

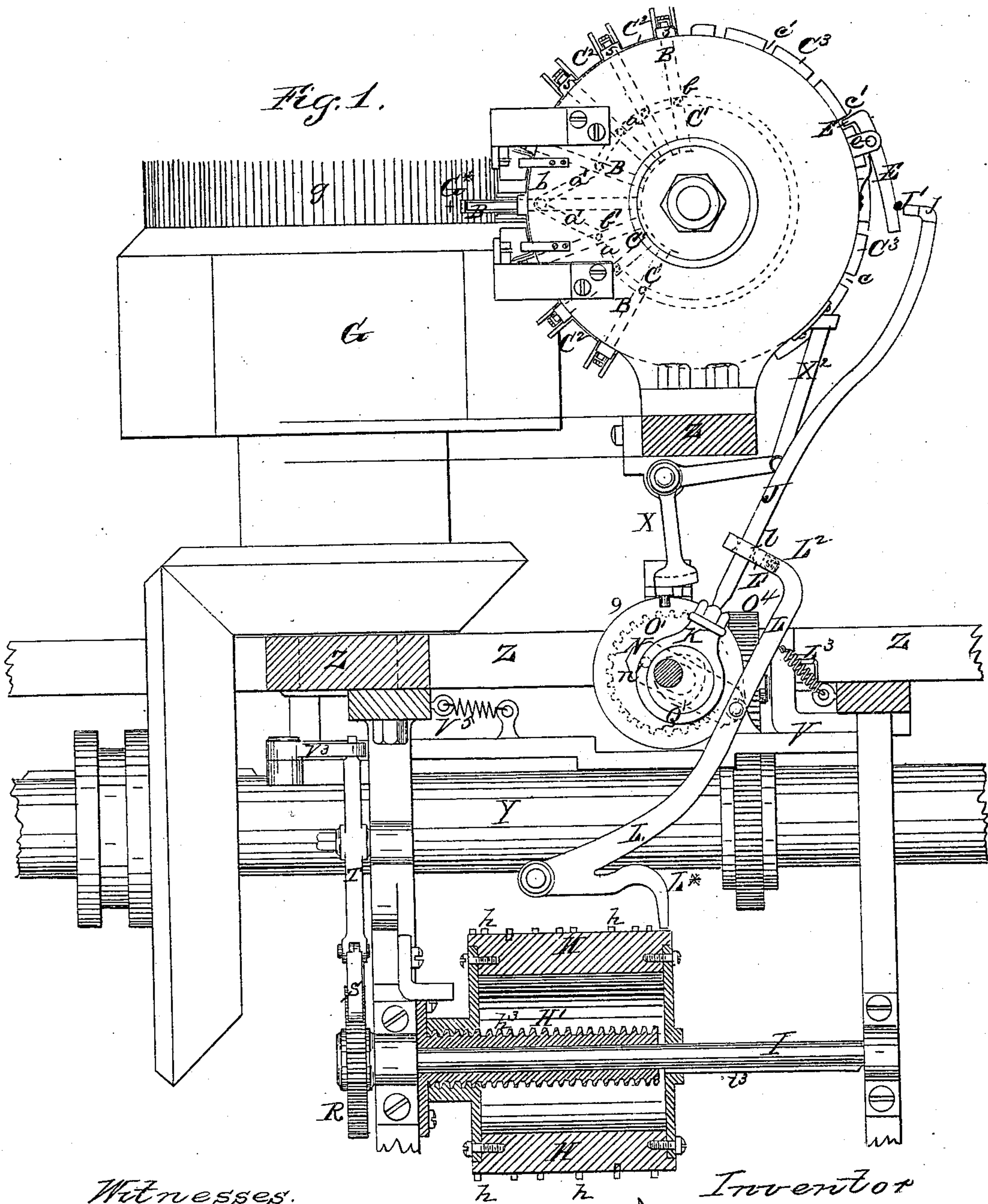
(No Model.)

7 Sheets—Sheet 1.

J. DOW.
KNITTING MACHINE.

No. 250,505.

Patented Dec. 6. 1881.



Witnesses.

*W. Colborne, Brookes
Charles C. Stetson*

Inventor

*Josiah Dow
by his atty
W. D. Stetson*

(No Model.)

