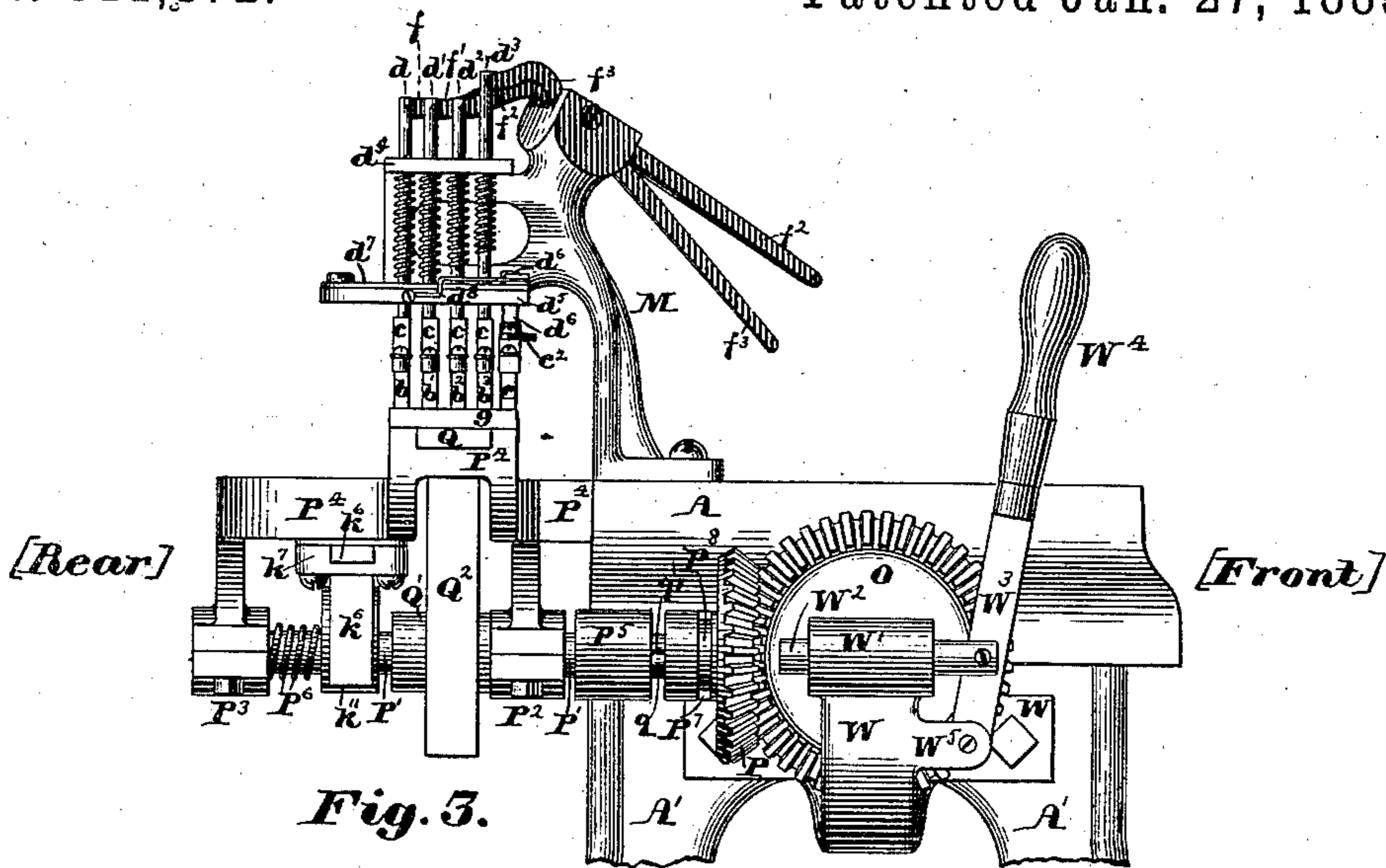
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Fig. 8. Inventor:

