(No Model.) 8 Sheets—Sheet 1.

J. J. ADGATE.

WEFT THREAD KNITTING LOOM.

No. 265,296. Patented Oct. 3, 1882.

Fig. 1.

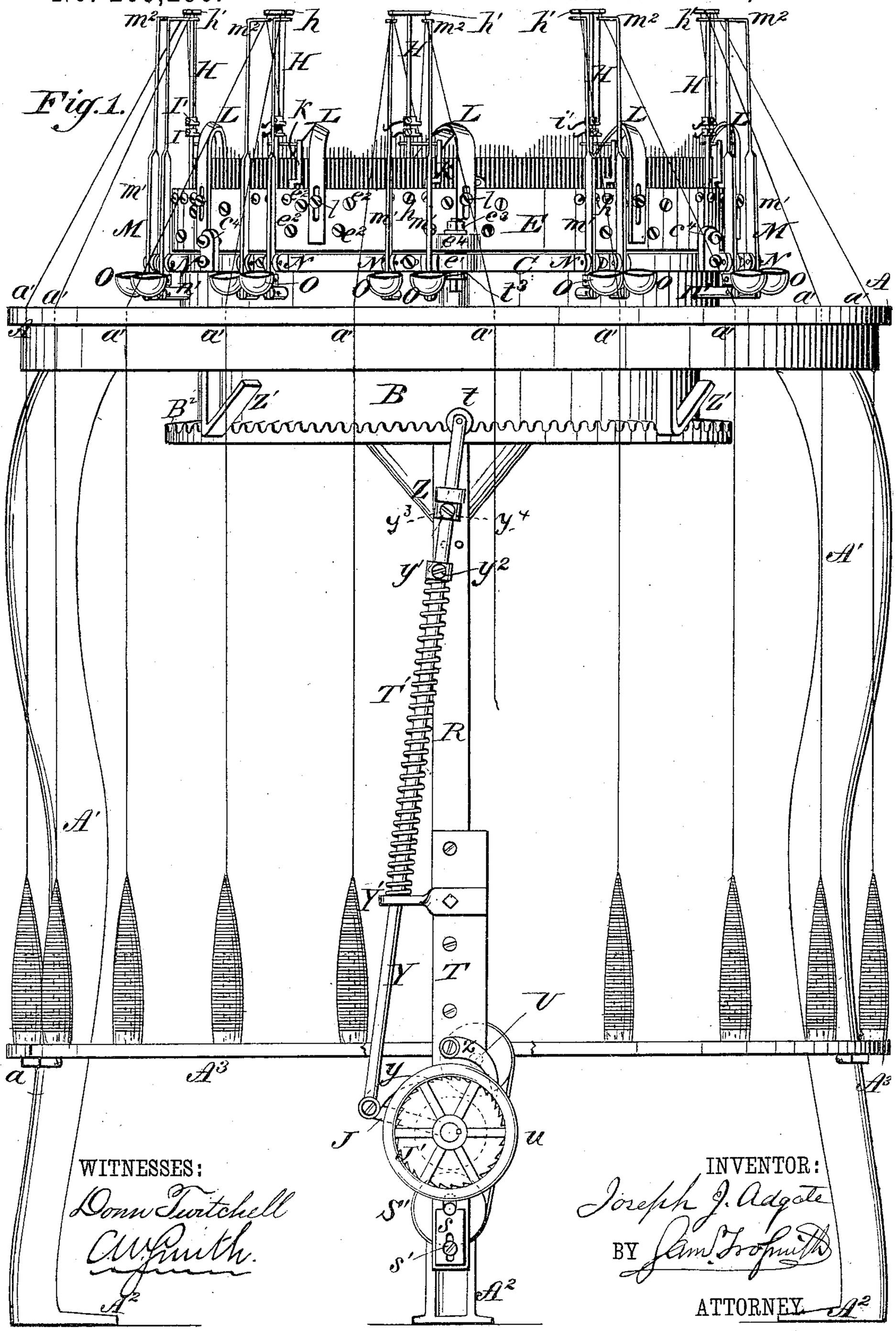

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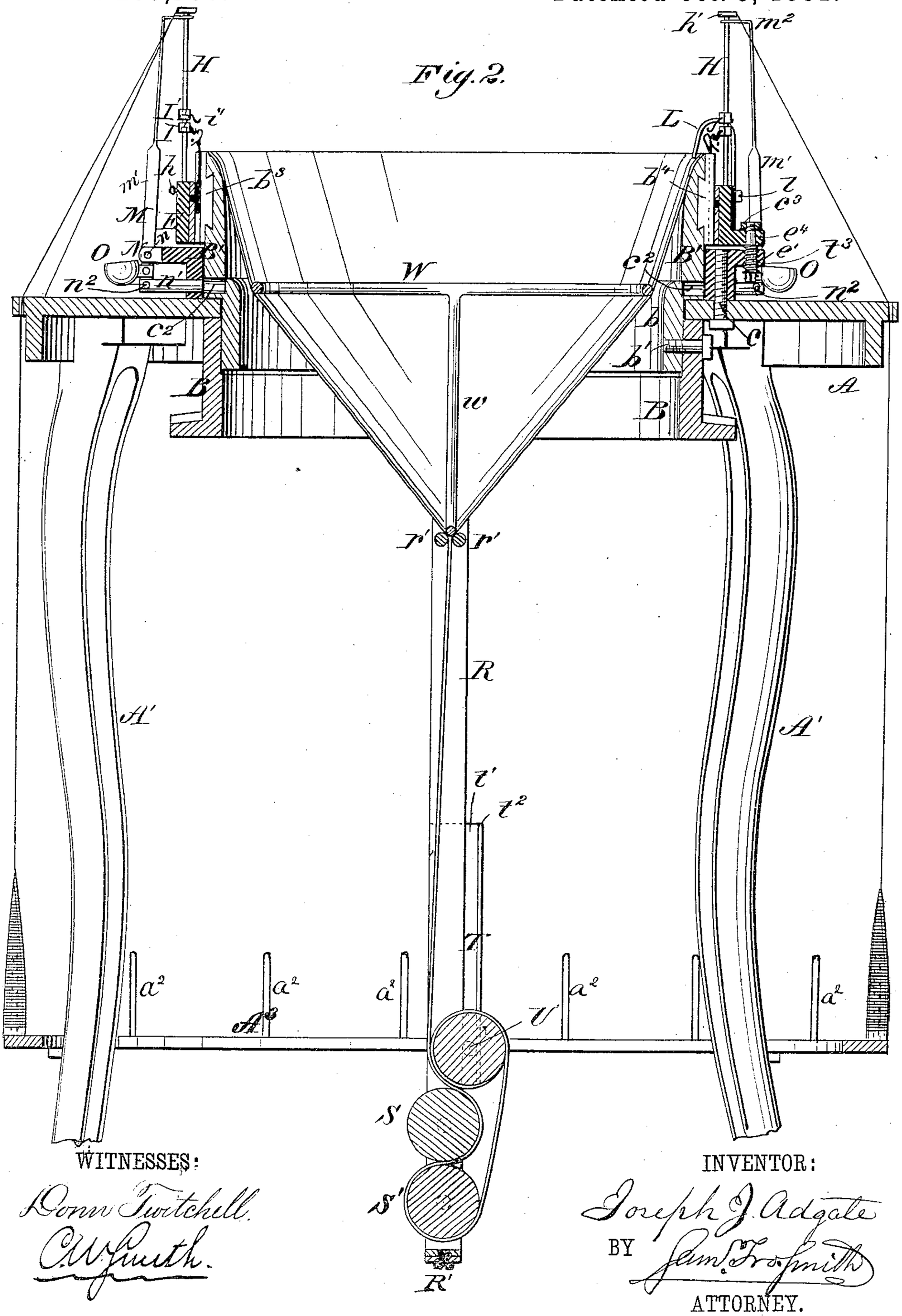
Fig. 2.



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No. 265,296. Patented Oct. 3, 1882.

Fig. 3.