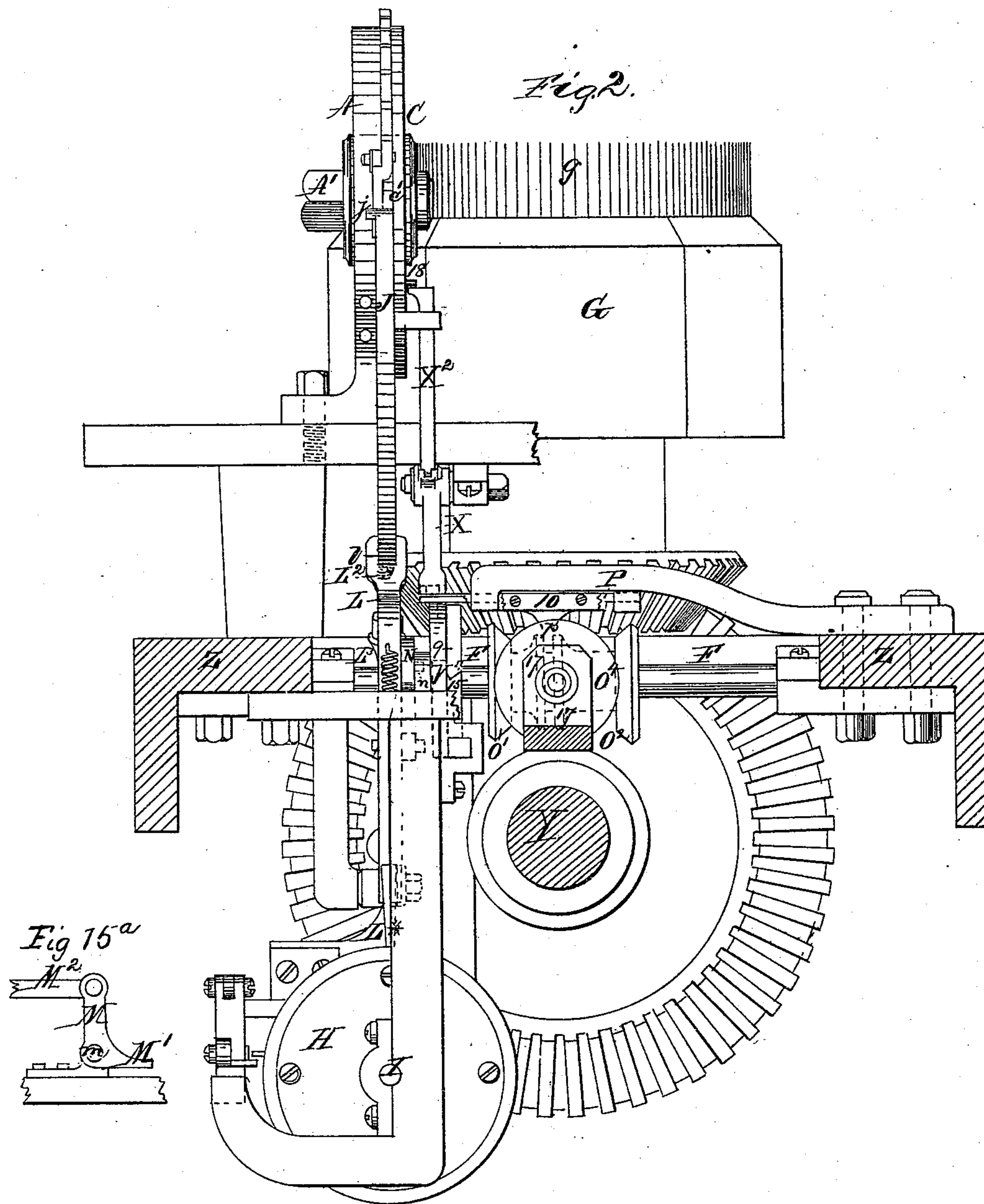
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W. L. Stetson.