John Byfield

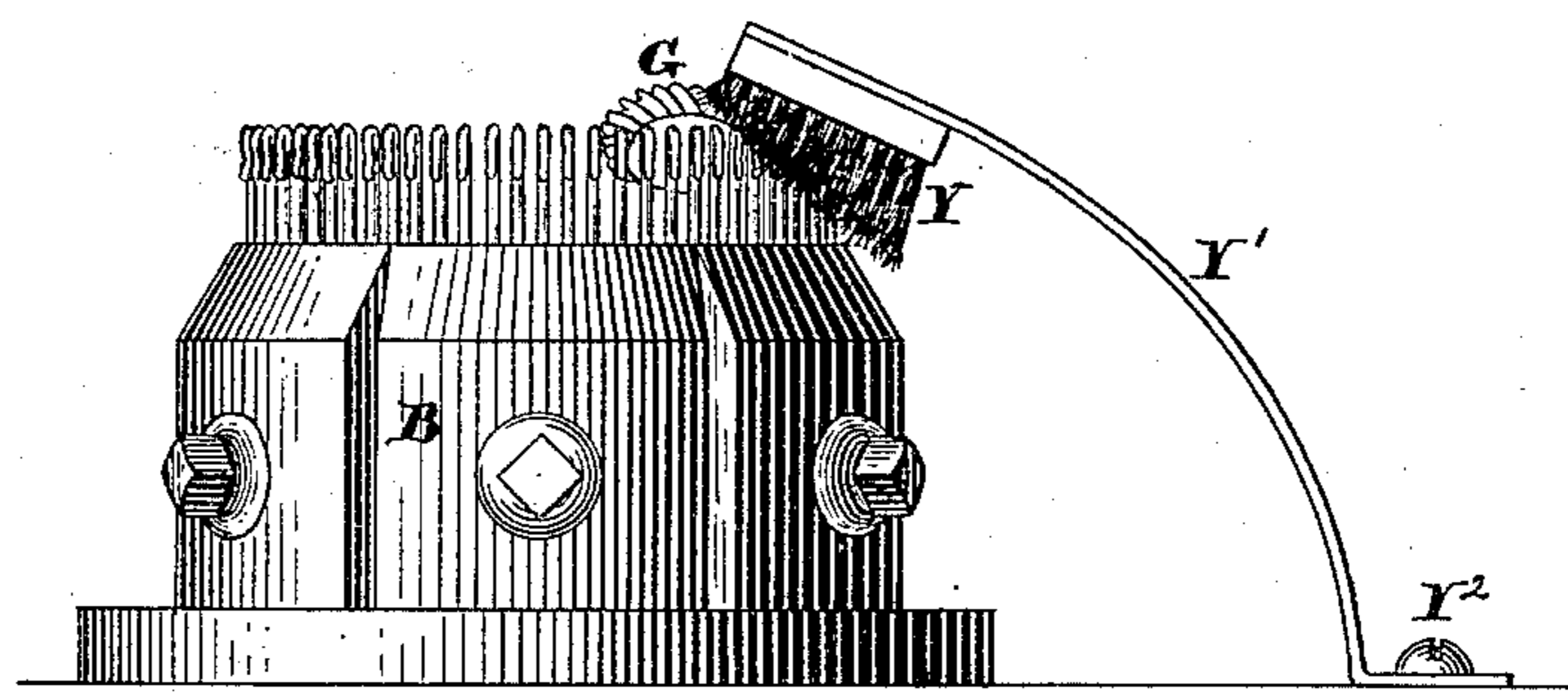
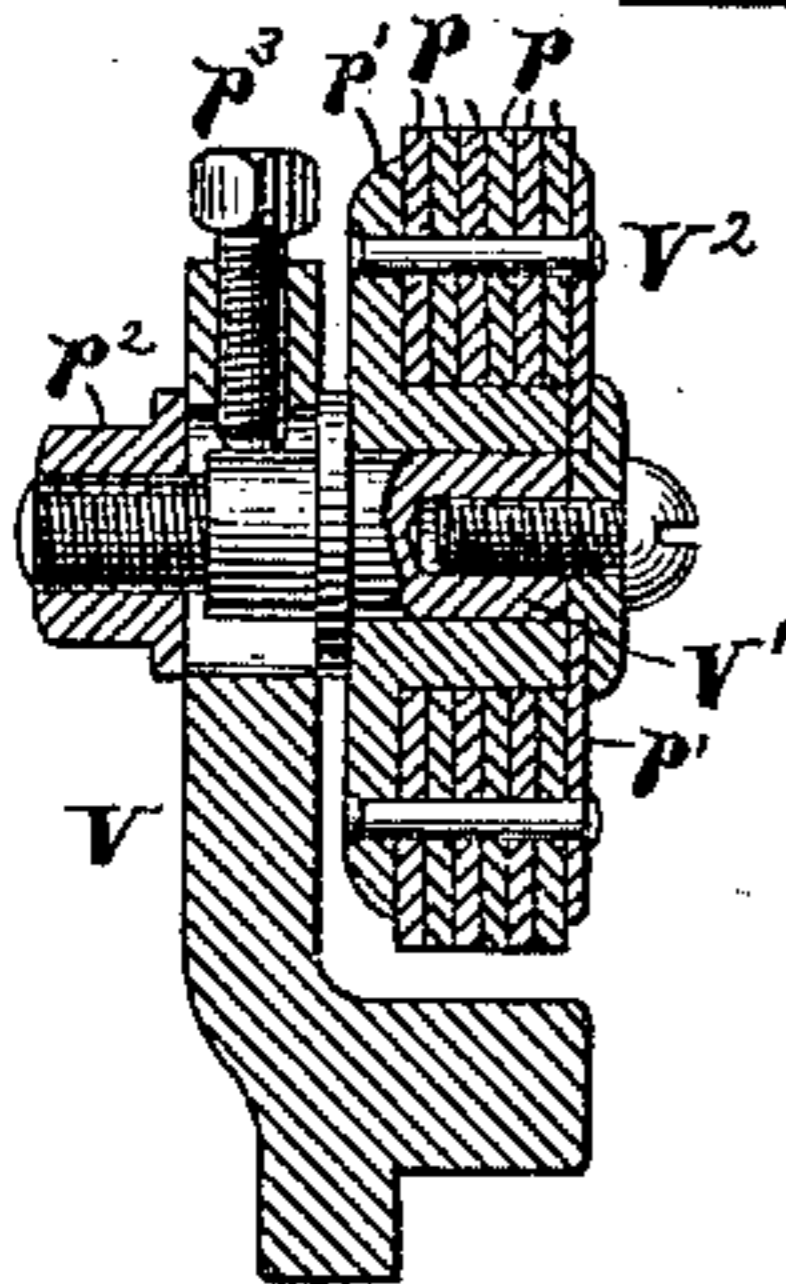
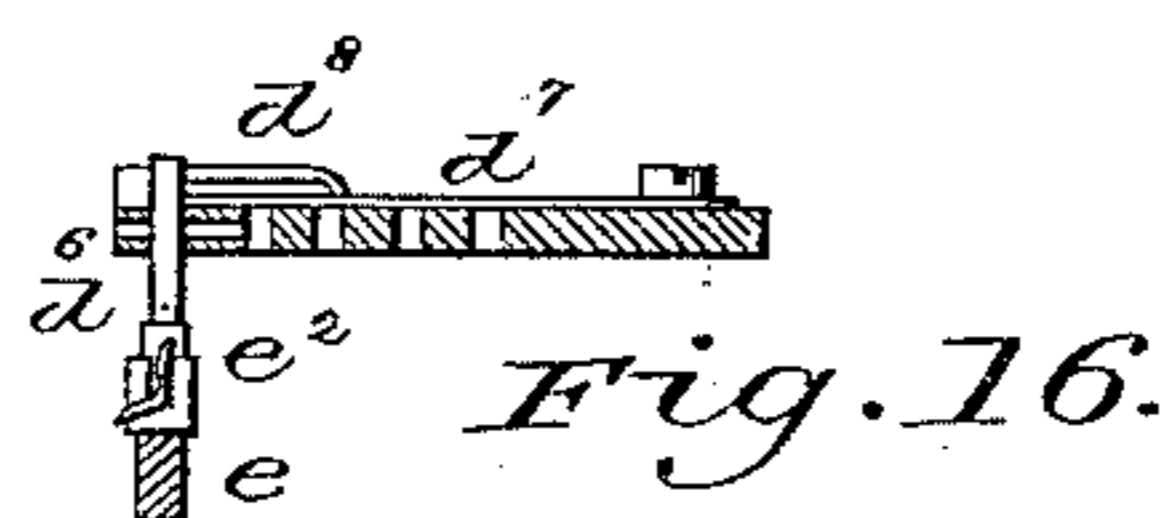