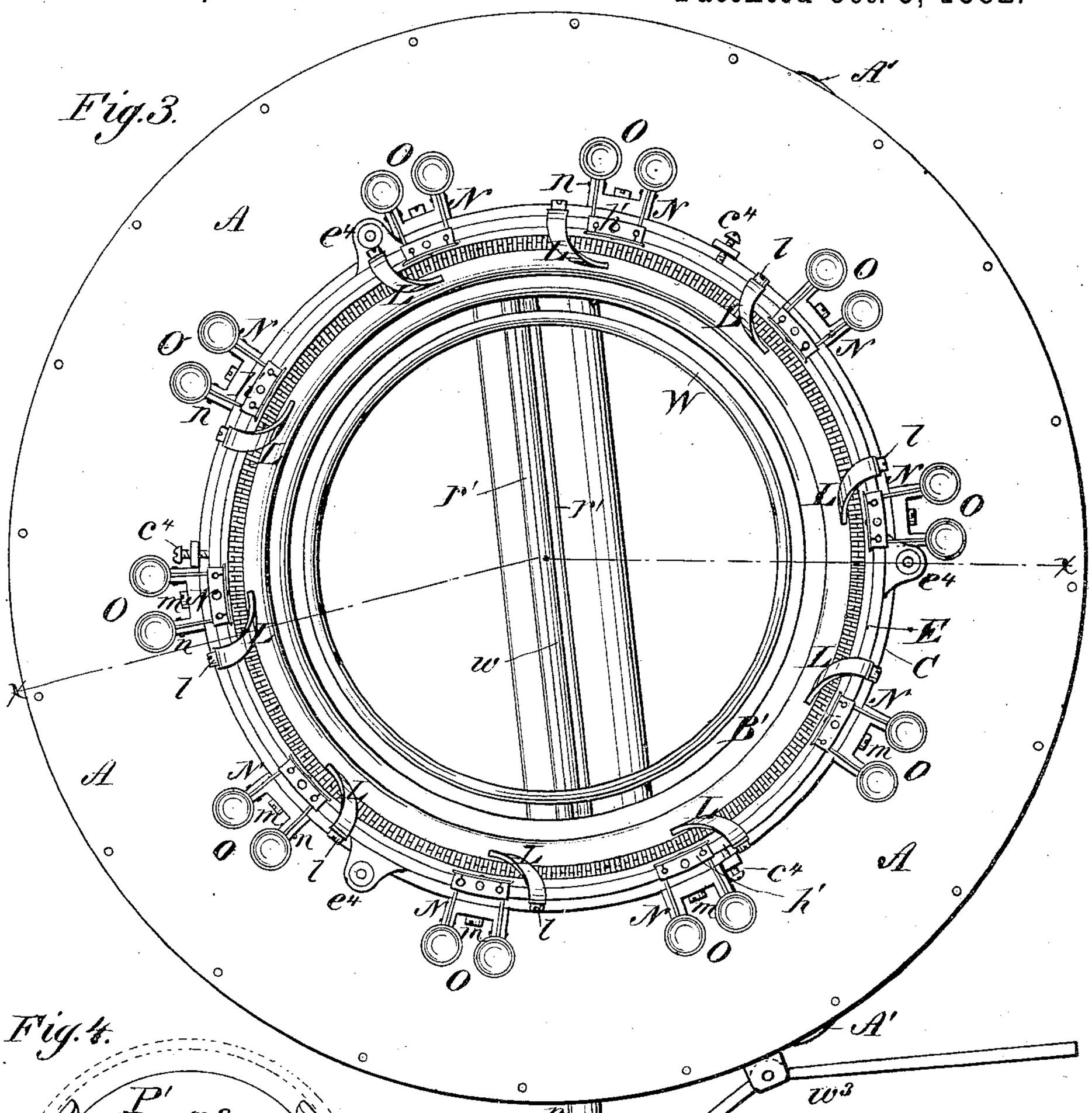
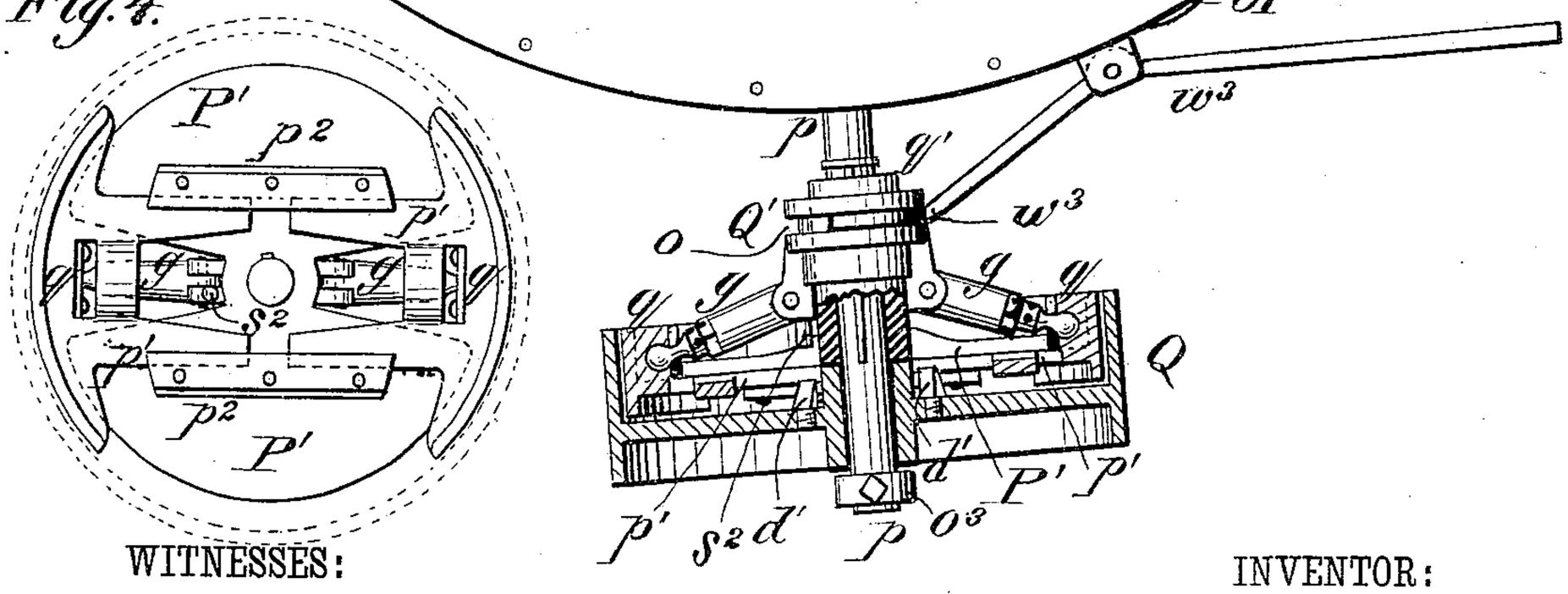


Fig. 4.



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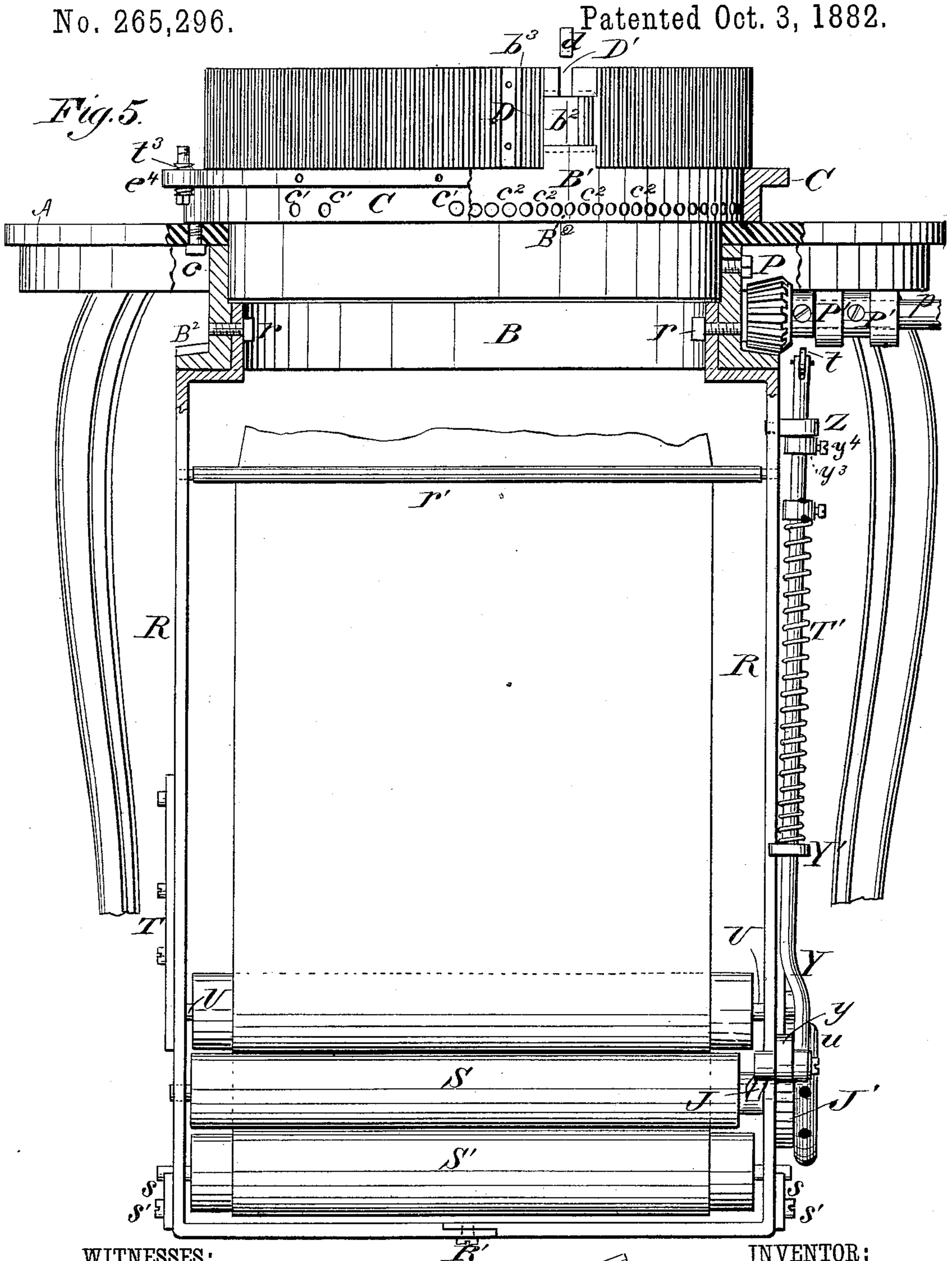
WEFT THREAD KNITTING LOOM.

No. 265,296. Patented Oct. 3, 1882.

Fig. 5.



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WEFT THREAD KNITTING LOOM.

No. 265,296. Patented Oct. 3, 1882.

Fig. 6.

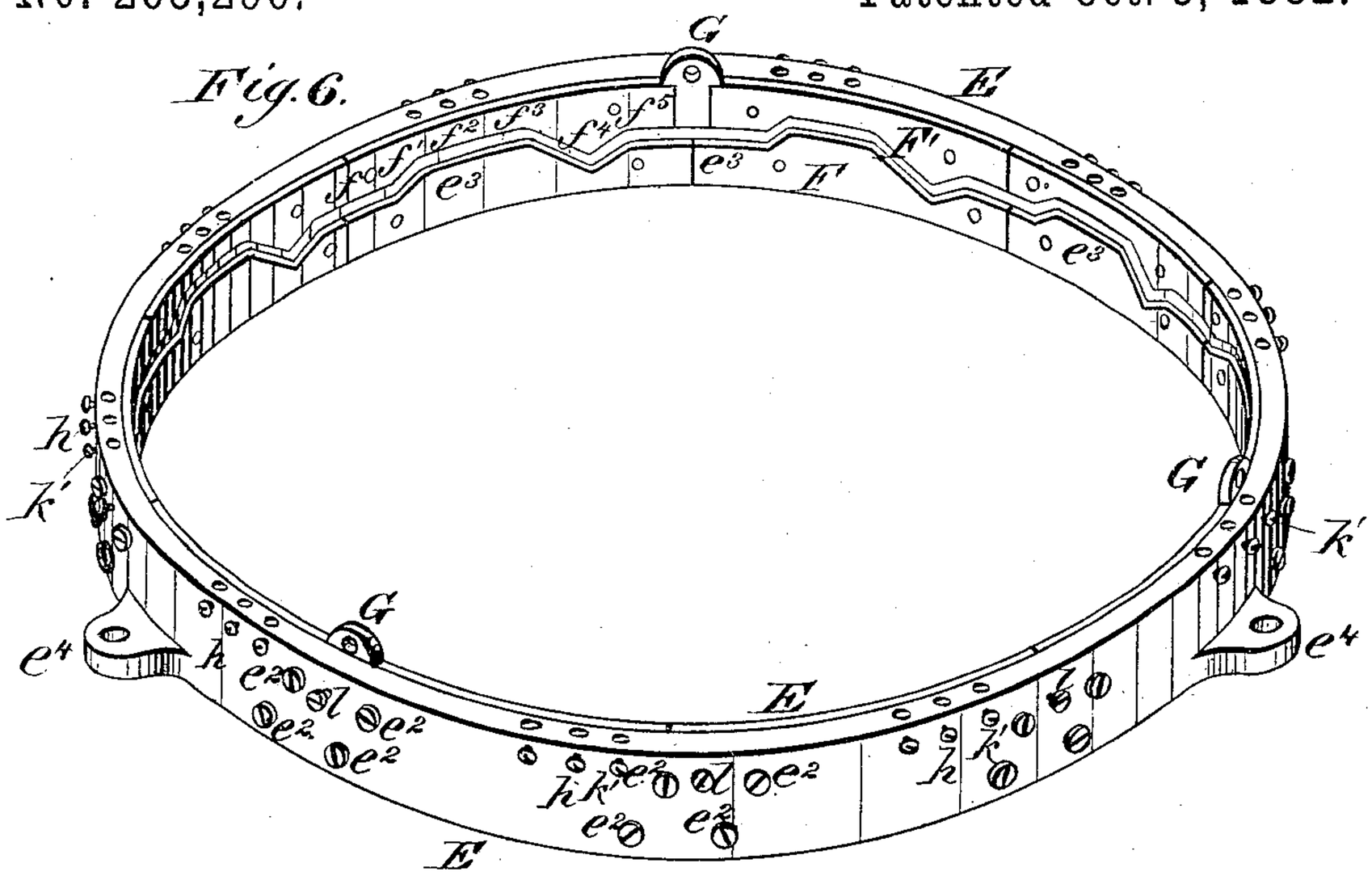


Fig. 9.