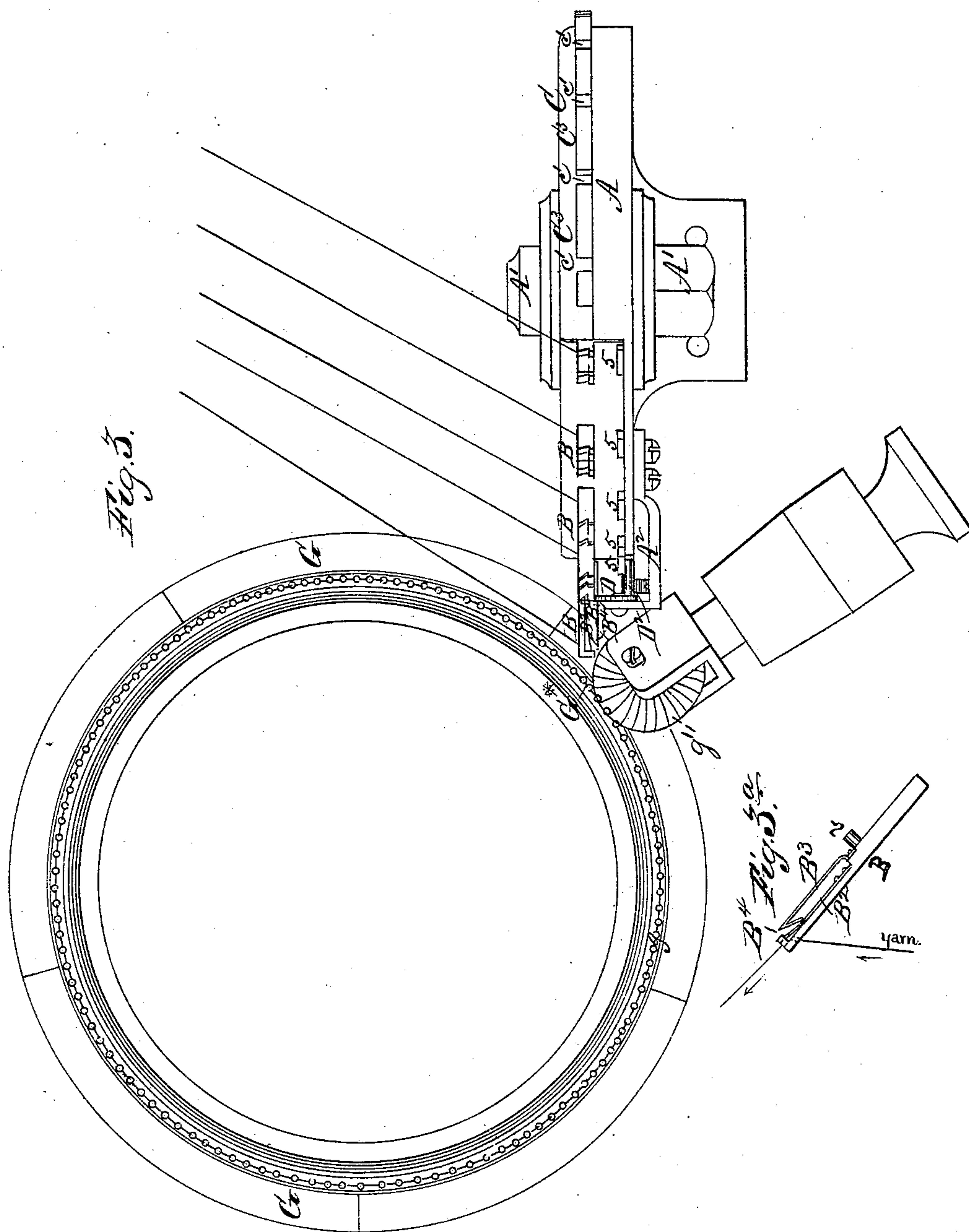
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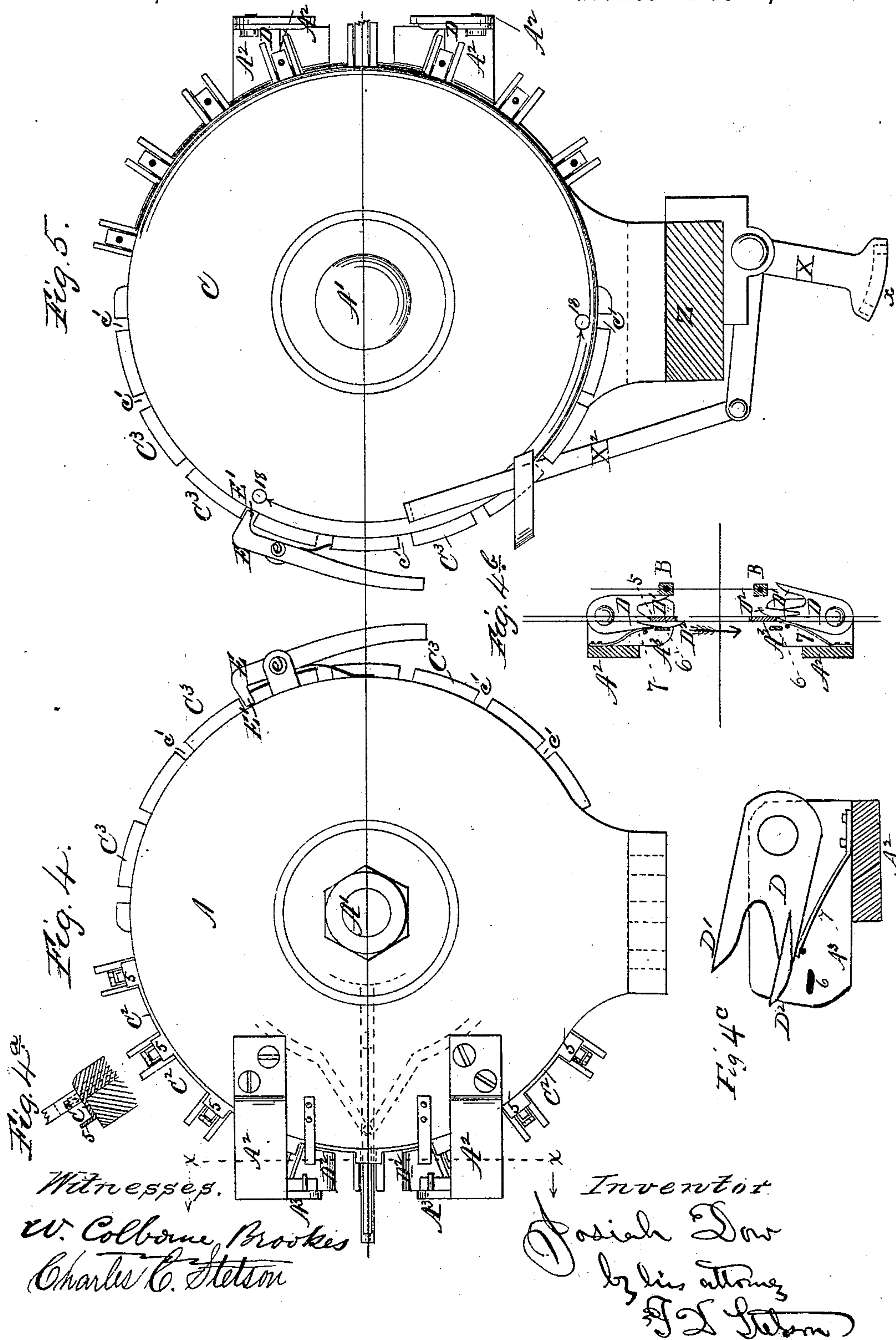
Witnesses.