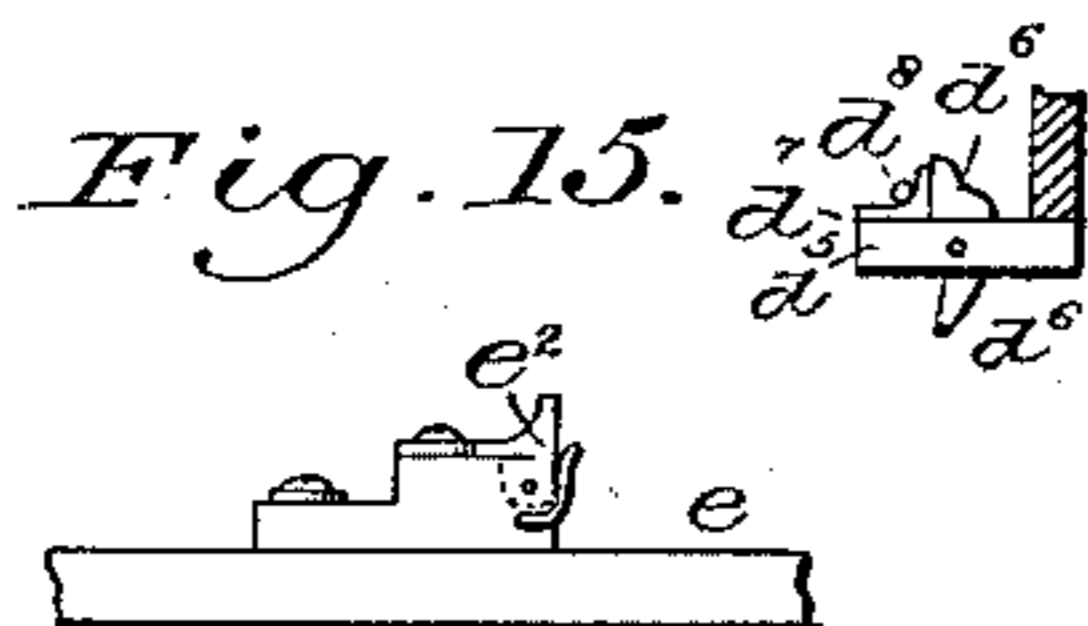
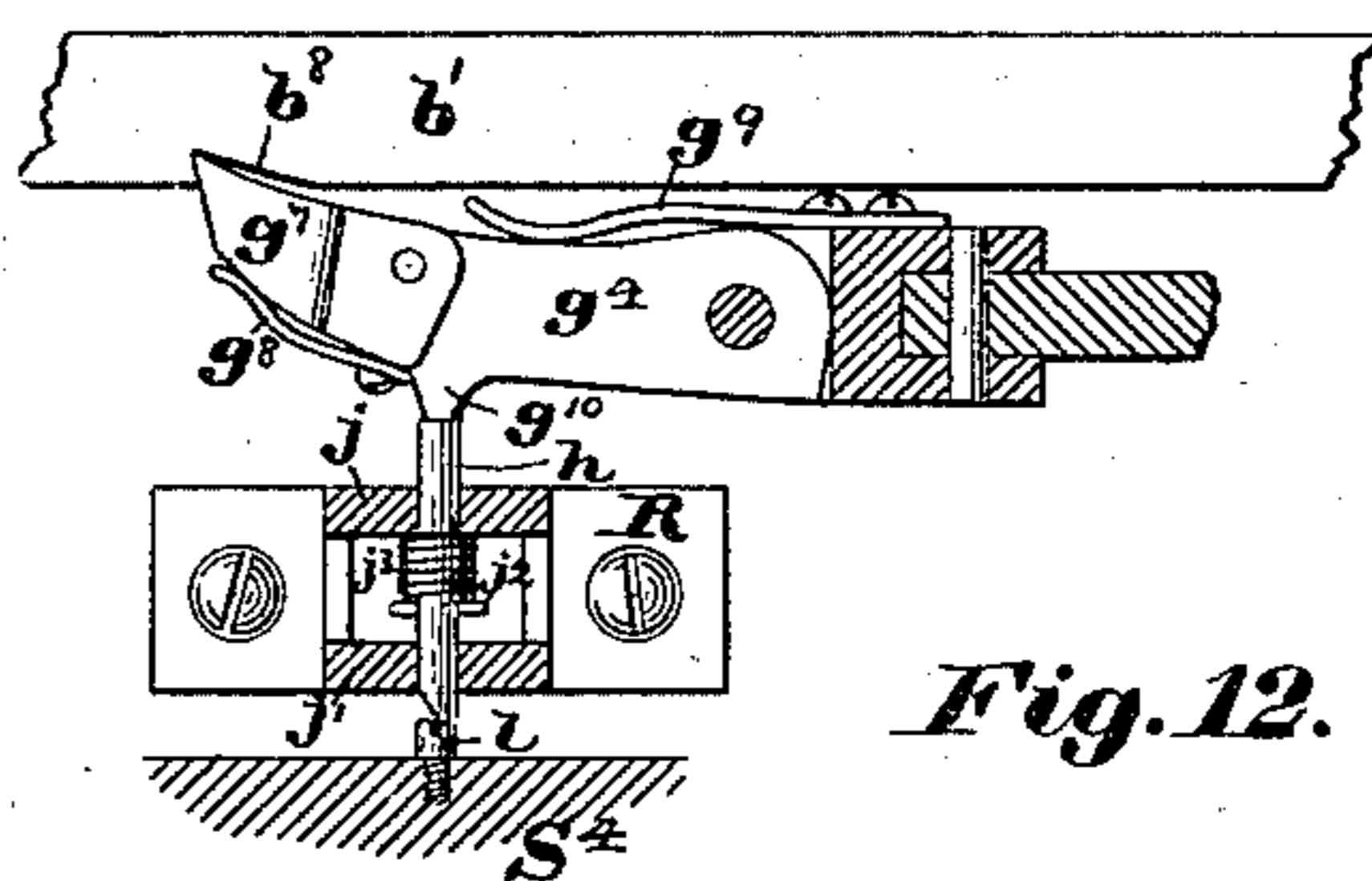
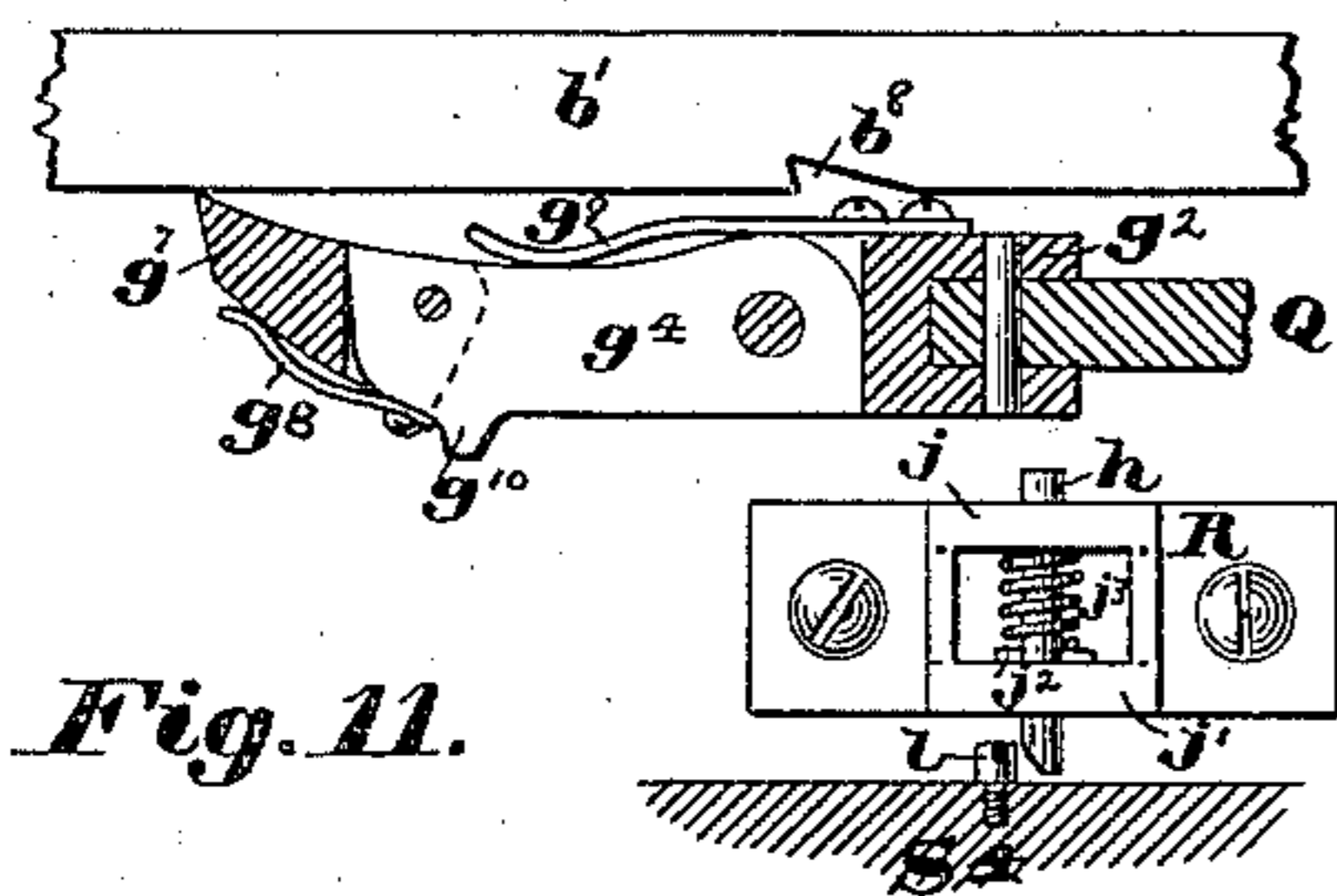
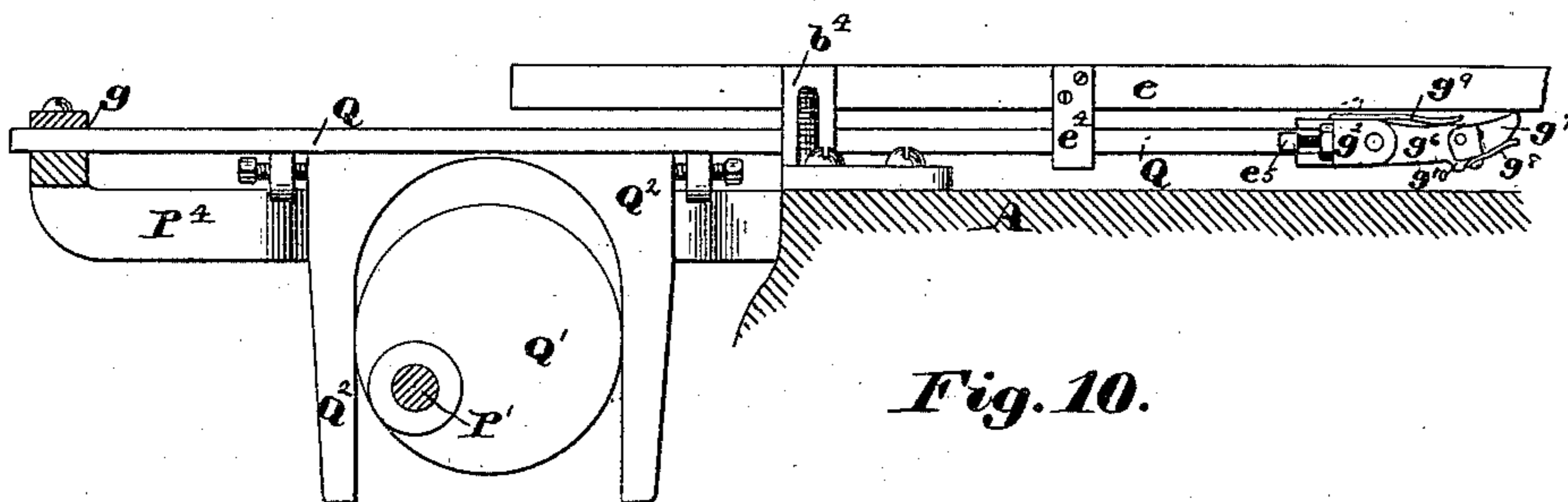
(No Model.)