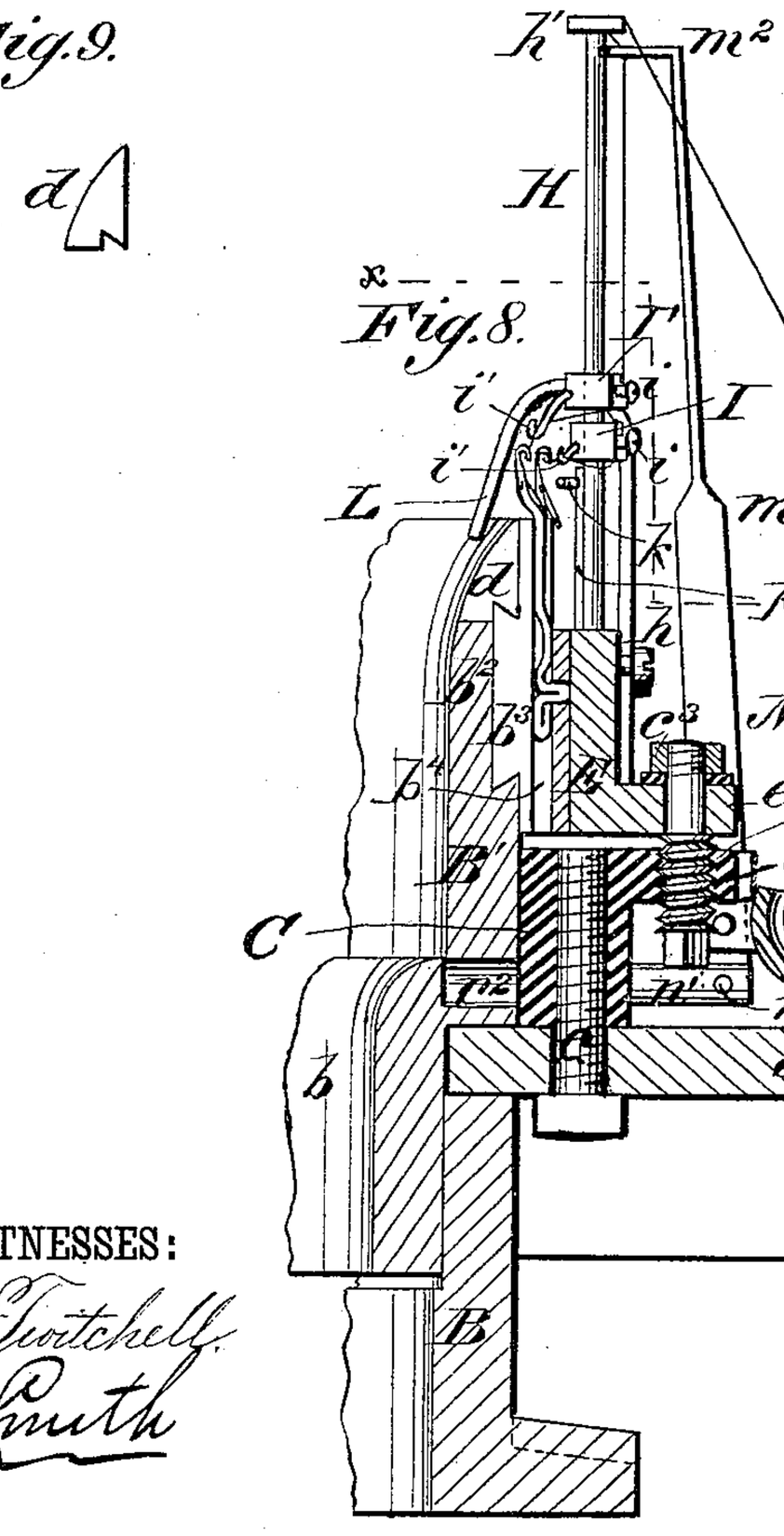
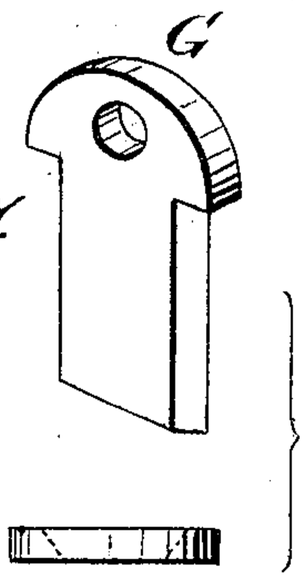


Fig. 8.

Fig. 7.



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J. J. ADGATE.

WEFT THREAD KNITTING LOOM.

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Fig. 10.

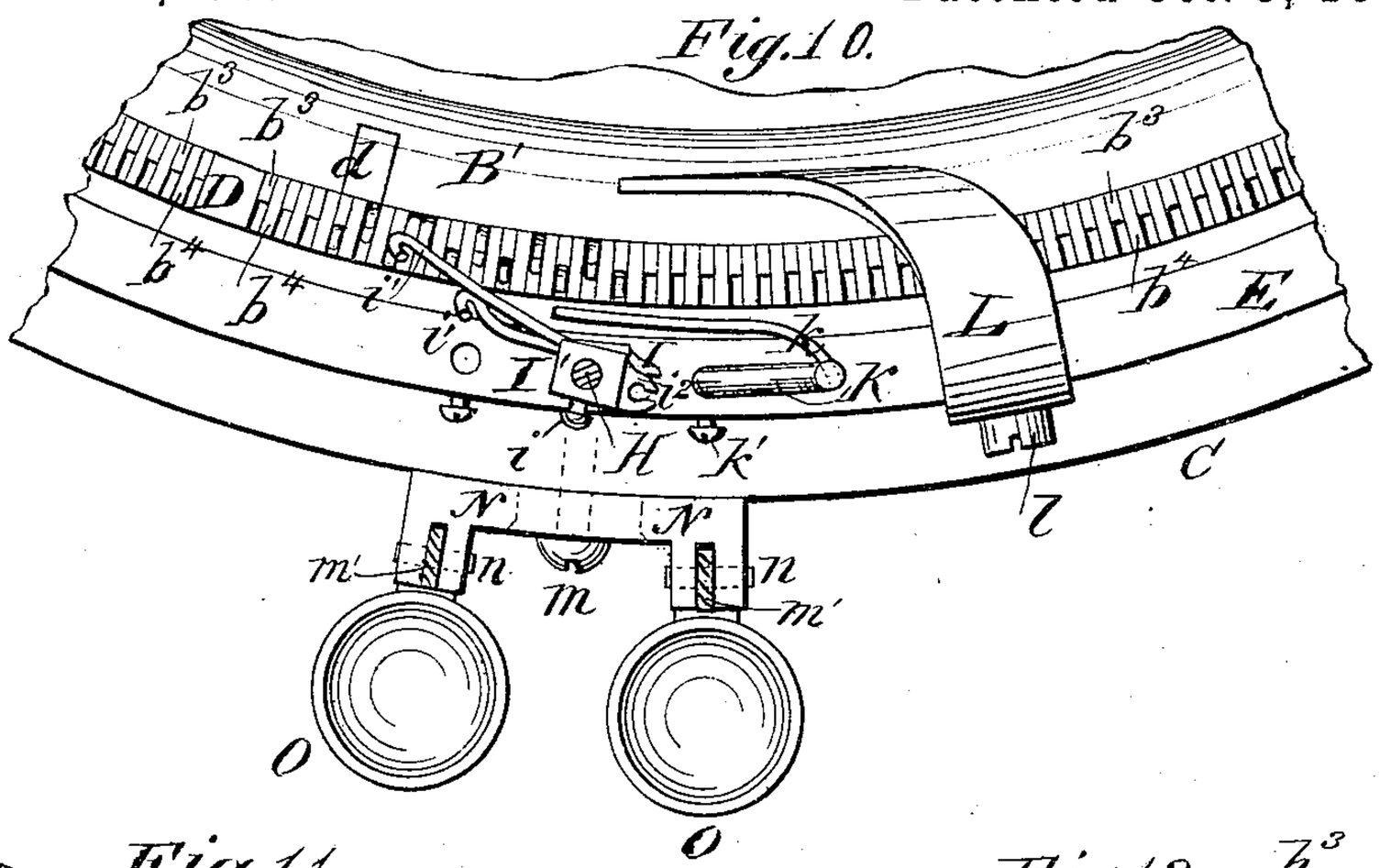

Fig. 11.

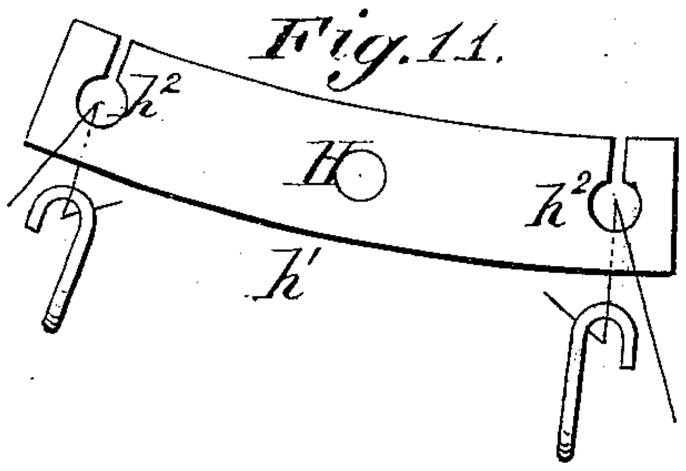

Fig. 12.

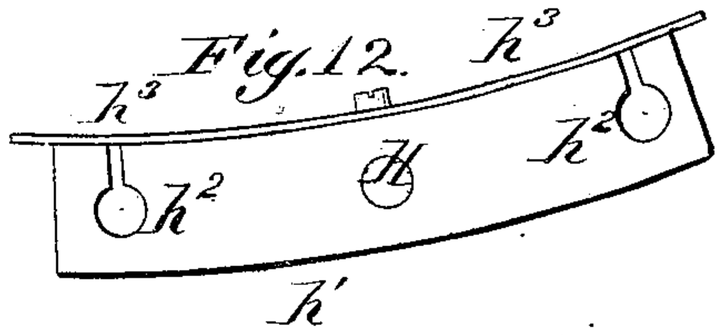

Fig. 13.