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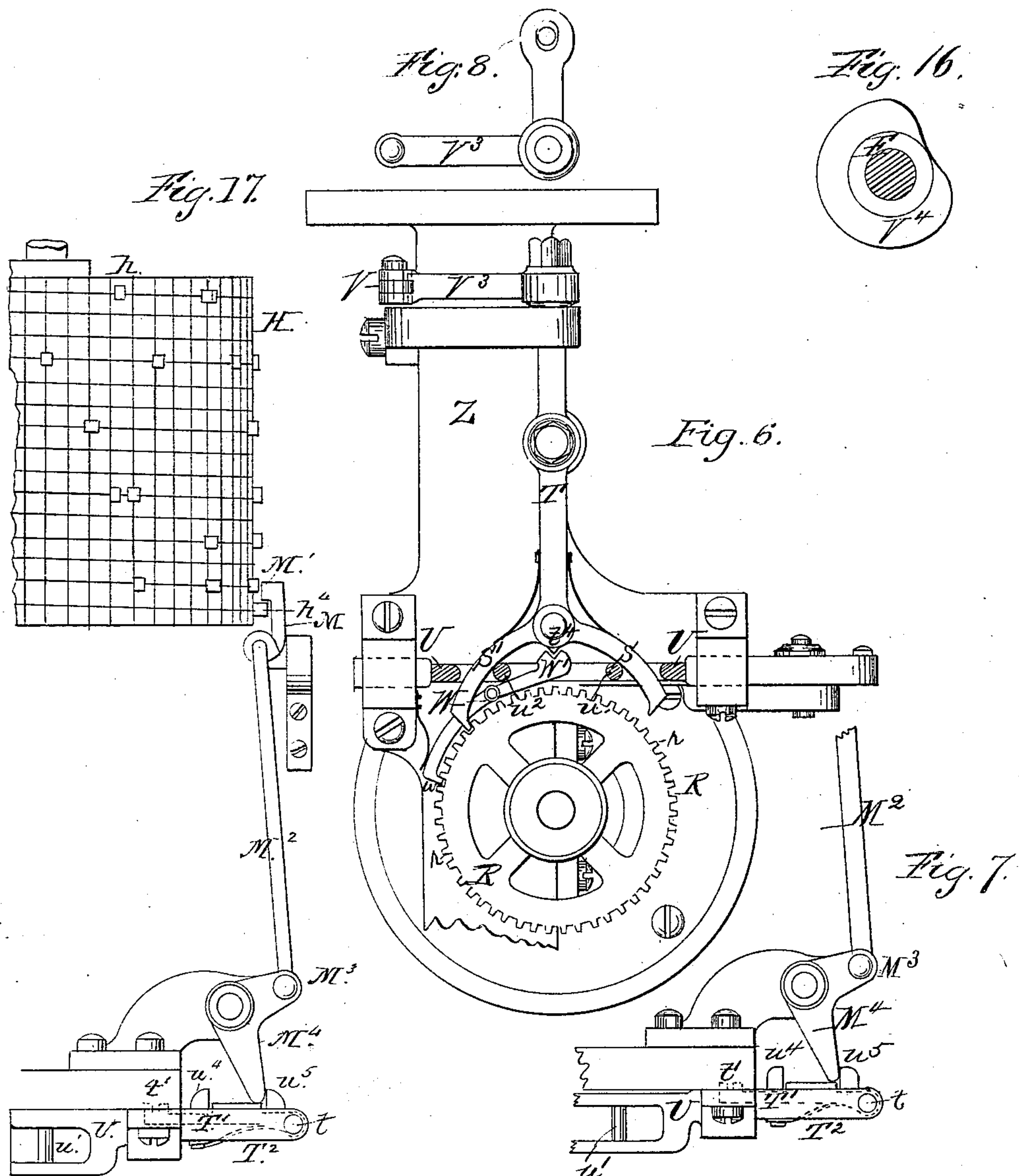
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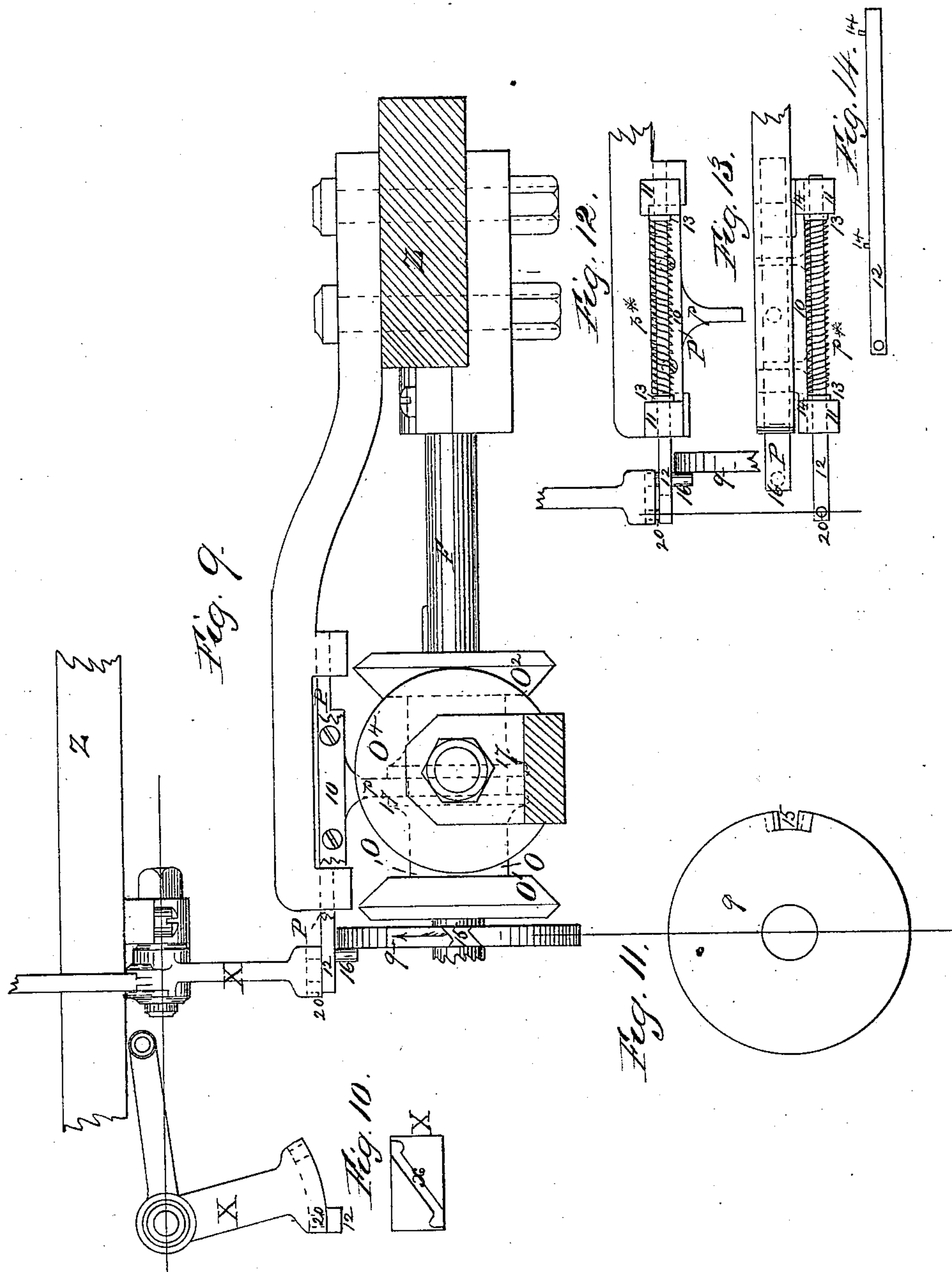