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KNITTING MACHINE.

No. 311,172.

Patented Jan. 27, 1885.



Witnesses:

Walter E. Lombard
E. A. Hemmenway.

Inventor:

John Payfield

UNITED STATES PATENT OFFICE.

JOHN BYFIELD, OF LOWELL, MASSACHUSETTS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 311,172, dated January 27, 1885.

Application filed September 17, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN BYFIELD, of Lowell, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Knitting-Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to that class of knitting-machines in which a series of barbed or spring needles are arranged and adapted to be revolved in a circle, and in which mechanism for intermittently throwing into and out of action yarns of different colors is employed, and is an improvement upon the inventions described in my pending applications, filed January 31, 1882, and May 2, 1883, in the United States Patent Office; and it consists in a novel construction and arrangement of the pattern mechanism; in certain combinations and arrangements of devices by which the pattern mechanism controls the throwing into or out of action the yarns of different colors, as desired; in a novel arrangement of devices for transferring the joining or splicing of the yarns in the knitted fabric from one side to its opposite, and in a novel construction and arrangement of brushes adapted to lightly rest upon the fabric, for the purpose of brushing the ends of the severed yarns attached to the fabric to prevent them from being caught by the needles and knit into the fabric, all of which features will be readily understood by reference to the description of the drawings, and to the claims to be hereinafter given.