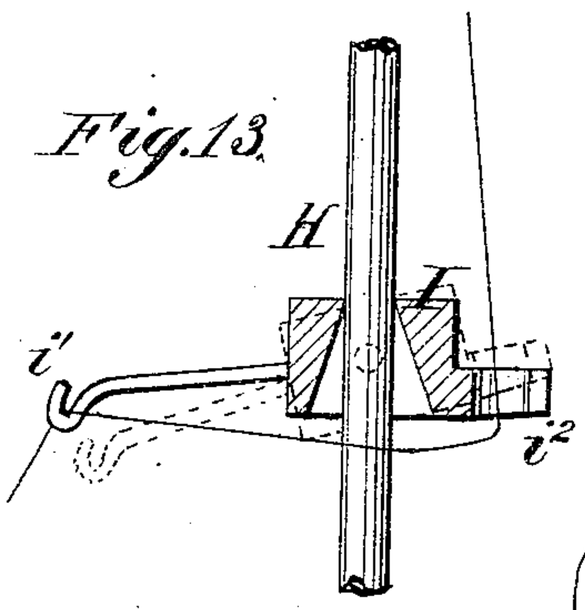

Fig. 14.

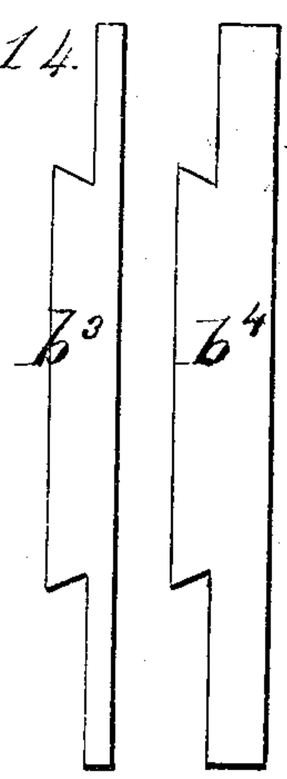

Fig. 15.

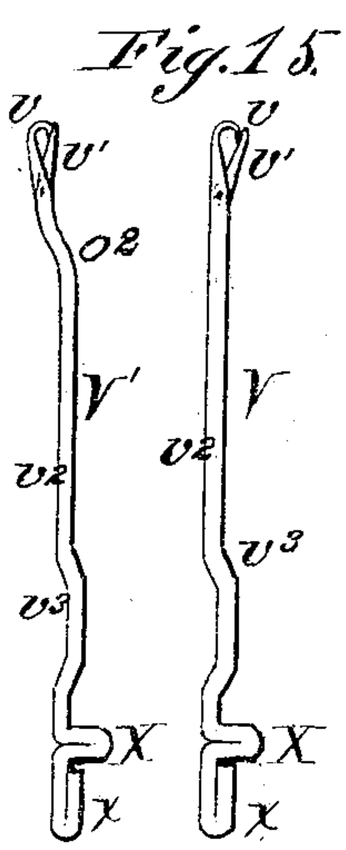

Fig. 16.

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WEFT THREAD KNITTING LOOM.

No. 265,296. Patented Oct. 3, 1882.

Fig. 17.

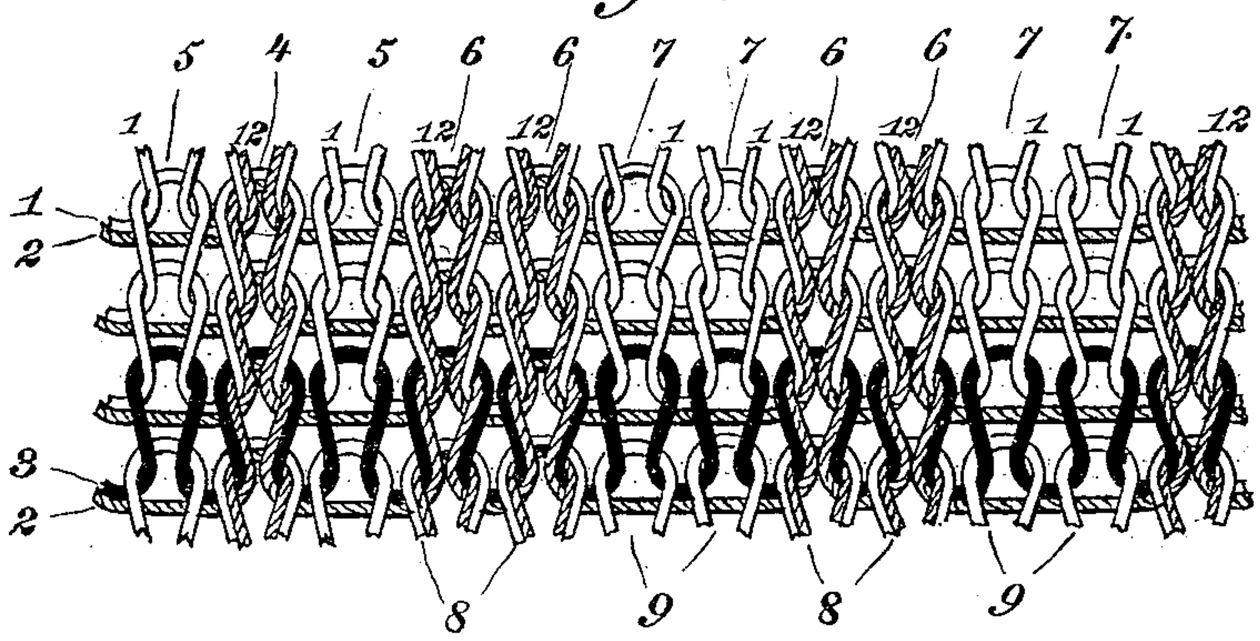
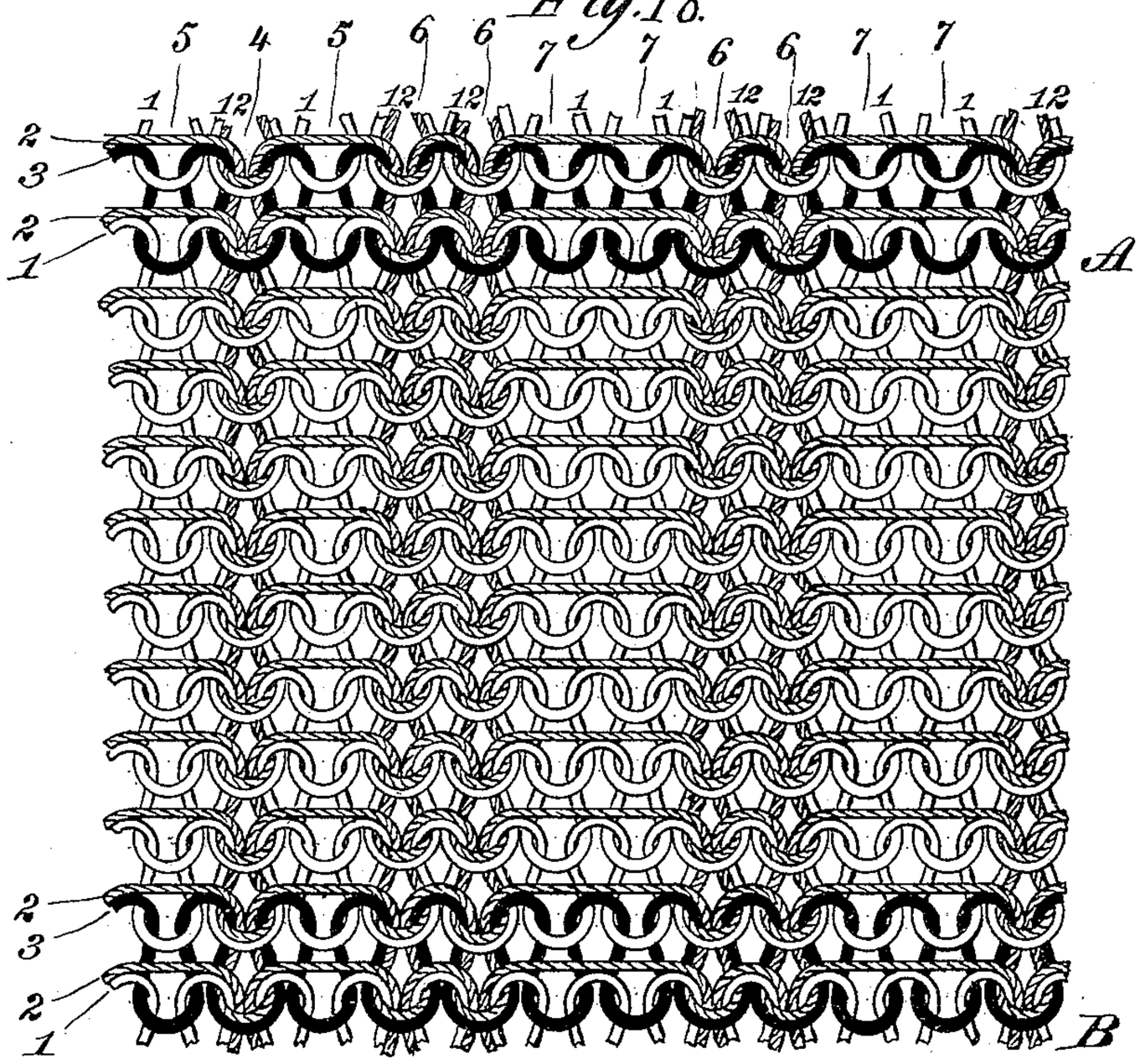


Fig. 18.



