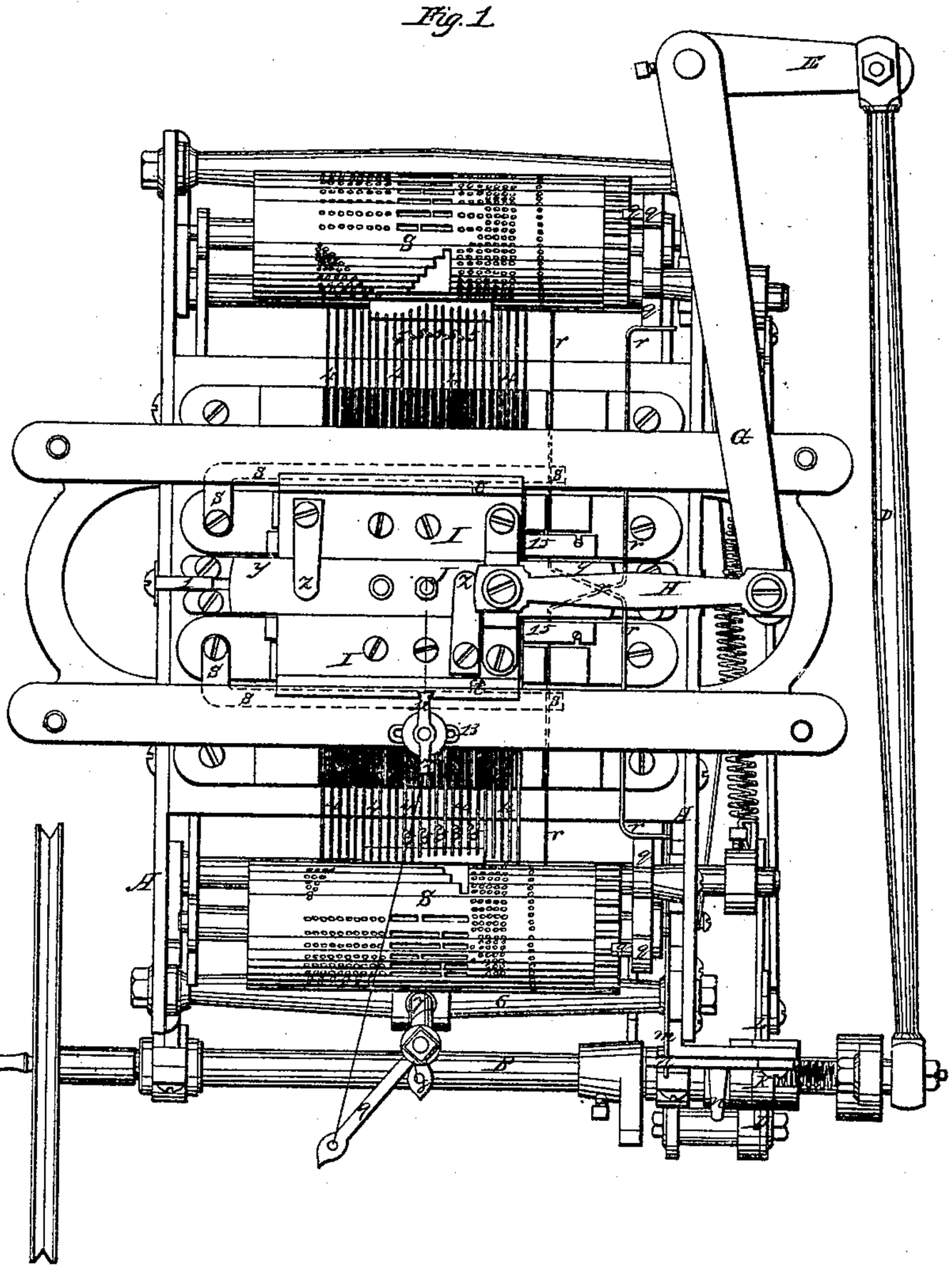
4 Sheets—Sheet 1.

A. C. CAREY.

KNITTING MACHINE.

No. 67,263. Patented July 30, 1867.

Fig. 1.