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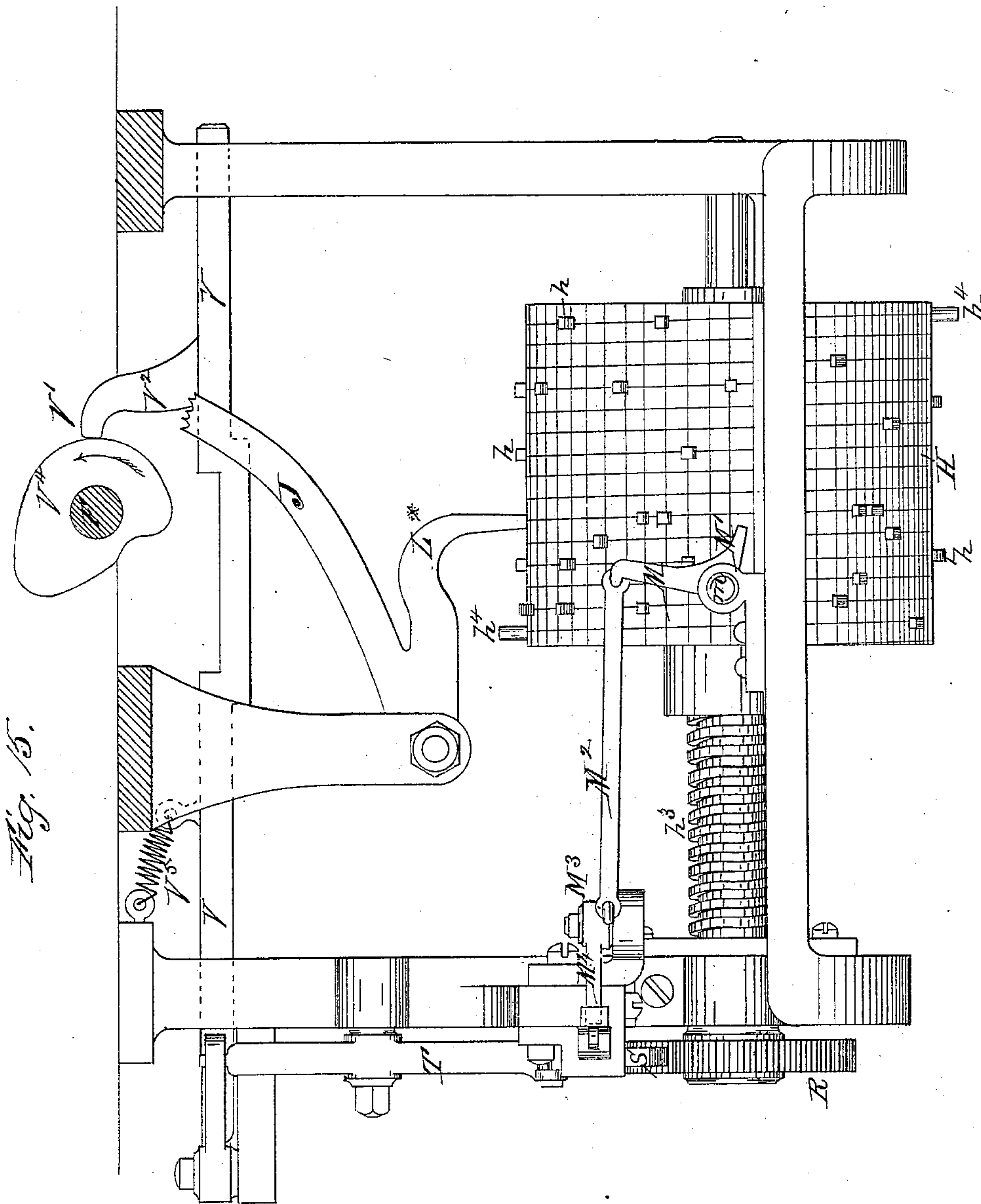
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UNITED STATES PATENT OFFICE.