In the drawings, Figure 1 represents a plan of my improved knitting-machine. Fig. 2 represents a rear elevation of same, the head, star-boxes, and severing devices being omitted. Fig. 3 represents a partial left-side elevation of the same. Fig. 4 represents a partial cross-sectional elevation of same, the cutting plane being on line *xx* in Fig. 2, showing the toothed cam-wheel *T* and its immediate adjuncts in elevation. Fig. 5 represents a sectional plan of the cam and toe for operating the chain-slide, and showing a portion of the co-operating spring in plan. Fig. 6 represents a central vertical section of one of the

chain-pulleys, its supporting-stand, and a portion of the main table or bed of the machine. Figs. 7 and 8 represent, respectively, a plan and an end view of one of the pattern-links and its connecting-links, one end of the pattern-link being represented in section to show the pivotal connection of the two links. Fig. 9 represents a rear sectional elevation of the mechanism for operating the pattern-chain. Fig. 10 represents a front elevation of the mechanism for operating the cam-bars. Figs. 11 and 12 represent rear sectional elevations of the cam-bar, operating-pawls, and the mechanism for acting upon the same. Fig. 13 represents a central vertical section of the friction-wheel and bracket. Fig. 14 represents a front elevation of the brush for operating on the ends of the yarns, showing its relative position as regards the needle-head. Fig. 15 is a partial side elevation of the bar for operating the yarn severing and holding devices, and showing in elevation the devices for disengaging the supporting-latch from the guidelifting rods; and Fig. 16 is a transverse sectional elevation of the same parts, the cutting-plane being on line *xx* on Fig. 15. Figs. 5, 7, 8, 11, 12, 13, and 14 are drawn to an enlarged scale.

A is the table or bed of the machine, supported upon the legs *A' A'*, and having mounted in suitable bearings therein the needle-heads *B B'*, which are provided with commonly-constructed bevel gear-wheels at their lower ends, which engage with and are operated by corresponding bevel gear-wheels secured upon the driving-shaft *C*, mounted in bearings beneath the table *A*, and adapted to be driven by a suitable belt upon the driving-pulley *D*. The needle-heads *B B'* have each secured thereon a series of barbed or spring needles arranged in a circle about said head in a well-known manner. The needle-heads *B B'* are arranged to be revolved about vertical shafts or studs *E E*, set in a fixed position in any suitable stands or brackets secured to the under side of the frame or bed *A*, and having secured to their upper ends the stands *a* and *a'*, which carry the journals, upon which are mounted the "landing-wheel" *F* and the

"knocking-over wheel" G, in a well-known manner.

H is the "stitch-wheel," I the "dividing-wheel," J the "presser-wheel," and K the "clearing-wheel," all arranged around the outside of each of the circular series of needles and adapted to co-operate therewith in a well-known manner.

L is the "push-back," of ordinary construction, adjustably mounted upon the post L' in a well-known manner.

Two, three, four, or more bars, $b\ b'\ b^2\ b^3$, according to the number of colors of yarn to be used, are arranged in suitable bearings, $b^4\ b^5\ b^6$, at the rear of the bed or frame A, each of said bars having secured thereto or formed thereon as many cams or wedges, $c\ c'$, as there may be needle-heads on the machine, which cams, when said bar is moved toward the right-hand end of the machine, or toward the driving-pulley, act upon and raise one set of the vertical rods $d\ d'\ d^2\ d^3$, mounted in bearings formed in the shelves d^4 and d^5 on the stands M M. Another bar, e , is mounted in the same manner by the side of the bars $b\ b'\ b^2\ b^3$, and has secured to its right-hand end, or that end nearest the driving-pulley D, the arm or plate e' , which projects transversely therefrom and over the ends of the bars $b\ b'\ b^2\ b^3$, in such a position as to be acted upon by either of the pins b^7 , set in the upper sides of the bars $b\ b'\ b^2\ b^3$, in such a manner that the bar e shall be moved toward the right-hand end of the machine whenever either of the bars $b\ b'\ b^2\ b^3$ shall be moved in that direction, and that either of the bars $b\ b'\ b^2\ b^3$ which has been moved to the right shall be moved to the left again by the movement of the bar e in that direction.

To the stands M M are pivoted the yarn-guides $f\ f'\ f^2\ f^3$, operated by the rods $d\ d'\ d^2\ d^3$, respectively, and provided at their inner ends with suitable eyes, through which the yarns are passed on their way from the bobbins (which are not shown in the drawings) to the needles. Each of the rods $d\ d'\ d^2\ d^3$ is surrounded by a spiral spring, so arranged as to tend to force said rod downward when released by the latch d^7 , pivoted to the shelf d^5 , and held firmly against the rods $d\ d'\ d^2\ d^3$ by the spring d^8 , (shown only in Fig. 3,) and adapted to engage with suitable shoulders upon the rods $d\ d'\ d^2\ d^3$ and hold said rods in a raised position, after being lifted, until they are again released therefrom. When one of the rods $d\ d'\ d^2\ d^3$ is raised by the cam c , which moves beneath it, the inner end of the one of the yarn-guides $f\ f'\ f^2\ f^3$ to which it is connected is depressed, so as to throw the yarn across and between the needles in such a manner that the stitch-wheel H will take the yarn and form the stitch in a well-known manner.

The latch d^7 is disengaged from the shoulders or notches on the rods $d\ d'\ d^2\ d^3$ by means of a pressure being brought to bear upon the

inner side of its free end by a suitable lever, d^9 , pivoted to the shelf d^5 , and having a downwardly-projecting arm which lies in the path of the toe e^2 and in the forward movement of the bar e —i. e., the movement toward the right-hand end of the machine, said toe engages with said downwardly-projecting arm, and thus moves the lever so as to disengage the latch d^7 from the rods $d\ d'\ d^2\ d^3$ and allow the spring upon the raised rod to move said rod downward and raise the inner end of its yarn-guide in precisely the same manner as described in my previous application, filed May 2, 1883, No. 93,664, said devices, as applied to my present improvements, being illustrated in Figs. 15 and 16.

It is obvious that it is necessary to have one of the rods $d\ d'\ d^2\ d^3$ up, and some one of the inner ends of the yarn-guides $f\ f'\ f^2\ f^3$ depressed constantly, to knit a continuous fabric.

N is a stand, securely fastened to the bed A, and provided with suitable mechanism for cutting the yarns that are thrown out of action with the needles and holding the ends of the same until again required, said mechanism being operated by the cam e^3 , forming part of and reciprocating with the bar e .

It will be seen that the number of bars $b\ b'\ b^2\ b^3$ represent the number of colors of yarns used in knitting the fabric, and that if more colors are desired more bars must be provided—that is, there must be a bar, b , for every color used.

All features thus far described are either old and well-known devices, or have already been described in my former applications, and will therefore need no further mention here, as they form no part of my present invention.

The object of my present invention is to provide a mechanism for operating the cam-bars $b\ b'\ b^2\ b^3$, which will be cheaper, more durable, easier of adjustment, and less liable to need repair than the mechanism shown in my former pending application, which object is fully accomplished by the mechanism which will now be described.

On the left-hand end of the driving-shaft C is mounted the bevel gear-wheel O, which revolves therewith, and is adapted to engage with and revolve the bevel gear-wheel P, mounted upon a shaft, P', at right angles to the driving-shaft C, said shaft P' being adapted to revolve in suitable bearings, $P^2\ P^3$, on the under side of the bracket P^4 , which is firmly secured to the frame A. These bevel gear-wheels O P must bear the same relation to each other that the bevel gear-wheels do that revolve the needle-heads B B', so that the shaft P' may revolve in unison with the needle-heads B B'—that is, the shaft P rotates about its axis once to every revolution of the needle-heads B B' about their axes.