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4 Sheets—Sheet 2.

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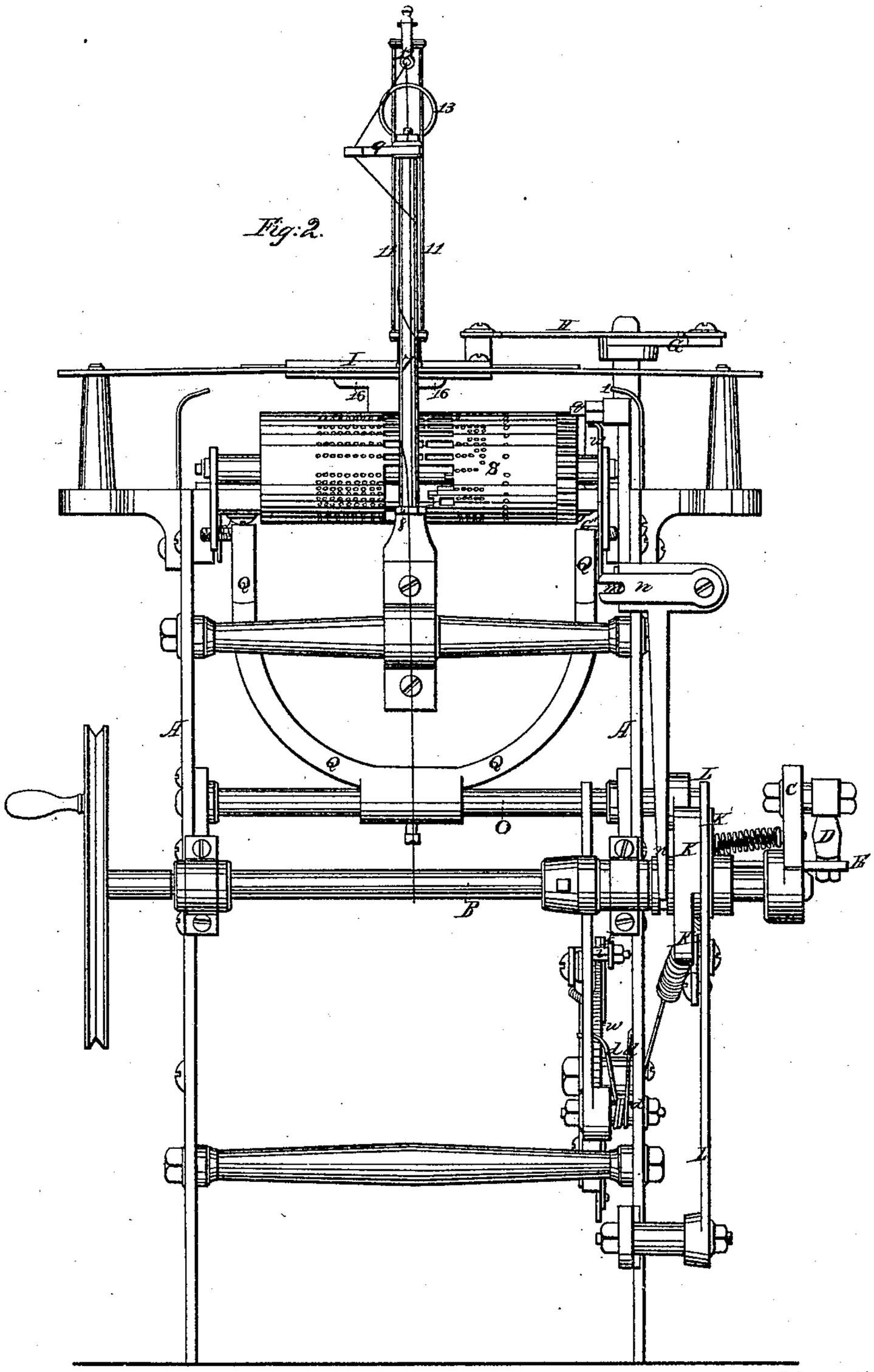
KNITTING MACHINE.

No. 67,263. Patented July 30, 1867.

Fig: 2.