JOSIAH DOW, OF LOWELL, MASSACHUSETTS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 250,505, dated December 6, 1881.

Application filed November 19, 1880. (No model.)

To all whom it may concern:

Be it known that I, JOSIAH DOW, a citizen of the United States, residing at Lowell, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a specification.

My improved machine is adapted for knitting in stripes of different colors or kinds of yarn. I have devised means for substituting the yarns one for another, as for supplying any given yarn for any given period.

The following is a description of what I consider the best means of carrying out the invention:

The accompanying drawings form a part of this specification.

Figure 1 is a back elevation of my machine, (parts being shown in section,) omitting the usual stitch-making wheels which surround the knitting-head and such other parts of the usual knitting machinery as would obstruct the view and are unnecessary to show the action of the new parts. Fig. 2 is a side view taken from the right of Fig. 1. Fig. 3 is a plan view of the knitting-head and parts immediately operating in connection therewith. Fig. 3^a is a detail of the yarn-carrier, showing the yarn passing through, the direction being indicated by arrows. Figs. 4 and 5 are opposite side views, showing the plate A and revolving disk C and their immediate connections on a large scale. Figs. 4^a and 4^b show detail views of parts shown in Figs. 4 and 5, Fig. 4^a being a section in the plane of the axis of C and radial thereto, and Fig. 4^b being a section on the line *xx*, Fig. 4, looking from the center of C. Fig. 4^c is an enlarged view of one of the cutters. Fig. 6 is a side view of the parts of the apparatus by which the pattern barrel or cylinder H is moved and controlled, and Fig. 7 is a corresponding plan of a portion of the same. Fig. 8 is a detail of a part shown in Fig. 6. Fig. 9 is a view showing the thimble and its actuating mechanism. Figs. 10, 11, 12, 13, and 14 are details of Fig. 9. Fig. 15 is a side view of the barrel-cylinder H and parts connected therewith. Fig. 15^a is a detail showing the bell-crank lever against which the pins of the pattern-cylinder operate. Fig. 16 shows a modification of the form of the cam V⁴. Fig. 17 is a plan view of the parts shown in Figs. 6, 7, and 15, showing the train of con-

nections by which the pattern-cylinder acts through the medium of a long pin at each end of its spiral series of projections to induce the movement in alternate directions of a slide which controls pawls, so that the step-by-step motion of the pattern-wheel is alternately reversed.

Similar letters of reference indicate like parts in all the figures.

Z represents a portion of the main framing of the apparatus, and Y is the main or driving shaft.

G is the knitting-head, and *g* the needles carried therein. These are of the ordinary construction, and are operated, in the ordinary manner well known to manufacturers of knitted fabrics, by that class of machinery known as "circular spring-needle knitting-machines."

G* represents the point at which the stitch or loop wheel *g'* first acts upon the threads in connection with the needles *g*. The loop-wheel *g'* is only shown in the plan view, Fig. 3, it being left out in the other views in order to facilitate the illustration of the invention.

Upon the fixed framing is bolted an upright circular plate, A, in the center of which is supported a stud, A', upon which revolves, or partially revolves, a circular disk, C. On the inside of one portion of this disk are formed radial slots C', in which play the yarn-carriers B, of which there may be any number convenient or necessary within the limits of one-half of the disk C. Upon each of these yarn-carriers B is attached a pin, *b*, which plays in a groove, *a a'*, mainly concentric with and formed in or upon the stationary plate A, and by this means the yarn-carriers B are kept in the same position relatively to the disk C until the pin *b* of one of them reaches the cam portion *a'*, when by the action of the latter the carrier B for a time is protruded toward the point G*. Each yarn-carrier B is equipped with devices which allow the yarn to pass when going into the work, but firmly hold it when ceases to run in that direction. As many yarns as there are yarn-carriers B are delivered from suitable spools, (not shown,) passing each through a guide at the end of its respective yarn-carrier. (See Figs. 3 and 3^a.) Each yarn-carrier B is of rectangular form in cross-section, with a considerable recess on the side which is toward the plate A when in position for work.