Immediately below the bars $b\ b'\ b^2\ b^3$ is mounted, in suitable bearings, $g\ g'$, the flat bar Q, which is provided at its right-hand end with the head or cross-piece g^2 , which is

provided with as many dogs $g^3 g^4 g^5 g^6$ as there are bars $b b' b^2 b^3$, immediately beneath which they are placed, as shown in Fig. 4.

To each of the dogs $g^3 g^4 g^5 g^6$ is pivoted at its front end (or that end nearest the right-hand end of the machine) the pawl g^7 , the front end of which is held in a raised position by the spring g^8 .

Above each of the dogs $g^3 g^4 g^5 g^6$ is placed a spring, g^9 , which depresses said dog and prevents the engagement of the pawl connected thereto with the notch b^8 of the one of the bars $b b' b^2 b^3$ situated above said pawl and dog when the bar Q is making a forward movement. This reciprocating movement of the bar Q is imparted by the action of the eccentric cam-wheel Q' upon the forked bracket Q^2 , adjustably secured to the bottom side of the said bar Q, said eccentric cam-wheel Q' being firmly secured to and revolving with the shaft P' , so that the bar Q, with its pawls g^7 , moves forward and then backward with every revolution of the needle-heads B L' .

The dog g^4 and pawl g^7 are shown in their normal position in Fig. 11, being held thus by the springs $g^8 g^9$, and in this position may reciprocate beneath the bar b' for an indefinite length of time without being liable to engage with the notch b^8 thereof; but when it is necessary for the color of yarn to be knit into the fabric, which color of yarn is represented by the bar b' , a pin, h , mounted in a suitable bracket, R, secured to the frame A, is raised so as to lie in the path of the lug or projection g^{10} of the dog g^4 , and be struck thereby in the backward movement of the bar Q, thus raising the dog g^4 against the force of the spring g^9 , and allowing the pawl g^7 , by means of the pressure brought to bear thereon by the spring g^8 , to engage with the notch b^8 , all as shown in Fig. 12. It is obvious that with the next movement of the bar Q and pawl g^7 the bar b' will also be moved forward, operating the yarn-guide f' in a manner already described.

As heretofore described the bar b' in its forward movement carries with it the bar e , the object of which has also heretofore been described. When the bar e is at its extreme forward position, the projection e^4 , secured thereto, is in contact with the adjustable shoulder e^5 of the cross-piece g^2 of the bar Q, and when said bar Q returns to the left-hand end of the machine it carries therewith the bar e by means of the action of the shoulder e^3 upon the projection or bracket e^2 , and the bar e , by the action of the plate e' upon the pin b^6 of the bar b' , returns said bar to its normal position.

It is necessary that, when the lug or projection g^{10} of any one of the dogs $g^3 g^4 g^5 g^6$ is raised by its co-operating pin h , the detent-notch b^8 should be immediately above the co-operating pawl, so as to readily be engaged thereby, and in order to accomplish this the forked bracket Q^2 is made adjustable upon the bar Q,

so that the relation of the pawls $g^7 g^7$ to the detent-notches $b^8 b^8$ may be nicely adjusted, as follows: The bracket Q^2 is attached to the bar Q by means of two screws, i , (one only of which is shown, and that in Fig. 1,) which pass through suitable slots, i' , in said bar into the forked bracket Q^2 , holding the same securely to said bar Q when said screws are tightened, clamping the bar Q between their heads and the bracket Q^2 . By loosening the screws i they may be adjusted endwise in the slots i' , thereby adjusting the bracket Q^2 in its relation to the bar Q.

While the operation of only one pin, dog, pawl, and bar is mentioned, it is obvious that any of the co-operating sets are operated in the same manner.

The pin-bracket R is made in skeleton form, having an upper shelf, j , and a lower shelf, j' , in which the pins h are adapted to slide in suitable bearings. A little below its center of length the pin h is provided with a transverse pin, j^2 , which rests upon the lower shelf, j' , thus regulating the distance that the pin h may extend below the under surface of the bracket R. Between this pin j^2 and the under surface of the upper shelf, j , is placed a spring, j^3 , coiled about the pin h , and adapted to hold it in position—i. e., with the pin j^2 resting upon the upper surface of the lower shelf, j' . The bracket R is provided with as many of these pins h as there are cam-bars, under which they may be placed.

The construction and arrangement of the stand or bracket R and its attendant parts will readily be seen by reference to Figs. 4, 11, and 12. Beneath the bracket R is placed the pattern-chain, hung upon the loose pulleys S S' , mounted upon suitable journals attached to the frame A, said chain being additionally supported by the bracket S^2 and the sliding guide-carriage S^3 as it passes beneath the bracket R. This pattern-chain is made up of a number of pattern-links S^4 and small connecting-links S^5 , constructed and arranged in such a manner that when the chain is passing over the bracket S^2 and the sliding guide-carriage S^3 the pattern-links form a continuous and uniform surface, as will be readily seen by reference to Figs. 1, 2, 7, and 8. The intermediate or connecting links, $S^5 S^5$, are hinged to the pattern-links $S^4 S^4$, as shown in section in Fig. 7, by a long pin, S^6 , passing from one side of the pattern-link through the connecting-link S^5 , and tapped into the opposite side of the pattern-link S^4 , said pin being provided with a suitable slot, by which it may be readily removed to allow extra links to be inserted into the pattern-chain when a longer pattern is desired. The upper side of the outer edge of pattern-links are provided with a series of ratchet-teeth, $k k$, of an equal distance apart, which are adapted to be engaged by the pawl k' , actuated by the leaf-spring k^2 , and pivoted in a suitable slot to the rod k^3 , adapted to reciprocate in the bearings $k^4 k^5$, as shown in

Figs. 2 and 9. To the left-hand end, or that end nearest the shaft P' , is secured the fork k^6 , which is provided with a bearing, k^7 , in the bracket P^4 . This fork is secured to the rod k^3 , so that, by means of the reduced threaded end k^8 and nuts k^9 , the pawl k' may be slightly adjusted so as to bring each transverse row of pattern-holes k^{10} to its proper position relative to the pins h of the bracket R . Each pattern-link has provided therein as many transverse rows of holes k^{10} as there are ratchet-teeth upon said link, the centers of said rows of holes k^{10} being directly opposite the center of said teeth k . These holes k^{10} are provided with female threads, into which are adapted to be screwed the pattern-pins l , which are adapted to raise the pins h of the bracket R in the passage of the pattern-chain beneath the same, the object of which has been fully explained. The two arms of the fork k^6 pass downwardly on either side of the eccentric cam-wheel k^{11} , securely attached to the shaft P' , with which it revolves, acting alternately on either arm of the fork k^6 , thus giving a forward and backward movement to the rod k^3 with every revolution of the needle-heads B B' . The amount of movement of the rod k^3 is such that with every reciprocation of said rod the pawl k' moves the pattern-chain toward the left-hand end of the machine a distance equal to the length of one of the teeth k , thus allowing each transverse row of holes k^{10} to take a position successively beneath the pins h of the bracket R .