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4 Sheets—Sheet 3.

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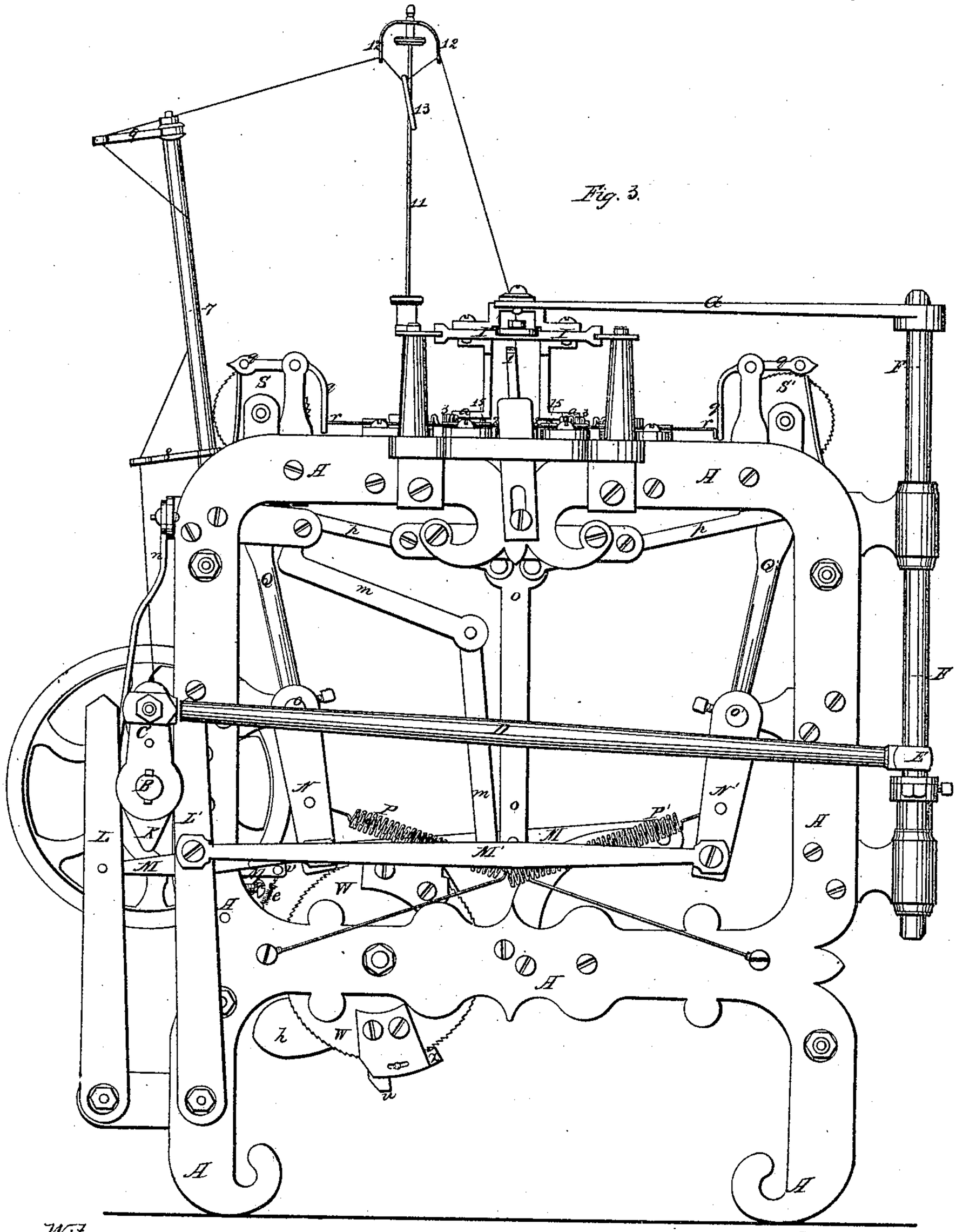
KNITTING MACHINE.

No. 67,263. Patented July 30, 1867.

Fig. 3.