B² is a spring bent outward from the solid back of the carrier B, so that when free it shall not bear at all upon the yarn or thread. Over this spring is placed another spring, B³, which is bent into V shape at the end B⁴ nearest the delivery end of the carrier, and its other end is curved and securely fastened near the pin b. When the carrier B is fully protruded this upper spring, B³, is free. Consequently there is no pressure upon the under spring, B², and the yarn or thread may pass freely, as shown in Fig. 3^a; but as the withdrawal of the carrier B commences the curved portion of the upper spring, B³, comes in contact with the rim C² of plate A, holding the spurs 5, thus causing a pressure upon the upper spring, B³, which, being transmitted through the V-shaped end B⁴ to the lower spring, B², causes it to close down and act as a brake upon the yarn. The upper spring, B³, is (in consequence of its shape) held down still more firmly upon reaching the limit of its withdrawal, and the pressure upon the yarn will be continued until the carrier is protruded again, when, the springs being released, the yarn is allowed to pass freely again.

It will be seen that whenever, by a partial rotation of the disk C, a yarn-carrier B, carrying yarn of the color or kind needed, is being brought into line with and protruded toward the point G* and the yarn liberated to be drawn out, another yarn-carrier B—the one last in use—is drawn inward. The yarn thus withdrawn must be cut off.

Two bifurcated cutter-plates, D, are attached respectively to L-shaped arms A² A², which are fixed to the plate A at equal distances above and below the line at which the carriers B are fully protruded. They stand in such positions that the yarns or threads passing out of work either in an upward or downward direction shall be drawn within the bifurcation in one of the two cutter-plates D D. The blades D' D' are sharp jaws moving across chisel-edges of the bars or arms A³ A³ on the adjacent portions, and are formed on the pivoted cutter-plates D D. The latter have upon them wedge-shaped or curved wings D² D², which act as cams. A spur, 5, attached to the revolving disk C by the rim C², which extends partly across the edge of the plate A, presses against the full side of the projection D² when the carrier is being withdrawn and causes the pivoted cutter-plate D to turn on its fixed center, and thus to open the cutter-blade D' to receive the yarn, which then passes inside of it. Just before the point at which the carrier B is fully withdrawn the spur 5 passes beyond the projecting wing or cam D², and the cutter-plate D, holding the cutter-blade D', is instantly brought back to its first position by the spring 7, which is attached to it, thus closing the cutter-blade D' and severing the yarn. The next yarn, which has simultaneously with the above operations been presented for work, is meantime engaged by the needles g revolving in contact with the

loop-wheel g', and commences to be wrought into the work. The point at which the yarn is cut is sufficiently beyond the end of the carrier B to leave it in right position to be taken into work the next time its turn comes. The length thus left I prefer to be about half an inch beyond the extremity of the carrier B. When a carrier B is bringing a thread into position, which then is to take the place of that which is being cut off, the spur 5 passes behind the cam D² and causes the cutter-plate D to turn a little on its pivot, and thus to cause the cutter D' to close a very little, keeping it entirely out of the way of the carrier being presented, and also out of the way of its thread. A spring-stop, 6, against which the cutter bears when drawn back by the spring 7, yields enough to allow this further closing of the cutter D'. These opposite actions of the spurs 5 upon the cam-surfaces D², attached to the cutter-plate D, are caused by the wedge or wing D² allowing the spurs 5 to pass freely in one direction. While passing in the other direction the curved end of the wing forms a cam, against which the spur 5 presses and deflects it. The spur 5 thus moves along the other side of the wedge, which, in yielding for this movement, causes the cutter-blade to open. The spring-stop 6 prevents the cutter from closing too far. By these means the yarns from the whole set of carriers can be used one after another, and each carrying a thread of different color or kind until the limit is reached. When the intermittent movement of the disk C is reversed they can be used in the inverse order, and so on as long as may be needed. Although these yarns will come in the same order, each following the other, it is necessary not only to keep up the order from each end continuously, but with various patterns to be made it is necessary also to vary at pleasure the length of yarn use from any one or all of the carriers B—that is, although the colors or kinds follow in a definite order, the same quantities of each may or may not be used in its successive return to position. Thus a great variety of effects can be produced in the fabric and patterns formed containing stripes of greatly-different appearance. The partial revolutions of the disk C are induced by the following means:

Upon the periphery of the revolving disk C and opposite to the yarn-carriers B are spurs C³, having notches c' between them, exactly equal from center to center to the distance between the several yarn-carriers B.

E is a locking-pawl turning on a fixed center, e. These parts are so arranged, as shown, that when the point E' of the locking-pawl E falls into a notch, c', a corresponding yarn-carrier B will be in position to feed its yarn to the needles g. Upon the shaft F, which makes one revolution to each revolution of the knitting-head G, is affixed an eccentric, K, to which is attached the rod J, which is bent sharply at its upper end, J', so that it may engage with the notches c' upon the revolving disk C.