As it would take an extremely long chain to take in a pattern that would make a pair of long stockings made of fine yarn if only a single series of holes are used—*i. e.*, a row of holes lengthwise of the pattern-chain for every pin h in the bracket R —I provide mechanism by which any reasonable number of series may be used, which in the machine shown in the drawings is three. To accomplish this object the pattern-chain, in passing beneath the bracket R and pawl k' , passes over the sliding carriage S^3 and between the vertical sides thereof, thus preventing any lateral movement of the chain without the aid of the carriage S^3 , as shown in Fig. 4. The carriage S^3 rests upon and is adapted to move transversely of the broader bracket S^7 , which is firmly secured to the frame A , so that the upper surface of the carriage S^3 is even or on a level with the bracket S^2 .

To the under side of the carriage S^3 is secured the toe m , adapted to move toward and from the machine in the slot m' of the bracket S^7 . The toe m , and with it the carriage S^3 , is pressed firmly toward the machine by the spring m^2 , acting upon said toe.

Between the carriage S^3 and the frame of the machine is placed the toothed cam-wheel T , loosely mounted upon a suitable journal in a bracket, T' , secured to the under side of the bed of the machine, said cam-wheel extending upwardly through a slot in the bracket

S^7 , so that the teeth of said wheel lie in the path of the pin T^2 , secured to one of the pattern-links S^4 . On the outer side of said wheel T project the cam-throws n n' n^2 , or as many throws as there are series of holes k^{10} , or a multiple of that number, which in the machine shown in the drawings is six, there being three series of holes in the pattern-chain. There must be a tooth on the circumference of the wheel to correspond to each throw on the face.

The operation of this mechanism is as follows: At the commencement of a pattern the toe m should rest against the face of the wheel T , and the pin T^2 should be immediately to the left of the said wheel T , and in this position the pins h h h h of bracket R would be immediately above the first series of holes—namely, 1, 4, 7, and 10, as shown in Fig. 7—and they all remain in this position until in the rotation of the pattern-chain the pin T^2 reaches the toothed cam-wheel and in its passage comes in contact with one of the teeth thereof, moving the same about its axis, so that the toe m is made to rest upon the second elevation, n' , moving the carriage S^3 , and with it the chain, thus causing the pins h h h h to be above the second series of holes 2 5 8 11, in which position they remain until the pin T^2 in its rotation moves the next tooth, so as to move the toe m to the third elevation, n^2 , by a similar operation, thus causing the carriage to move again, so that the pins h h h h are over the third series of holes, 3 6 9 12, in which position they are shown in the drawings. The next time the pin T^2 moves the wheel T it causes the elevation n^2 to be moved from the path of the toe m , which is immediately forced by the spring m^2 against the lowest elevation, n , thus bringing the carriage S^3 to its starting-point, when the operation commences again with a new pattern and a new pair of stockings.

It is obvious that the pin T^2 should move each tooth of the wheel T with which it comes in contact a distance equal to its length—*i. e.*, one-sixth of the distance about its axis where there are six teeth, and one-third where there are only three, &c. To allow of this lateral movement of the pattern-chain, the pulleys S S' , upon which it is supported, are each loosely mounted upon a journal somewhat longer than the hub of said pulley, so that each of said pulleys is easily moved with the pattern chain as that is moved by the carriage S^3 , the object of which is obvious, Fig. 6. The pulley S , at the left-hand end of the machine, is made square, as shown in Fig. 2, so that the pattern-chain will fit about said pulley on its passage from the carriage S^3 without any binding thereon. The pulley S' is made round, as any unevenness of the pattern-chain has time to become rectified before reaching the carriage S^3 . The journal U , upon which the pulley S' is mounted to accommodate the varying length of the pattern-chain, is made adjustable upon the slotted

bracket U' , which is firmly secured to the under side of the bed A , and which is shown in the drawings in Figs. 2 and 6. The journal U is provided with the enlarged end U^2 , which is flattened on opposite sides of its inner end, as at o , so as to fit the slot o' of the bracket U' , in which it is adjusted lengthwise of the machine. The said end U^2 is also provided with a reduced threaded portion, o^2 , upon which operates the nut o^3 , to firmly clamp the bracket U' between said nut and the shoulders o^4 of the enlarged end U^2 , all in an obvious manner, Fig. 6.

To the standard V , secured to and moving with the carriage S^3 , is adjustably secured the stud V' , upon which revolves the friction-wheel V^2 , constructed of several disks of leather, p p , riveted together between two disks of metal, p' p' . By loosening the nut p^2 and turning the screw p^3 the disks of leather p p may be adjusted to or from the ratchet-teeth k k of the links S^4 , upon which they press. The object of this is to regulate the friction upon the pattern-chain so as not to allow its own weight to carry it a number of teeth when once started by the pawl k' , as was found to be the case when this was not in use. By its proper use the desired tooth-by-tooth movement of the pattern-chain is easily obtained.

The joinings of two different colors are made in a straight line the whole length of the fabric, as the machine has been described; but this is very objectionable, as it causes the joinings to come on the front of every alternate stocking. To overcome this objection it is necessary to change the joinings to the opposite side of the fabric while knitting the feet of the stocking, which causes the joinings to be formed in a straight line at the back of the leg of each stocking. To accomplish this the bevel gear-wheel P is loosely mounted upon the shaft P' , upon which is securely fastened the collar P^5 , having provided upon its front face the two pins q q , which engage with corresponding pins, q' q' , upon the rear face of the hub of the bevel gear-wheel P , and from which power is transmitted from said gear to said shaft P' . The shaft P' is mounted in the bearings P^2 P^3 of the bracket P^4 , so as to allow a lengthwise movement therein.

Between the bearing P^3 and the eccentric cam-wheel k^{11} , and around the shaft P' , is coiled a powerful spring, P^6 , which tends to keep the pins q q q' q' engaged so that a continuous rotary motion is given to the shaft P' by the bevel gear-wheel P unless otherwise acted upon.

To the leg A' , at the left-hand end of the machine, is firmly secured the bracket W , provided at its outer end with a suitable bearing, W' , in which the rod W^2 is mounted, the axis of which lies in a line with that of the shaft P' . The front end of the rod W^2 is pivoted to the lever W^3 , provided with the handle W^4 , and having its fulcrum in the ear or projection W^5 of the bracket W , all as shown in Figs. 1 and 3.