Witnesses:

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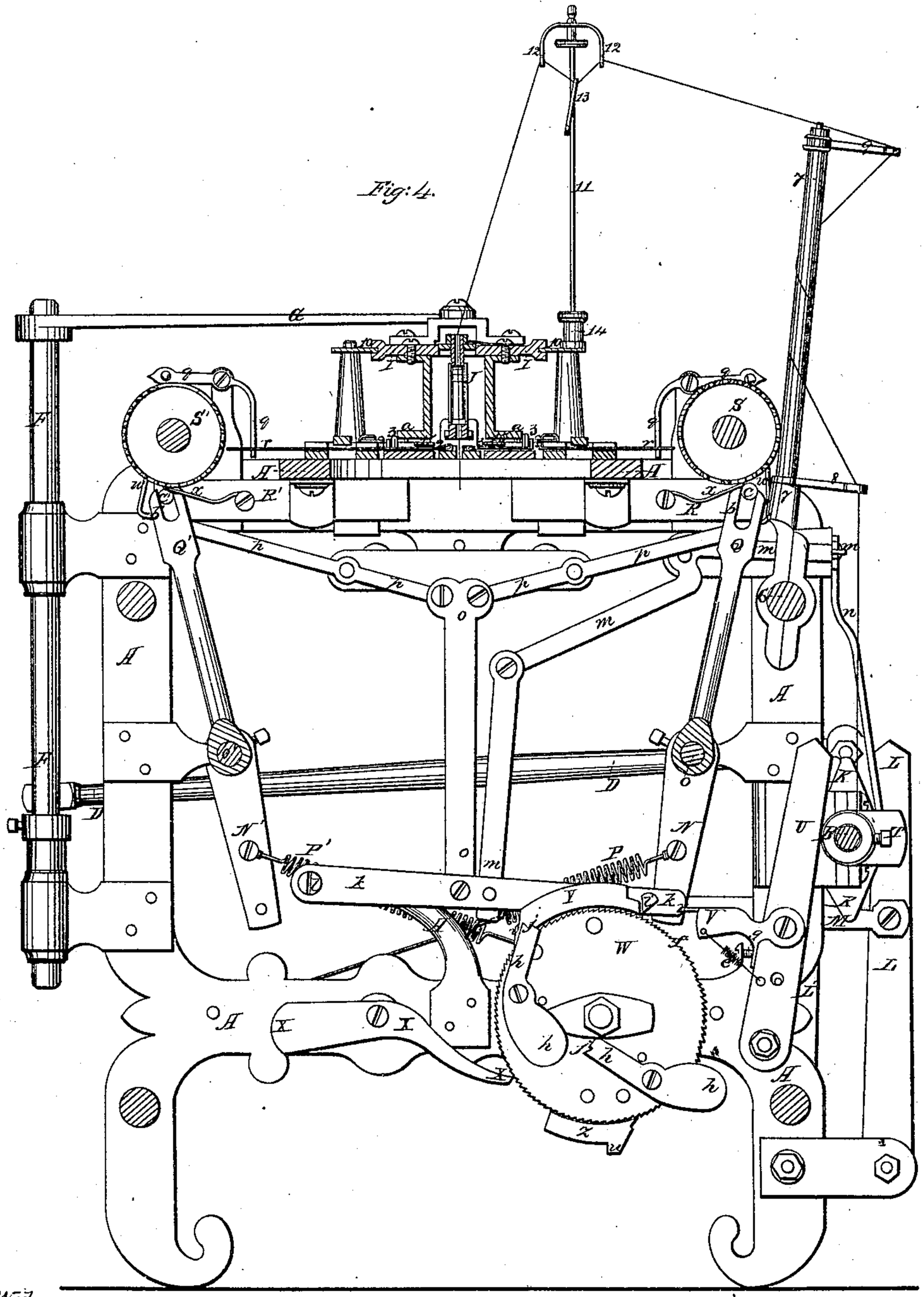
4 Sheets—Sheet 4.

A. C. CAREY.

KNITTING MACHINE.

No. 67,263. Patented July 30, 1867.

Fig: 4.



Witnesses:

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United States Patent Office.