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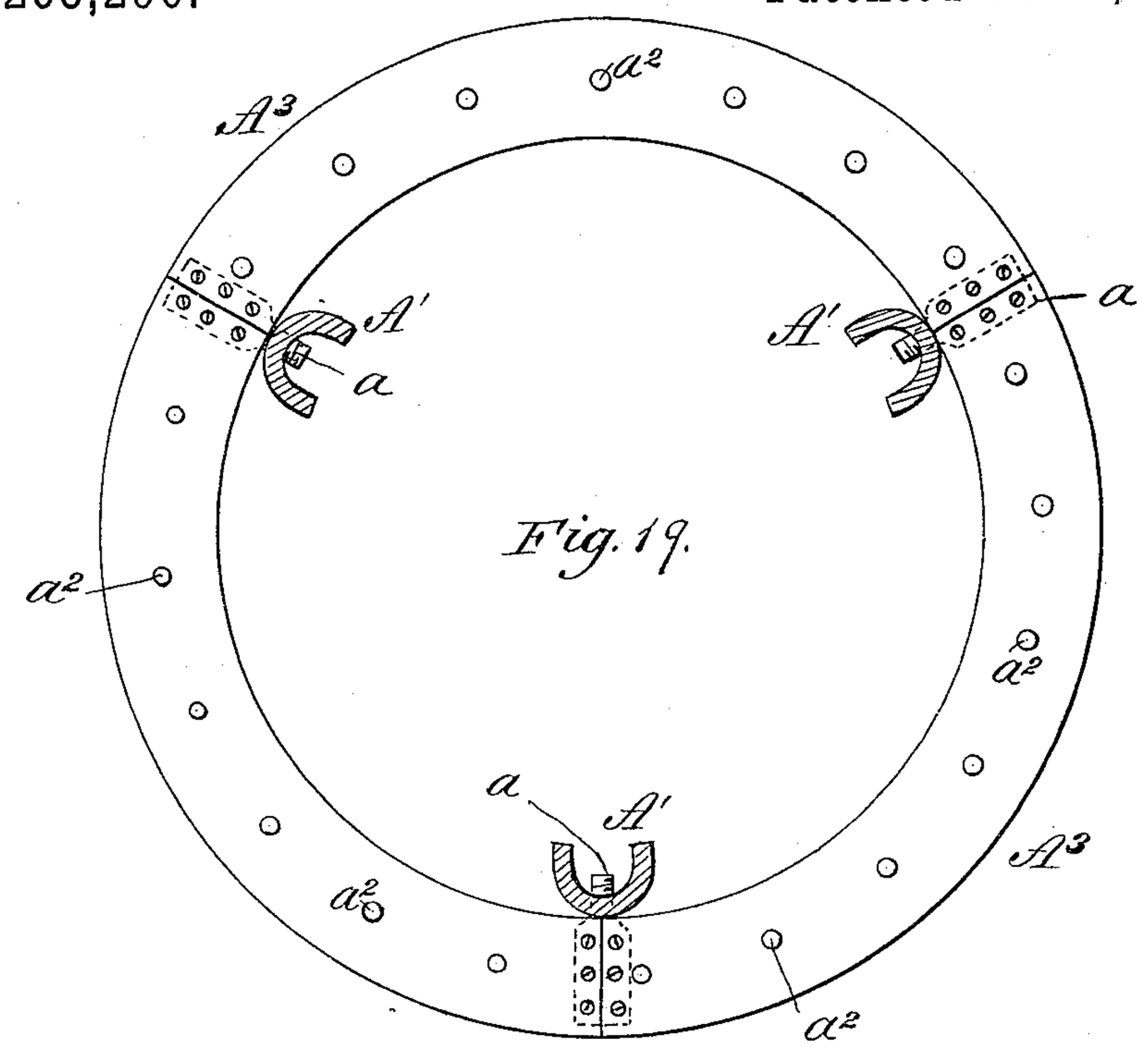

Fig. 19.

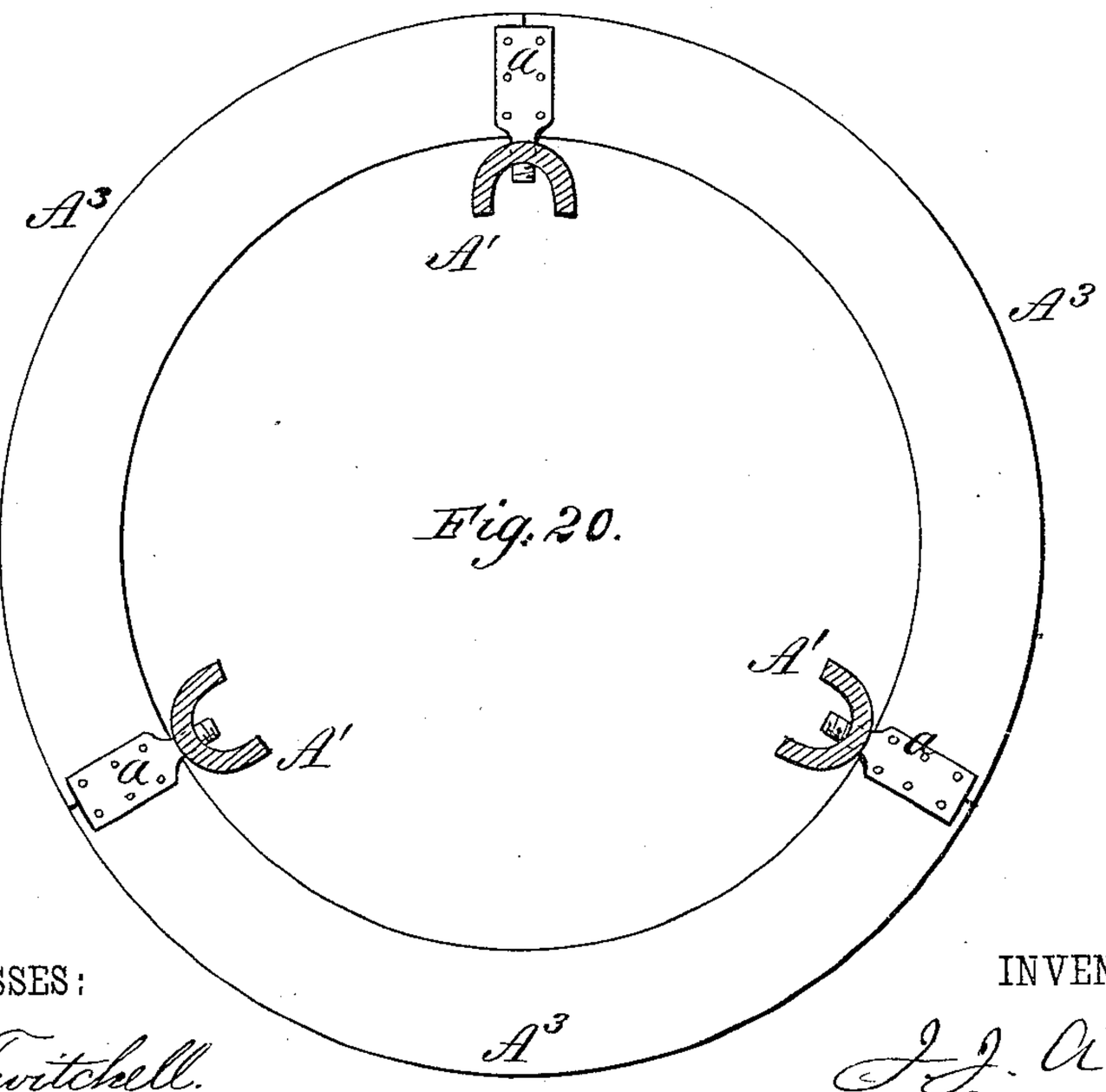

Fig. 20.

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UNITED STATES PATENT OFFICE.

JOSEPH J. ADGATE, OF NEW YORK, N. Y.

WEFT-THREAD KNITTING-LOOM.

SPECIFICATION forming part of Letters Patent No. 265,296, dated October 3, 1882.

Application filed July 20, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH J. ADGATE, of New York city, New York, have invented a new and useful Improvement in Weft-Thread Knitting-Looms, of which the following is a specification.

My invention consists, first, in an improved thread-standard and thread-guides; second, in an improved stop-motion mechanism; third, in an improved take-up device; fourth, in an improved cloth-guide in connection with the take-up mechanism, all substantially as hereinafter set forth.

My invention will be hereinafter described in connection with other mechanism of the machine, and is illustrated in the accompanying drawings, in which—

Figure 1 is a side view of the loom ready for use, with the needles in place and yarn supplied from bobbins, showing the cloth after it leaves the cylinder, and an end view of the take-up mechanism. Fig. 2 is a sectional side view of the loom on the line *x x* of Fig. 3, showing the cloth on the inside of the cylinder held in position by the adjusting cloth-guide W as it leaves the cylinder on its way to the take-up. Fig. 3 is a top view of the loom. Fig. 4 is an end view of a part detached. Fig. 5 is a side view of the loom with the cam-cylinder removed and a portion of the ring C, table A, cylinder B, and take-up cut away so as to represent portions thereof in section, showing the cylindrical holes in the ring C, and the corresponding holes in the cylinder B′, in which the pin *n′* of the stopping device operates, and the manner in which the pinion engages the cogs on the flange at the bottom of the cylinder B, with a side view of the take-up mechanism, and the means of inserting and securing the plates which form the needle-channels; also, the bent metal rod *u′*, which serves as a hand-lever to turn the hand-wheel *u*. Fig. 6 is a perspective view of the cam-cylinder, with the gates for inserting the needles shown in place therein. Fig. 7 is a perspective and plan view of the gate removed from the cam. Fig. 8 is a sectional view of a portion of the table, the cylinder B, the ring C, and the cam-cylinders B′, showing the manner in which the several parts are secured together, and the relative position of the plates b^3 b^4, and the needles and stopping device, and the means of adjusting the stitch and conducting the thread from the bobbins to the needles. Fig. 9 is a side view of the key which secures the plates b^3 and b^4 in place after their insertion in the groove of the cylinder B′. Fig. 10 is a top view of a part of the loom, showing the standard H in section, as at the line *x x*, Fig. 8. Fig. 11 is a top view of the cross-bar on the thread-guide standard, showing the slotted holes for receiving the thread; Fig. 12, a view corresponding to that in Fig. 11, but showing also a spring or springs for preventing the thread from getting out of place when the loom is in operation; Fig. 13, a section of the thread-guide and clamp on the standard, showing the method of adjustment by means of a tapering hole and set-screw; Fig. 14, side views of plates marked b^3 and b^4; Fig. 15, side views of different forms of needles used in the machine; Fig. 16, a view in section showing a modified form of the needles and the means for locking the cylinder B to the fixed ring C, and other parts designated by letters and hereinafter described. Fig. 17 is a view of the right side of the fabric made on the loom with the needles set in the following order, beginning on the left hand: first, a straight needle, 1; second, a crooked needle, 1 2, showing the front thread taken with the rear or locking thread; third, a straight needle, 1; fourth and fifth, crooked needles; sixth and seventh, straight needles; eighth and ninth, crooked needles; tenth and eleventh, straight needles; and twelfth, crooked needles. Fig. 18 is a view of the "wrong" side of the fabric, showing the result of the same order of setting the needles and the quantity of fabric made by one revolution of the cylinder and two stitches on the next revolution. The white line 1 represents a white front thread. The hatched line 2 represents a white rear or locking thread, and the black line 3 represents one colored front thread used with the nineteen white ones. The fabric is represented as very open, the width of the stripe from A to B on Fig. 17 being, when closely knitted, about five-eighths of an inch. Fig. 19 is a plan view of the bobbin-shelf and fastenings, showing the legs in section, and the pins which hold the bobbins, with dotted lines representing the plates which secure the shelf to the legs of the table. Fig. 20 is a view of the bottom of the same, showing the plates

and their connections with the legs, which are shown in section.

The same letters refer to similar parts throughout the several views.