While the legs of the stocking are being knit a continuous rotary movement is given to the shaft P' , as has already been described; but as soon as it becomes necessary to change the joinings to the opposite side of the fabric while the feet are being knit, the handle W^4 , and therefore the lever W^3 , is quickly pressed to the rear of the machine, and all pressure immediately removed therefrom. This movement of the lever W^3 presses the rear end of the rod W^2 against the front end of the shaft P' , moving it backwardly in its bearings P^2 P^3 , thereby disengaging the pins q q from the pins q' q' of the bevel gear-wheel P , which is kept from moving endwise with the shaft P' by the bracket P^1 , secured to the bracket P^4 , and having formed on its outer end a suitable fork fitted to the groove P^3 , formed in the hub of said bevel gear-wheel P . The bevel gear-wheel P , being continually in motion, moves the pins q' q' thereon by the pins q q of the collar P^5 , and makes a half-revolution, when the pins q' q' once again engage with the pins q q , which have been moved forward by the force of the spring P^6 upon the cam-wheel k^{11} , as soon as the pressure has been removed from the lever W^3 . It is obvious that this movement of the lever W^3 will cause the shaft P' and all parts connected thereto to remain stationary while the heads B B' are making one-half a revolution, thus causing the joinings to be made after the said movement to be made on the opposite side of the fabric from those already made. After one color of yarn has been knit into the fabric and another cut off, the ends of these yarns are apt to get caught by the needles and knit into the fabric, which is very objectionable. To prevent this, I provide the brush Y , (shown in Figs. 1 and 14,) which is placed so as to rest upon the fabric immediately over the knocking-over wheel G , being firmly pressed thereon by the spring Y' , to which it is attached, said spring being secured to the bed A by the screw Y^2 . In this position the brush causes the ends of the yarns to be carried upward and clear of the needles, preventing any engagement therewith. By loosening the screw Y^2 the brush may be swung about its pivot out of the way of the operator when adjusting the parts of the needle-heads B B' , or when commencing a new tube of knitting.

In another application of mine, filed in the United States Patent Office January 31, 1882, is shown and described a revolving brush for the same purpose as my present stationary brush, which latter is a great improvement upon my former invention, for the reason that it is much cheaper, more readily removed or adjusted, and, in fact, works better.

What I claim as new is—

1. The combination of two or more yarn-guiding levers, two or more reciprocating cam-bars, mechanism connecting the cam-bars with the yarn-guiding levers, two or more pawls arranged to engage with and move said bars, mechanism for reciprocating said pawls,

a pattern-chain provided with two or more longitudinal rows of holes, having set therein pattern-determining pins adapted to operate said pawls, and mechanism for operating said pattern-chain, substantially as and for the purposes described.

2. The combination of two or more yarn-guiding levers, two or more reciprocating cam-bars, mechanism connecting said cam-bars with the yarn-guiding levers, two or more pawls arranged to engage with and move said bars, two or more pivoted dogs, each carrying at its free end one of said pawls, two or more springs for pressing the free ends of said pawls upward, mechanism for reciprocating said dogs and pawls, two or more lugs—one to each of said dogs—two or more pins adapted to co-operate with said lugs to raise said dogs, and mechanism for raising and lowering said pins, substantially as and for the purposes described.

3. The combination of two or more yarn-guiding levers, $f f'$, &c., two or more reciprocating cam-bars, $b b'$, &c., mechanism connecting the cam-bars with the yarn-guiding levers, two or more pins, $b' b''$, the cam-bar e , provided with the plate e' , and bracket e'' , and the reciprocating bar Q , provided with the shoulder e^3 , substantially as and for the purposes described.

4. The combination of the bar Q , the cross-piece g^2 , two or more pawls, $g^1 g^i$, pivoted thereto, two or more reciprocating cam-bars, $b b'$, &c., two or more yarn-guiding levers, $f f'$, &c., mechanism connecting the cam-bars with the yarn-guiding levers, the forked bracket Q^2 , the eccentric cam-wheel Q' , and the shaft P' , substantially as and for the purposes described.

5. The combination of two or more yarn-guiding levers, $f f'$, &c., two or more reciprocating cam-bars, $b b'$, &c., mechanism connecting the cam-bars with the yarn-guiding levers, two or more pawls, $g^1 g^i$, the bar Q , for reciprocating said pawls, the forked bracket Q^2 , the screws $i i'$, the slots $i'' i'''$, the eccentric cam-wheel Q' , and mechanism for rotating said cam-wheel, substantially as and for the purposes described.

6. The combination of two or more yarn-guiding levers, $f f'$, &c., two or more reciprocating cam-bars, $b b'$, &c., mechanism connecting said cam-bars with the yarn-guiding levers, two or more reciprocating pawls, $g^1 g^i$, two or more pins, $h h'$, the stand R , the shelves $j j'$, the pins $j^2 j^3$, the springs $j^3 j^4$, and mechanism for raising said pins, substantially as and for the purposes described.

7. The combination of a pattern-chain pro-

vided with two or more series of holes, each series consisting of two or more longitudinal rows, two or more series of removable pins, $l l'$, set therein, one or more pins or rods, h , arranged above said chain, one or more pawls, g^1 , means for reciprocating said pawls, one or more cam-bars arranged to be acted upon and moved by said pawls, a series of ratchet-teeth formed upon the outer surface of said chain, a reciprocating pawl arranged to act upon said teeth to impart to said chain an intermittent longitudinal motion, and mechanism for intermittently moving said chain transversely, all arranged and adapted to operate, substantially as and for the purposes described.

8. The combination of the pattern-chain S^4 S^5 , the pin T^2 , moving therewith, the toothed wheel T , the elevations n , n' , and n^2 thereon, the carriage S^3 , the toe m , secured thereto, and adapted to be pressed against the elevations n , n' , and n^2 , and means for moving the pattern-chain lengthwise, substantially as and for the purposes described.

9. The combination of the intermittently-moving pattern-chain $S^4 S^5$, the carriage S^3 , the toe m , the spring m^2 , the cam-wheel T , provided with the elevations n , n' , and n^2 , and means for moving said cam-wheel T a given distance about its axis with every revolution of the pattern-chain, substantially as and for the purposes described.

10. The combination of the bevel gear-wheel O , the driving-shaft C , the bevel gear-wheel P , provided with the groove P^8 , the bracket P^7 , the collar P^5 , the pins $q q' q'' q'''$, the spring P^6 , adapted to cause the engagement of said pins $q q'$ and $q'' q'''$ when disengaged, and the rod or plunger W^2 , all arranged and adapted to operate, substantially as and for the purposes described.

11. In combination with a circular series of needles arranged to be moved about a common axis, and a knocking-over wheel, the brush Y , mounted upon the spring or yielding support Y' , in a position in contact with said needles at a point in close proximity to the knocking-over wheel, and adapted to brush the ends of the yarns away from the needles and prevent them from being knit into the work, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 12th day of September, A. D. 1883.

JOHN BYFIELD.

Witnesses:

WALTER E. LOMBARD,
E. A. HEMMENWAY.