AUGUSTUS C. CAREY, OF MALDEN, MASSACHUSETTS, ASSIGNOR TO HIMSELF AND HUGH K. MOORE, OF THE SAME PLACE.

Letters Patent No. 67,263, *dated July* 30, 1867.

IMPROVEMENT IN KNITTING MACHINES.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, AUGUSTUS C. CAREY, of Malden, in the county of Middlesex, and State of Massachusetts, have invented certain new and useful Improvements in Jacquard Looms for Knitting Stockings and Similar-Shaped Articles; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings making a part of this specification, in which—

Figure 1 represents a top view of the loom or knitting machine.

Figure 2 represents an elevation from one of the ends thereof.

Figure 3 represents an elevation from one of the sides of the machine.

Figure 4 represents a vertical longitudinal section through the machine, and showing the uncut portions in elevation.

Similar letters of reference, where they occur in the several separate figures, denote like parts of the loom or knitting machine in all the drawings.

My invention consists, first, in the use of revolving and vibrating jacquard pattern cylinders, in combination with sliding needles, on a straight frame, for the purpose of knitting irregular tubular work.

And my invention further consists in combining and operating, in connection with two rows of needles, two jacquard pattern cylinders that are at times both thrown forward together, at other times thrown forward alternately, first one and then the other, and at times cease to revolve, as the style or shape of the article that is being knit may require.

And my invention further consists in interposing wires between the jacquard pattern cylinders, and the needles, by which wires the needles are operated, and which admit of making the cylinders small, and operating them without interfering with other working portions of the machine.

And my invention further consists in the use of nibs or projections on the wires that drive the needles, and remote from their ends, so that the needles in the line of such nibbed wires may be moved forward far enough by the bars in the jacquard to catch and hold the loops, but not to knit, and thus prevent the making of holes in the knit work.

And my invention further consists in the combined use of a pattern-wheel and the jacquards, for operating the pawls that actuate the jacquard cylinders.

And my invention further consists in a thread or yarn-tension regulator, in combination with a knitting-loom or machine, which can be adjusted at any time whilst the machine is in motion.

To enable others skilled in the art to make and use my invention, I will proceed to describe the same with reference to the drawings, first premising that the organization of a machine that will begin a stocking at the toe, and with a single stitch, (or two, three, or more,) and then automatically widen out to the dimensions of the foot portion and knit that part, and then widen out and turn the heel portion and finish that, then begin and knit the leg portion and finish that and the stocking, and begin the toe of the next stocking, and so on, obviously requires great labor and mechanical skill, independent of invention of a marked character, as such a machine, to be useful and valuable, must be simple enough in its construction not to become disarranged in any of its parts, and to produce good merchantable work, and capable of being managed by such labor as is most economically employed in such work, and more than all, must be cheap enough in its first cost to successfully compete with hand work, which its product most resembles and imitates. Such a machine I have invented, constructed, and successfully operated. And whilst the machine may be changed, and possibly with advantage, I have shown the elements that must constitute its success under whatever modifications of construction it may appear.

The machine is supported in and upon a suitable frame, A, containing the necessary boxes, bearings, supports, ways, and guides, for the moving parts, as will be explained hereafter in the course of this specification. B is a shaft to which motion may be communicated by steam, water, or any other kind of power, and through which shaft the various parts of the machine may derive all their movements. Upon the extreme end of this driving-shaft B, and beyond the side frame, there is a crank, C, to which one end of a connecting-rod, D, is