I will now proceed to describe the machine as follows:

The frame consists of a table, A, made of cast-iron or other suitable material, supported by legs A′, which legs A′ are also provided with feet A^2, which may be fastened to the floor by bolts, screws, brackets, or other suitable means. The legs A′ are also provided with a shelf or platform, A^3, on which the bobbins that supply the yarn are placed, running loosely on studs or pins a^2, which project above the surface of the shelf and correspond in number with the number of threads to be used in the cloth to be made. The shelf A^3 is preferably of wood, and is constructed in three parts, being sections of a flattened ring, with close-fitting joints opposite the centers of the legs A′ of the frame, and joined together by being bolted or secured to iron plates *a*, having their inner ends in the form of bolts, which are screwed into holes in the legs A′; or they may pass through the holes in the legs and be secured on the inner surface of the legs by means of nuts. The outer edge of the table is pierced with as many small holes *a′* as there are threads to be used on the loom.

In the center of the table A, in a circular hole, is placed a cylinder made of cast-iron, the circumference of which is equal to the width of cloth to be made on the loom. This cylinder consists of two parts, one part, B, extending below the table, its lower edge being flanged and provided with cogs, and its upper edge coming up to the lower surface of the table. The other part, B′, extends above the table and rests on the edge of the table adjacent to the circular hole in which the cylinder revolves, having a flange, *b*, which extends down and into the upper portion of part B, to which it is firmly fixed by means of the bolts *b′*. The outer opposite surfaces or sides of the cylinder B′ are made parallel and turned to a true circle, being provided around its circumference with a dovetailed groove or depression, b^2, for receiving the plates b^3 and b^4, which constitute the channels in which the needles play. The upper portion of the cylinder rests and turns on the flat surface of the table A, as seen in Fig. 8. It may, however, if desired, be constructed at the point of contact in the form of a V, with a corresponding groove in the upper surface of the edge of the table, by which means the cylinder will be made to move more accurately in its revolutions, and will the more easily be kept properly lubricated, the channel forming a reservoir for the oil. On the lower part of this cylinder is a line of holes, c^2, near together, and extending around the whole circumference of the cylinder, as seen at B^2 in Fig. 5. The construction of the cylinder as above described is not herein claimed.

Upon the top of the table A, and outside of the cylinder B′, is affixed firmly by bolts *c* a solid iron ring, C, turned to match the cylinder B′, and placed as close to it as possible without impact. In the ring C are two holes, *c′*, under each heading on the loom.

Upon the outer surface of the cylinder B′, and at right angles to and fitted in the dovetailed groove b^2, is affixed an abutment-bar, D, made of steel, by bolting or riveting it firmly to the cylinder, projecting about one-fourth of an inch beyond the outer surface or circumference of the cylinder, and being about one-fourth of an inch in thickness, more or less, according to the size of the loom.

Plates of steel b^3 and b^4 are constructed of the proper thickness to make channels for the needles, and about three inches in length, with one edge dovetailed near both ends to match the dovetailed groove b^2 in the cylinder B′. Half of these plates b^4 are made of a width to cause them, when in place, to project about one-fourth of an inch, the same as the abutment-bar D. The other half, b^3, are made about one-eighth of an inch narrower, care being taken to have the plates b^4 of the proper thickness to regulate the closeness of the fabric which is desired to be made on the loom, and also to have the plates b^3 of such thickness as to make the needle-channel of the proper width to fit the needles to be used. It will be observed that the width of the needle-channel will depend on the thickness of the narrow plates b^3, and that the spaces between the needles will be regulated by the thickness of the wide plates b^4. These plates are placed in the dovetailed groove b^2—first a narrow one, b^3, and then a wide one, b^4, and so on alternately—and driven firmly against the abutment-bar D until the whole circumference of the cylinder is supplied, the last one being driven in firmly at the opening D′, and secured in place by means of the key *d*. The side plates, b^4, which form the flanges or divisions between the needle-channels, are made square at the top, and of a width sufficient to form a support for the stitches when the needles descend, and thus assist in casting off the stitches. They may, however, if desired, be narrowed down to any desired width which will accomplish this purpose. The length of the plates b^3 and b^4 is regulated by the size of the loom. The top must come up flush with the top of the cylinder B′, and the bottom extend down nearly to the top of the ring C, leaving, however, a small space between them and the ring to avoid friction and to receive any piece of broken needle or foreign matter that may pass down through the needle-channel. The abutment-bar D is left without channels, and serves to mark the proper place for cutting the knitted web of cloth, and to make a selvage when the cloth is fulled and dressed; but, if desired, it may be channeled for needles and made uniform with the balance of the cylinder.

On the outside of the cylinder B′, when so completed, is placed a cam-cylinder, E, which is attached to the ring C by means of the bolts t^2

passing through the lugs e' and e^4, and secured by the nut c^3.

On the inner side of the cam-cylinder E is constructed a cam-groove, e^3, extending around the entire circumference of the cylinder, as follows: The surface is divided into ten equal sections, each section to be the location of a heading which is to supply a weft and a rear or locking thread to the fabric to be knitted on the loom. A plate of steel, F, is prepared, about an eighth of inch in thickness, curved or bent so as to fit the inner surface of the cylinder, and adjusting the lower edge to the lower edge of the section. The upper edge is cut or formed as follows: At one end, f, the upper edge of the plate is about midway of the height of the section, extending parallel with the top of the section a short distance, the measurement being such that when the knee of the needle-shank rests thereon the top or hook of the needle will be high enough above the top of the cylinder B′ to have cleared the latch from the loop surrounding the needle. It then rises at f' on a gradual incline until the point f^2 is reached, where the top of a needle so placed will be about one inch above the top of the cylinder B′, or high enough to allow the bend in the crooked needle V′ to be free from impact with the cylinder and to free all the latches from the encircling loop. It then resumes its horizontal course along the cam-race until it arrives at the point f^3, or about one and a half inch, when it descends on an incline until it reaches the point f^4, where the top of the needle so placed will be enough below the top of the cylinder B′ to free it from the loop which was caused by the stitch taken in the needle-hook at the last heading. It then runs again on an incline until it reaches the exact height from the lower edge of the plate (indicated by f^5) at which the line was started from the other end of the plate, when it resumes its horizontal course to the end of the plate. Another similar plate, F′, is prepared, with its lower edge corresponding exactly in shape with the upper edge of the plate F. These plates are fixed to the inner surface of the section of the cam-cylinder E, by means of screws e^2, at such a distance apart as to make a proper cam-race, e^3. Each section being supplied with similar plates, a continuous cam-race is formed around the entire circumference of the inside of the cam-cylinder E. The cam-race may be carried, if desired, from the point, f^5 on the incline up to a height equal to the highest point, f^2, and the plates may be cast of steel and fitted to the cylinder; or they may be struck out of a steel plate of a proper thickness by means of dies in the ordinary manner, or by a die so arranged that a single plate may be cut in two parts on the cam-line, one part being used for the upper and the other for the lower plate of the section, the space between them constituting the cam-race; or, if desired, the sections may be made longer and include two or more headings of the loom in one section.

When the cam-plates are adjusted and fixed to the cylinder, at intervals around the same sliding gates G are placed, about three-fourths of an inch in width, with beveled edges, extending from the top of the cam-plates down to the cam-race, which gates may be removed and replaced, as desired, for the purpose of placing, removing, and replacing the needles. The gates G are placed on that portion of the cam where the cam-race runs parallel with the top of the cylinder, so as to avoid any danger of its interfering with the action of the needles when the loom is in operation, and also that it may be accessible between the headings.

I affix to the top of the cam-cylinder, at the point where the needles are highest, a rod or standard, H, about ten inches in length, by inserting it into a hole in the cam-cylinder and securing it by a set-screw, h. On the top of this rod is a cross-bar, h', having at each end a small slotted hole, h^2, to receive the yarn. The cross-bar h' may, if desired, be supplied with a spring, h^3, as seen in Fig. 12, to prevent the yarn from escaping therefrom.

On the rod H, I place two sliding clamps, I and I′, by passing the rod through a hole in the clamps just large enough to allow the clamp to slide up and down freely, and the clamp is secured at any desired point by means of the set-screw i. To each of these clamps, as shown in Figs. 8 and 13, is attached a wire formed at the end into a hook, i', properly arranged to carry the yarn and guide it to the hooks of the needles. The holes through the clamps I and I′ are tapering—that is, made larger at one end than at the other, as seen in Fig. 13—so as to allow considerable change of position of the hook without moving the clamp on the rod H. The bodies of the clamps I and I′ are provided with projections i^2, having in them slotted holes through which the yarn is passed before going to the thread-guide i'.

At the right of the standard H is affixed in the cam-cylinder E, by means of the set-screw k', a crank-shaped standard, K, having an arm, k, made of small elastic wire, extending behind the standard H and along the side of the needles, as a latch-guard to prevent the latches of the needles from flying up when the loop of the yarn slips from them. This guard is made of small elastic wire, which will bend so easily as not to injure the latch by contact, but be of sufficient resistance to cause the latch, when striking it, to resume its pendent position, the crank of the standard allowing considerable margin in the distance at which the guard can be placed from the needles by simply turning the standard in the hole in which it is secured by the set-screw k'. The crank-standard also enables one, in connection with bending the wire guards, to set them in any desired position readily. Still further to the right of the standard H, to the cam-cylinder E, by means of a set-screw, l, passing through a slot, is affixed a cloth-presser, L, consisting of a plate of steel so bent as to pass over, above, and be-

hind the needles, with its free end above the cloth, near the top of the cylinder B′, in such position as to prevent the cloth from being forced upward by the clinging of the loops to the needles. This cloth-presser is adjustable by means of the slot at the set-screw *l*, and the free end may be bent inward, so as to be as near the needles as desired.

Opposite to each heading I affix, by means of the screw *m*, a stopping device, M, which consists of a lever, *m′*, attached to the ring C by means of a bracket, N, and pivot *n*, terminating at its upper end in a hook, m^2, and having at its lower end a steel rod, *n′*, made to fit loosely in the holes *c′* and c^2, and so arranged as to move freely on the pivot n^2.

Above the pivot n^2 and below the pivot *n* is rigidly fixed a cup, O, of iron or other suitable metal, of sufficient weight to operate the lever *m′* by turning the upper end outward when it is not held in place by the yarn passing through the hook m^2 at its upper extremity.

For convenience in application I connect the two levers *m′*, which are to be used at each heading, in one bracket N, which is fixed in place by the screw *m* passing through a slot to make it adjustable, though, if desired, each lever may be constructed with a separate bracket.

If, from any cause, more weight should be required to operate the stopping device, the cup O serves as a receptacle for shot or other convenient weighting to any amount that may be required.

In use the steel rod *n′* is inserted in the hole *c′* in the ring C, when the bracket N is attached to ring C, and the hook m^2 at the top of the levers *m′* is made to engage the yarn as it leaves the cross-bar *h′* to pass to the thread-guide *i*. The line of holes c^2 c^2 c^2 in the cylinder B′ are made to correspond exactly in size with the holes *c′* *c′* in which the rods *n′* are inserted, so that when the yarn is removed from the hook m^2 and that end of the lever *m′* released the weighted cup O forces the rod *n′* against the surface of the cylinder B′ and into the first hole c^2 which comes before it, thus effectually locking the cylinder to the fixed ring C and stopping the loom instantly before another stitch can be taken, as hereinafter described.