attached; the other end of said rod being attached to a projecting arm, E, upon a vertical rock-shaft, F, supported in the main frame. To the top of this vertical rock-shaft, F, there is attached a long arm, G, which extends to and is attached to a bar, H, on the slide I, that carries the thread-guide J and the shoes *a a* that move the needles back after they have been projected by the jacquard cylinders. Upon this same shaft B, just inside of the crank C, but outside of the frame, there is a sliding double cam, K, arranged by a slot and spline, so that whilst it always turns with the shaft, it may be moved longitudinally on the shaft to bring into or throw out of action that part of said cam K which has two beats or throws brought into operation for every revolution of the shaft, or that part K′ which has but a single beat or throw for every revolution of said shaft as the work being knit may require. The cam K turns between two upright pivoted arms L L′, to which arms are respectively connected the bars M M′ that connect them with the crank-arms N N′, fastened on the ends respectively of the rock-shafts O O′, and the pivoted arms L L′ are held up to the cams by springs P P′ to insure their contact action. On the rock-shafts O O′, respectively, are bow-shaped pieces Q Q′, forked at their upper and outer ends, as at *b b′*, fig. 4, so as to take or straddle pins or studs *c c′* in the frames R R′, that carry the jacquard cylinders S S′, and through these connections the jacquards get their motion to and from the needles or the wires that drive the needles forward. When the cam with the two beats or throws is working against the arms L L′ the jacquards are thrown forward and back both at the same time. When the single-beat portion of the cam is working in connection with said arms, then the jacquards are moved forward and backward alternately, first one and then the other. Upon the shaft B, between the sides of the main frame, there is a single-beat cam, T, that strikes an arm, U, that is held up against it by a spring, *d*, throwing forward said arm by every revolution of said shaft. On this arm, U, there is a pivoted dog, V, that is drawn downward by a spring, *e*, but can rise on its pivot when it is necessary. This dog, V, every time it is thrown forward, and not otherwise influenced, takes against the ratchet-teeth *f* of the pattern-wheel W, and turns said wheel. The dog V has a set-screw, *g*, in it, by which its downward motion is regulated; and on the opposite side of the pattern-wheel, diametrically from the dog, there is a weighted pawl or dog-lever, X, that prevents the pattern-wheel from having any back motion. The pattern-wheel W has two segments, Y Z, upon it, the former being what I term the "heel" segment, and the latter the "toe" segment, so called because they are actively engaged whilst these portions of the stocking are being knit. The pattern-wheel W, moreover, carries two lifters, *h h*, which aid the dog *i* to rise up on to the segments Y Z, the feeding-dog V taking into a notch, *j*, in the ends of these pivoted and weighted lifters; and as the outer surfaces of these lifters are higher or project beyond the perimeter of the pattern-wheel, they give a longer throw than the ratchet-teeth on a less diameter would give. The weighted ends of these lifters, beyond their pivoted points, swing them into and out of action at the proper times and places. The dog *i* that is raised and lowered by the heel and toe sections on the pattern-wheel is adjustably fixed in an arm, *k*, pivoted to the main frame at *l*, and to this arm *k* are attached first an upright, *m*, that operates a shipper, *n*, which shifts the cam K on the shaft B; and secondly, an upright, *o*, that through the pivoted levers *p p*, raise or lower, as the case may be, the pawls or ratchets *q q* that turn the jacquard cylinders S S′. But whilst the ratchets *q q* are thrown in and out of action by the mechanism just above described, they are also actuated by wires *r r*, that are moved by the shoes *a a* on the slide I through the hinged switches *s s* and the projections *t t* thereon, in one direction, and by the jacquard through the same wires *r r* in the opposite direction. It will thus be seen that the rotation of the jacquards upon their axes whilst they continue to be thrown forward and back by the mechanism above described, is suspended from two distinct operative sources, viz, by the sections Y Z on the pattern-wheel W, through the lever *k r r*, and by the wires *v v* through the shoes on the slide I, through the intervention of the switches *s s* and the jacquards S S′, the latter operation being more distinctly shown in the drawing, fig. 1. When the single-beat cam K′ is working, the jacquards S S′ move alternately; when the two-beat cam K works, both jacquards move up and back together. When knitting straight work the jacquards move alternately up and back without revolving on their journals or axes. When knitting the heel portion of the stocking the jacquards are thrown up and back together, and revolve alternately. When knitting the toe portion of the stocking the jacquards throw up together and revolve together when closing up, and then alternately, and throw the needles in and out. The sudden rise *u* on the toe section Z is to throw up both jacquards once, or more than once. The depression *v* near the end of the heel section Y, is to use any blank that may be left on the jacquard, before a new stocking is begun. It keeps the jacquard revolving after the change from the double to the single cam. When the jacquards are not to revolve, the lifting wires *w w*, attached to the levers *p p*, throw the pawls *q* out of action. The horizontal wires *r r* are for special working, viz, for throwing out the pawls *q* when knitting the heel portion of the stocking; and whenever the pawls *q* are thrown out of action the jacquards cease to revolve, and are held against any accidental turning by the jar and motion given to them by friction springs *x x* that bear against them, though a take-up dog may be arranged to prevent any motion backward.

Of the construction of the jacquard cylinders it is only necessary to mention that they are hollow cylinders, with holes and slots made in their perimeters which leave bars and uncut spaces between them, said holes, slots, and bars forming the pattern and means of throwing in the needles to knit to a particular form and shape, and may be changed, removed, and replaced by others when it is necessary to change the form or figure of the article to be knit on the loom. In the centre of the slide I, and longitudinally of the slide, there is placed a bar, *y*, which is held by friction springs *z z* to the slide I, but has a motion imparted to it independent of that it has with the slide, or rather a cessation of the motion that the slide would impart to it if not otherwise restrained, as follows: The bar *y* projects beyond the ends of the slide I, being considerably longer than the slide, and to each of the sides of the frame, in the line of the bar *y*, there is affixed a spring-stop, 1, against which a projection, 16, fig. 2, on the under side of the bar alternately strikes and stops, whilst the slide or cross-head itself moves on and far enough to carry the shoes *a a*, attached to it, to the end of or a little beyond the end of the rows of needles.

The thread-guide J is arranged on the bar *y*, and has an upward curved shoe at its lower end, so as to pass over the work without disturbing it, and for closing down the latches of the needles should any of them fail to close. The needles 2 are short, and lie in suitable grooves or guides, in which they can be freely and truly moved. They have nibs 3 on their rear ends, which, projecting upward in their groove or guide, keep their latches in proper working position or prevent them from turning out of their right positions. Behind the needles, and in suitable grooves corresponding to those of the needles, are wires 4, which project far enough to come within the influence of the jacquards, and by means of the holes, slots, and bars of the jacquards these wires 4 are actuated, and through the wires the needles are moved up and back, or remain in the line of the knitting, as the case may be, or as the jacquards may be cut or prepared for in the usual way of making jacquards for such purpose, viz, knitting to pattern. Upon any suitable number, or upon all of the wires 4, there may be near their remote rear ends nibs 5, which are or may be used for throwing up the needles far enough to receive and hold the yarn, but not to knit; the portions of the wires behind these nibs entering holes or slots in the jacquard, by which means they are not moved until the nibs come against an uncut part of the jacquard, and consequently they do not come up to the knitting line. The object in holding the yarn on the needles without allowing those needles to knit is to prevent the making of holes in the work, when some of the needles for the time being cease to knit, and afterwards begin again to knit, as in narrowing, widening, or turning a heel or making a toe.

The yarn-guide and tension is made as follows: On a cross-bar, 6, there is arranged a post, 7, which may turn on the bar under a regulated amount of friction that will hold it at any point or position at which it may be set. Near the lower end of this post there is an arm, 8, with a hole through its outer end for the yarn to pass through. At the top of the post 7 there is arranged an arm, 9, which can be turned clear around on the post, and in the end of this arm 9 there is a hole for the yarn to pass through. On one of the ways, 10, on which the cross-head or slide I moves, and in nearly a central position of the machine, there is an upright, 11, on the top of which a bow-shaped or two-armed piece, 12, is arranged, with a hole in each of its arms for the yarn to pass through, and upon the upright there is a ring, 13, through which the yarn passes, this ring acting as a falling weight to take up any or all slack in the thread or yarn. The post or upright 11 is free to turn in its bottom support or socket 14, so as to accommodate the yarn to the traversing of the yarn-guide J, through which it finally passes to the needles or knitting line. The yarn, as shown more particularly in fig. 4, is passed through the hole in the arm 8, and may be passed once or twice around the post 7, or not at all, (as will be explained;) thence through the hole in the turning arm 9, thence through one of the arms, 12; then through the ring 13, thence through the other arm 12, and down through the thread-guide J to or within the action of the needles. Now, to put more tension on to the yarn, it is only necessary to turn the arm 9 a whole or a part of a revolution, which makes a whole or a part of a turn of the yarn around the post; and to reduce the tension the arm is turned in an opposite direction.