The loom is connected with the power by means of a cogged pinion, P, on the end of a shaft, *p*, which has its bearings in lugs P′, which are cast on the under side of the table A, which shaft is fixed at the other end to a pulley, Q, around which the belt passes.

If it is required to operate the loom by hand, the pulley Q may be removed and a crank substituted in its place.

To avoid jar and strain on the loom when stopped and held by the stopping device, I arrange the pulley so that the stopping of the loom unclutches the pulley automatically and disconnects the power until it is reclutched at the pleasure of the operator, though the construction of the clutch itself is not a part of the present invention, the description herein given only being intended to show how it is to be applied to the knitting-loom herein described. This I accomplish as follows: The pulley Q is what is known as a "clutch" or "friction" pulley, and is provided with devices and arranged to connect or disconnect the same to or from the shaft *p*. It is constructed as follows: To the end of the shaft *p* is attached a disk or plate, P′, with two or more inwardly-forked segments, *p′*, fitted to slide radially between ribs p^2, cast on the face of the disk and held in place by caps riveted to the ribs. The outer edges of the segments *p′* are broadened into flanges the peripheries of which are made to fit in the inner side of the flange of the pulley Q, and are provided with projections *q*, which are connected to a sleeve, Q′, on the hub *q′* of the disk by means of adjustable arms *g* with joints at each end. The sleeve is provided with a groove, *o*, to receive a shipper-fork attached to a lever, w^3. The sleeve and inwardly-forked segments are so arranged relatively that when the sleeve is moved toward the disks the segments are forced outward and when moved from the disk the segments are drawn inward. The pulley Q is fitted loosely on the shaft by means of a hole through its hub, and is secured by means of the collar o^3, with its flange overlapping the flanges on the segments *p′*. The pulley Q is connected with the driving-shaft by a belt which passes around it and around a drum on the driving-shaft. (Not shown in the drawings.)

On the inner side of the disk of the pulley Q, and near the hub and in a circle around it, I affix, at equal distances apart, three inclined studs, *d′*, rising a short distance above the surface of the plate, by screwing them firmly into the disk. I also affix to the body of the sleeve Q′, near its connection with one of the arms *g*, a projecting stud, s^2, screwed firmly into said sleeve, and of such length of projection that when the sleeve Q′ is moved toward the disk P′, so as to force the segments *p′* against the inner surface of the pulley Q sufficiently to cause friction enough to operate the loom, the stud s^2 will come in close proximity to the inner surface of the disk of the pulley, and as the disk P′ revolves will strike and rest against the inclined surface of one of the inclined studs *d′*, the resistance of which assists the segments in clutching the disk P′ sufficiently to turn the shaft.

The stud s^2 may be so arranged that it may be made to project more or less at pleasure, so as to regulate the amount of force required to carry it over the inclined stud *s′*.

If desired, the above-described mechanism may be applied to two parts of the same line of shaft at a place other than the pulley, substituting a flanged cap fixed rigidly to the end of the shaft instead of the pulley, thus leaving the outer portion of the shaft to revolve when the clutch is released.

In operation, when the cylinder B is stopped suddenly by the stopping device the additional force which is thrown upon the stud s' causes the inclined stud d' to force it backward, carrying with it the sleeve Q', and thus automatically releasing the clutch of the pulley and allowing it to turn freely without imparting any motion to the loom until the sleeve Q' is again moved toward the disk P' by the lever w^3 forcing the segments p' outward and engaging the pulley sufficiently to again clutch the pulley and put the loom in motion.

For the purpose of taking up and winding in compact form the cloth as fast as it is made and at the same time giving the proper tension to the cloth at the needles, I attach to the bottom of the cylinder B, by the screw-bolts r, a frame made of wrought-iron, and consisting of two broad bars, R R, extending downward nearly to the floor, then turning at right angles, and meeting at the center R', where they are halved and firmly fixed together by means of screws. By this manner of construction the whole frame can be taken apart and removed with ease; or by removing the screw at R' and loosening one of the bolts r the rollers S and S' can be removed and replaced without difficulty.

At the lower end of the frame I place two friction-rollers, S and S', placed one above the other, having bearings in the bars R R, and being coated with emery or otherwise roughened on the surface to cause them to engage the cloth sharply. The lower roller, S', is so arranged in a slotted bearing that by means of the movable blocks or plates s it can be raised or lowered at pleasure and secured in the desired position by the set-screw s'.

To each of the bars R R, I attach an iron plate, T, extending from above the roller S to nearly half-way to the iron rods r', and projecting on one side beyond the edge of the bar R, and provided with a flange, t^2, which, with the edge of the bar R, makes a groove, t', which is open at the top.

In the grooves t' t', I place the ends of a rod, U, constructed of iron or other heavy material, which is allowed to slide down in the grooves, and is provided with a boxing on which is rolled the cloth to rest on the top of the roller S, and is not confined vertically above, but is allowed to rise up as the cloth-roll increases, until it is ready to be removed from the loom, which is done by cutting the cloth and raising the roll until the ends of the rod U are removed from the tops of the grooves t' t'. The rod U, except its journaled ends, which turn and slide in the grooves t' t', may be made square and boxed with straw-board or other suitable material in such manner that it cannot turn in the boxing, but can be easily withdrawn endwise therefrom. The said boxing should be made cylindrical, in order that the web rolled thereon shall have a cylindrical form and press evenly on the roller S below. It is used for the purpose of removing the web from the rod when the said web is large enough to remove from the loom. One end of the journal of the roller S passes through a hole in the end of the arm J, and then through a bearing in the bar R, and then through a ratchet-wheel, J', to which it is rigidly fixed, as also to a crank-wheel, u, on its outer end, which is provided with holes in its outer edge, into which the hand-lever w' may be inserted for the purpose of more easily tightening the cloth-roll when desired.

To the outer end of the arm J is pivoted a rod, Y, which passes up through a guide-link, Y', which is firmly riveted to the bar R, and extends upward through another guide-link, Z, also fixed to the bar R, to a point a little below the lower side of the table A, where its upper end terminates in a pivoted roller, t. On the pivot which attaches the rod Y to the arm J is placed a pawl, y, which engages the ratchet-wheel J' on its upper side.

To the bar R, directly over the ratchet-wheel J', is pivoted another pawl, z, which engages the ratchet-wheel on its side opposite to the arm J.

On the rod Y, near its upper end, is placed a collar, y', which can be moved up or down and fastened with a set-screw, y^2. Around the rod Y is placed a helical spring, T', which rests on the guide-link Y' at its lower end, being held in place at its upper end and its tension regulated by the collar y', which is adjustable by means of the set-screw y^2. Above the collar y' is another adjustable collar, y^3, which, being firmly fixed to the rod Y by its set-screw y^4, when forced up by the action of the spring T' impinges on the guide-link Z and limits the portion of the rod Y which extends above the guide-link Z, thereby adjusting the pivoted wheel t to engage the inclined studs Z' at a greater or less distance from their lower extremity, as may be desired to regulate the action of the pawl y.

On the under side of the table A, at equal distances apart, are placed, in the line of the pivoted roller t, four studs, Z', with inclined surfaces, against which the pivoted roller t strikes when the loom is in operation.

A greater or less number of studs Z' Z' may be used, according to the size of the loom, or other controlling circumstances.

The needles V and V' are constructed of ordinary steel wire of the best quality, as follows: On the top is a hook, v, with a latch, v'. Below the shaft v^2 is bent or bored out at v^3, so as to prevent the needle from turning in the needle-channel, below which it is bent at right angles, and the wire then turned back upon itself, forming a knee-like projection, X, to engage the wall of the cam-race, then bent again at right angles in a line with the shaft v^2 above the knee, and again turned back upon itself x nearly up to the knee X, thereby making an additional bearing to prevent its turning in the channel. The needle V is constructed with the shaft straight from the bend or bow

v^3 to the hook v. The needle V′ has the shaft v^2 straight from the bend or bow v^3 up to the point O^2, about half an inch below the hook v, where it bends backward and then upward, so as to throw the hook v out of a vertical line in the rear toward the inner surface of the needle-cylinder about a quarter of an inch. This construction of needle does away with the necessity of a jack, with its projection, to act in the cam-race, and also with the undesirable feature of soldering, which tends to weaken and injure the needles, and gives the desired length and strength with a good lateral bearing in the needle-channel, with the best possible knee to engage the cam, and all in one piece, which adds to the economy, strength, and durability of the needle.

For the purpose of keeping the cloth in proper shape when it leaves the needles and guiding it to the cloth-roll U, I construct an adjusting cloth-guide consisting of a ring of iron wire, W, a little less in diameter than the inside of the cylinder B′, with a bail-like appendage, w, which I place within the cylinder after the cloth has been passed down between the rods r' r', with the ring W resting on the cloth below the needles, and the bail-like appendage on or above the rods r' r' for the purpose of spreading and guiding the cloth on its way to the cloth-roll U.

For the purpose of regulating the length of the stitch the bolt t^3 is used for an adjusting-screw, by which the cam-cylinder E can be raised or lowered at pleasure, as seen in Fig. 8. The lowering of the cam-cylinder carries with it the needles, so that when the needle, having seized the yarn, is at the point where the previously-taken loop is cast off, the yarn is drawn down, so as to form a longer stitch than when the cam-cylinder is higher, and the needles consequently not drawn so low. Three of these adjusting-screws t^3 are provided, although the construction is not limited to any particular number, as a loom of large diameter will require more of these adjusting-screws than one of small diameter. The adjusting-screw t^3 is constructed as follows: Through the lug e' of the ring C is a hole provided with a screw-thread, in which hole is fitted the screw-bolt t^3, the upper end of which is smaller and passes through a smaller hole in the lug e^4 of the cam-cylinder, which it fits snugly. The bolt t^3 is turned down at the upper end, where it passes through the lug e^4, leaving a shoulder on which the lug e^4 rests, the smaller portion passing up through the lug e^4, where the cam-cylinder is secured in place by the nut e^3. When the bolt t^3 is turned up the shoulder carries up the cylinder E, and when it is turned down the cylinder E is lowered correspondingly.

To the ring C, at equal distances between the bolts t^3, is fixed a metal plate by screwing it firmly to the ring C, and through this plate are inserted the screws c^4, which extend through and project on the inside, so that they may be pressed against the inner surface of the cam-cylinder for the purpose of adjusting it and causing the needle-cylinder to revolve at equal distances from its inner surface at all points. This is accomplished by turning these screws c^4 inward or outward until the space between the two cylinders is equal on all sides.