The general operation of the machine is as follows: The stocking is begun at the toe. Both jacquards and both rows of needles are thrown forward by the action of the "toe section" Z on the pattern-wheel, and the double cams K. As soon as the dog *i* drops off from the high part *u* of the section Z or segment, the wires *w* being still down, the single cam K is brought into action by the shipper *n*, and then the jacquards are thrown up alternately, and have a turning motion on their axes by means of the pawls *q*, one at a time, and this continues, increasing one or more needles, until the toe is of the proper width. Then the dog *i* drops off from the toe segment Z, and the pawls are raised up by the lifting wires *w* and are out of action. In this condition of the parts the machine will knit straight work until the foot of the stocking is of the proper length. Then the heel segment Y comes around, raises up the lever *k*, and shifts the cam K, and drops the lifting wires *w*, and allows the pawls *q* to take on to the ratchets on the jacquards and to turn them, two teeth on one side and one tooth on the other, and *vice versa*, which is done by the horizontal wires *r r* moving the pawls alternately out of and then allowing them to go into action. The horizontal wires *r* are moved in one direction by pivoted levers or switches *s*, overlying the wires that drive the needles, said switches being moved by an incline on the shoe *a* on the cross-head I, which moves the nib on one of the needles against the projection or nib *t* on the switches respectively, and are returned by the jacquard or by the weight of the pawl, or both acting together. Before the heel portion of the stocking is commenced, or rather the commencement of the heel portion, is the widening out of the foot portion; and the throwing in and out of the needles is regulated by the jacquards and inclines on the shoes, which are previously arranged for the special shape, form, and size of the stocking to be knit. There are additional needles which do not knit in the foot portion of the stocking, but when the stocking is to be widened out, as at the heel, (or calf or leg,) then these additional needles are thrown in by the jacquards. The heel is formed by knitting back and forth with a portion of the needles only on one end of the row, and first on one side and then on the other, and throwing in additional needles, according to the form to be produced, which form is cut or made in or on the jacquards, and repeating this back and forth, knitting and throwing in of additional needles, or knitting a single gore or two or more, until sufficient is knit to form the heel, then all the needles are thrown in, and the leg or straight work is knit as in the knitting of the foot. When the heel portion is knit the arm or lever *k*, or rather its dog, *i*, drops from the segment Y, and the single cam is thrown into action, the lifting wires *w* are raised, which throws out the pawls *q*, and the machine goes on to knit the leg portion of the stocking.

Having thus fully described my invention, what I claim therein as new, and desire to secure by Letters Patent, is—

1. The combination of revolving and vibrating jacquard pattern cylinders, with sliding needles on a straight frame, for the purpose of knitting irregular tubular work, substantially as described.

2. I also claim combining and arranging in connection with two rows of needles, two jacquard cylinders, that are at times both thrown forward together; at other times thrown forward alternately, first one and then the

other, and at times cease to revolve, as the style, shape, or pattern of the article that is being knit may require, substantially as described.

3. I also claim, in combination with vibrating jacquard cylinders, and with needles in straight rows, the wires interposed between the jacquard and the needles, by which the needles are operated from the jacquard, substantially as and for the purpose described.

4. I also claim the use of nibs or projections on the wires that are interposed between the jacquard and the needles, and remote from the ends of said wires, so that the needles in the line of such nibbed wires may be moved forward far enough by the jacquard to catch and hold the yarn, but not to knit, and thus prevent the making of holes in the knit work, substantially as described.

5. I also claim the combined use of a pattern-wheel having a toe and heel segment thereon, and the jacquards for operating the pawls by which the jacquards are turned on their axes, substantially in the manner and for the purposes described.

6. I also claim a yarn-tension, composed of the arm 8, post 7, turning-arm 9, guides 12, and suspended weight or ring 13, arranged to operate in the manner and for the purpose substantially as herein described.

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Witnesses:

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H. K. MOORE.