The operation of the loom is as follows: The parts having been properly adjusted, the needles placed in the needle-chamber alternately, first a straight needle, V, and then a crooked needle, V′, with the knees X resting in the cam-race, the gates replaced, the bobbins of yarn (twenty in number) placed on the studs for their reception, alternating one of weft and one of locking thread, each yarn being passed through its guide-holes, first in the edge of the table, then in the cross-bar h', then through the slotted projections i^2 on the clamps I and I′, (shown in Figs. 13 and 8,) and then through the thread-guide i to the fabric in reach of the proper needle-hook v, and the fabric carried down between the rods r' r', around the roller S, between that and the roller S′, around that, and then attached to the cloth-rod U, and the "take-up" mechanism adjusted so that the pivoted roller t will strike the inclined studs Z′ at the proper height, and the helical spring T′ be supplied with the proper tension, and the adjusting cloth-guide W having been placed within the knitted fabric resting between and upon the rods r' r', and the hook m^2 of the stopping device being placed on the yarn and the power applied to the pulley Q by means of the lever w^3, the pinion P engages the cogs B^2 on the cylinder B, thereby turning the cylinder B′ from left to right, carrying the needles with it, which, following the direction of the cam-race e^2, in which their knees engage the cam, rise up in the needle-channels above the top of the cylinder B′, the needles V standing perpendicular, and the needles V′, having the projecting bend, disengaged from impact with the back wall of the needle-channel as they pass before the standard H, fall back in a line about a quarter of an inch in the rear of the top of the needles V. The yarn which passes through the slotted projections i on the clamp I′ at each heading is delivered by the thread-guide attached thereto between the two divided lines of needles and constitutes the weft-thread, while the yarn which passes through the slotted projections i on the clamp I at each heading is delivered by the thread-guide attached thereto in front of the front row of needles and constitutes the locking-thread of the fabric. As the needles pass the headings, the latches being down, they descend, and the hooks of the front needles seize the locking-thread and carry it down with them, while the needles of the rear line, as the bend o^2 comes in contact with the back wall of the needle-channel, move forward and seize the rear or weft thread, and, coming into line with the front needles, seize the locking-thread also, and both go down below the top of the cylinder B′. As they descend the

tops of the plates b^4 prevent the fabric from descending with them, and the loop which is already around the shaft of the needles below the latches is drawn up, closing the latch upon the hook and holding the stitch just taken until the rising loop is cast off, and by the tension of the knitted fabric, produced by the action of the take-up, drawn back sufficiently to allow the needle to rise without again passing through it. The needle then rises, forcing itself through the loop formed by the stitch it holds in its hook until the latch is freed from the loop, being assisted in the operation by the downward tension of the fabric and by the action of the cloth-presser E, under which it passes, and by which it is held down while the needle rises to the proper height. At this point the latch-guard *h* is placed, and if the latch flies up, as sometimes happens, it strikes against the elastic wire and falls back to its pendent position as the needle again rises at that heading to repeat the action above described. This operation is repeated at each heading, and when the needle-cylinder has made a full revolution the ten weft and ten locking threads have been incorporated in the knitted fabric so closely and intricately interlaced that when the fabric is properly finished raveling is impossible.

If, during the operation, from a weak spot, knot, or burr in the yarn, or from any other cause, one of the threads of the yarn should part, the upper end of the lever M, through which it passes, becomes disengaged and the weight of the cup O causes it to fall back, thus forcing the rod n' into the hole c^2 which happens to be before it, instantly stopping the motion of the cylinder B, and by the increased resistance of the pulley causing the inclined studs d' to force the stud s^2 backward, thus releasing the clutch of the segments p' upon the pulley Q and allowing the pulley Q to revolve without communicating motion to the loom, thereby releasing the loom from strain and pressure until the broken yarn is repaired, when a movement of the lever W^3 again applies the power, and the operation is resumed, as before.

If the stitch is too long, it may be shortened by raising the cam-cylinder by means of the screws t^3; or it may be lengthened to any practical degree by lowering the cam-cylinder by the same means.

If a thinner or less closely knitted fabric is desired, the side plates, b^4, are replaced by thicker plates of the same construction, thus lessening the number of needles in a heading, but retaining the same needles and the same width of needle-channel.

If a coarser or heavier fabric is desired, a larger or lower-gage needle should be used, and the narrow plates b^3 should be replaced by thicker ones, to correspond with the lower-gage needles.

It will be observed that by the use of colored yarn and a different arrangement of the colors a great variety of patterns can be obtained, limited only by the different combinations to be made with the twenty threads entering into the fabric. 7c

It will also be observed that as the crooked and straight needles can be alternated in many ways, as singly, or by twos, or threes, or in irregular succession, a great variety of styles can be made on the loom by simply changing the order of the needles.

It will also be observed that there is no limit to the width of goods that may be made on this loom, a loom one foot in diameter making cloth one yard in width, a loom three feet in diameter making cloth three yards in width, and so on to any practical size and capacity.

It will also be observed that more than two threads can be put in at a heading, as two or more threads may be supplied to each thread-guide and delivered together to each needle-hook by increasing the number of bobbins, and thus increasing the weight of the goods manufactured, and I do not confine myself to any specific number of threads.

In operating the loom it is necessary to have sufficient tension on the cloth to free the stitches from the needles as soon as they are cast off. This I accomplish by the take-up device, as follows: The roll of cloth, to which is added the weight of the bar U, rests firmly on the roller S and is turned by the friction of the roughened surface. The roller S′ having been pressed up against the roller S by means of the blocks *s* and secured in position by the screw *s′*, confining the cloth between the rough surfaces of the two rollers S and S′, while at the same time it is made to pass around both, all the power which is expended on the roller S is necessarily transmitted to the cloth as it comes from the needles at the same time that it serves to roll it upon the bar U. The power which turns the cylinders is also transmitted to the roller S by means of the inclined studs Z′, the rod Y, the pawl *y*, and ratchet J′, and this power can be regulated by means of the spring T′. If the tension be too light, the collar y^3 should be moved down, so as to cause a longer impact between the inclined studs Z and the pivoted wheel *t*, thereby giving a longer stroke to the arm J, causing the pawl *y* to pass over a greater number of teeth on the ratchet, and thereby turning the roller S more rapidly. The tension of the knitted fabric depending on the relative rapidity with which it is moved up on the roller S, compared with the rapidity with which it is constructed by the needles, the change of position of the collars *y′* and y^3 serves to regulate such tension. If the tension be too strong, the collar y^3 should be moved up on the rod in the same proportion.

If, from any cause, it becomes necessary to tighten the cloth or roll it up more rapidly than is accomplished automatically, it may be done by inserting the small lever *u′* into the holes in the periphery of the hand-wheel *u*, or by

turning the hand-wheel *u'* with the hands; and it may be loosened in the same manner by raising the pawls *y* and *z* and turning the hand-wheel *u* backward.

When the roll of cloth has become as large as desired it may be cut across between the roller S and the cloth-roll U (care being taken to leave enough on the loom to be attached to the bar U,) and removed by simply lifting the bar U out of the grooves *t'* and pulling it from the center of the roll, when it may be again replaced in the grooves *t'*, with the cut end of the cloth attached to commence a new roll.

With a loom of the size shown in the drawings at least ten yards of cloth per hour can be made. With the help of the stopping device one person can easily tend three or four looms.

By reference to Figs. 17 and 18 of the drawings it will be understood that at every alternate stitch of the fabric, when the needles are equally and alternately divided—that is, at every stitch taken by the rear needle—the stitch consists of two threads, while the intermediate stitches—that is, the stitches taken by the front needles—consist of one thread only, and that these double and single loops, as joined closely together, make a uniform surface which will full and finish with a smooth surface; but when two crooked needles are placed side by side, as indicated at 6 6, and two straight needles side by side, as indicated at 7 7, alternated in pairs, as the space between the rows of double stitches made by the two single threads is too wide to allow the others to close together, the double stitches of the two crooked or rear needles will form a rib or raised surface, as indicated at 8, Fig. 17, and the single stitches of the straight needles will result in a depression, as indicated at 9 in the same figure, the cloth being twice as thick at 8 as at 9, thus constituting what is called "ribbed cloth," which can be varied in style by changing the order of the needles.

Figs. 17 and 18 represent a fabric in which nineteen threads of white yarn and one of colored weft-yarn were used, making broad white stripes divided by a single colored thread. This stripe will be as wide as the twenty threads will make it, and will be reproduced at each revolution of the cylinder, and may be varied, by the use of colors, at the pleasure of the operator. A loom of ten headings will make a stripe of nearly an inch in width, and the greater the number of headings the wider will be the stripe which can be made. A loom of the proper width for knitting blankets would make a stripe of from two to three inches in width of any desired style or brilliancy.

An examination of the loom and the fabrics which can be made on it will show, as has also been demonstrated by its use, that the finest or coarsest qualities of underwear, broadcloth, cassimeres, fancy curtain-cloth, balmoral skirts, or blankets for the bed or for the lap, or for horses can be made from a single loom by simply changing the needles and channel-plates.

I am aware that devices of various kinds have been constructed for the purpose of stopping the cylinders of circular looms on the breaking of the yarn, and do not therefore claim the application of a stopping device, broadly.

Having thus described the loom as complete, and the various details of my invention, disclaiming all those parts which are shown and described and not claimed in this application, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the cam-cylinder, of a vertical standard, H, slotted cross-bar *h'*, clamps I and I', having tapering holes to receive the standard H, the set-screws *i i*, and thread-guides *i' i'*, as described and shown.

2. The combination, with the revolving needle-cylinder B, stationary cam-cylinder E, and series of needles, of the stopping device M, consisting of the vertical lever *m'*, bracket N, pivots *n* and n^2, rod *n'*, and cup O, as described and shown.

3. The combination, with the needle-cylinder and mechanism for revolving the same, and a table provided with inclined studs upon its under side, of a take-up device firmly fixed to and dependent from the bottom of said cylinder, and consisting of the frame R R R', rollers S S' and U, rods *r' r'*, rod Y, guide-link Y' Z, collars *y' y³*, movable blocks *s s*, screws *s' s'*, flanged plate T, arm J, ratchet-wheel J', pivoted roller *t*, pawls *y* and *z*, set-screws y^2 y^4, hand-wheel *u*, and spring T', as described and shown.

4. The combination, with the table A and cam-cylinder E, of the inclined studs Z', attached to the table A, the cylinders B B' and mechanism for revolving the same, frame R, fixed to the cylinder and provided with the rollers S S' and U, blocks *s*, screws *s'*, flanged plate T, rods *r' r'*, arm J, ratchet-wheel J', hand-wheel *u*, rod Y, guide-links Y' and Z, pawls *y* and *z*, collars *y' y³*, set-screws y^2 y^4, spring T', pivoted roller *t*, ratchet-wheel J, and bolts *r r*, as herein described and shown.

5. The combination, with the needle-cylinder B B' and the frame R of the take-up, of the adjusting cloth-guide W, consisting of a metallic ring with a bail-like appendage, as herein described and shown.

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Witnesses:
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