At the side of the rod J is a spur, j , which presses upon the free end of the pawl E, so that before the end J' of the rod J has entered one of the notches c' , and by the motion of the eccentric K commenced to turn the disk C in one direction or the other, the pawl E will be removed from engagement with the notches c' and the disk C will be temporarily free to be turned. The movement of the disk is effected by means of the downward or upward movement of the eccentric K. The rod J passes through a socket, l , formed in the bent end of the lever L, and is free to move up and down therein; but it is grasped laterally by a movable piece, L' , pressed by the spring L^2 at one side of this socket. The spring L^2 serves to keep the rod J firmly in position when engaged with the revolving disk C, and at the same time yields sufficiently to accommodate the necessary movement of the rod J during its action in effecting the partial rotation of the disk C.

It will be seen that when the socket l in the bent end of the bar L is in the position shown in Fig. 1 the eccentric K will move the rod J idly. The rod J cannot engage with the notches c' in the revolving disk C, for the reason that its end is held too far off; but when the finger L^* , attached to the lever L, is raised by reason of its resting on a pin, h , upon the pattern barrel or cylinder H, which is turned slowly and intermittently, then the socket l in the bent end of the lever L will be held more directly over the eccentric K, and the parts being thus conditioned, the turning of the shaft F will engage the rod J with one of the notches c' , and will turn the disk C, containing the yarn-carriers B, just enough to bring another carrier B into position. Upon the rod J releasing its hold the point E' of the pawl E will fall into position and hold the disk C fast until the next movement.

If the shaft F turns from left to right, (see Fig. 1,) it will be seen that the rod J will make the engagement just at the beginning of its downward throw; but when the shaft F turns from right to left, then the rod J will engage at the beginning of its upward throw, in one case turning the revolving disk one step in one direction, and in the other case turning it a like distance in the opposite direction. This change is made always when the yarn-carriers in use have passed their yarn into work up to the last one of the series, when a reversing of the direction of the motion will cause them to be presented in the reverse order, and so on as long as knitting is being done. To effect this reversing in the following manner: The shaft F is put in motion through double-beveled gears O' O^2 upon the thimble O, which is feathered on the said shaft. When the gear O' at one end of the thimble O engages with the gear O^4 , which is turned continuously by any convenient connection to the continuously-revolving parts, the shaft F will turn in one direction, and when the gear O^2 at the other end of the thimble O engages with the gear O^4 it will turn in the

opposite direction. Therefore by moving the thimble O from one side to the other the reversing will be effected. The thimble O has a continuous groove between the collars 17 17 to hold the end of the shipping-pin p upon the bar P. The bar P has fastened to its side a plate, 10, part of which is broken away in Fig. 9, which holds bearings 11 11, through which slides the bar 12, having upon its end a pin, 20, which fits within the cam-groove x on the lower end of the bell-crank lever X. This cam-groove x causes the bar 12 to move forward or backward as the bell-crank X is moved. Upon the bar 12 is a spiral spring, p^* , which is compressed when one of the pins, 14 14 on bar 12 comes in contact with one of the collars 13 13, between which collars the spring is confined; and as the pins 14 14 can slip through the bearings 11 11, but the collars cannot, it will be seen that in whichever direction the bar 12 is pushed the spring upon it, being compressed by one of the pins 14 pressing against one of the collars 13, exerts a pressure which tends to slide the shipping-bar P and consequently ship the gears O' O^2 ; but upon the underside of the bar P, at its outer end, is a pin, 16, against which revolves the circular plate 9, upon the shaft F, which performs an important function. In this plate 9 is a peculiarly-formed slot, 15, large enough to permit the pin 16 to pass. When the movement of the revolving disk C, which brings the last carrier B of the series into position to deliver its yarn, takes place the bell-crank X is moved, (by a motion of the hook-ended rod X^2 , attached to X, received from one or the other of the pins 18 18,) and, through the action of the oblique cam-groove x in the end of bell-crank X on the pin 20 of the bar 12, the bar 12 is pressed forward or backward, according to the direction of the movement of the disk C; but as the slot 15 upon the circular plate 9 is at the opposite part of its revolution from the pin 16 upon the shipping-bar P when this movement takes place the pin 16 cannot pass through the slot 15 in the plate 9, and consequently the shipping-bar P cannot move; but the spring p^* upon the bar 12, being compressed, exerts a force upon the bar P and causes the pin 16 to press against the plate 9 (see Fig. 12) until the slot 15 comes to it, when it passes promptly through the slot 15 to the opposite side of the plate 9, and thus the shipping-bar P is allowed to yield to the force exerted by the spring p^* and move, and by its shipping effect the shipping of the gears O' O^2 . This action is effective in both directions. I thus effect an instantaneous shipment of the gears O' O^2 , which occurs at the exact point of time when the movement of the revolving disk has ceased and when said disk is in position to present a carrier, when its motion is reversed. The shaft F and the knitting-head revolve in exactly equal time; otherwise either a full course around the fabric would not be completed or more than a full course would be produced before the next

carrier could be presented after the motion of the shaft F (and consequently the disk C) had been changed, which would make irregular widths of stripes.

5 The lever L is moved toward the shaft F at each of the revolutions of the latter by the nearly-triangular cam Q coming in contact with the pin *n* upon the slotted lever N, and is carried back into position by the spring L³,
10 as shown in Fig. 1; but during the whole of the period while the lever L is thus held up or forward the eccentric K is in such position that the hook end J' of the bar J is moving idly in the air, being entirely out of contact with
15 the disk C. After the cam Q' has released the slotted lever or link N the attached lever L will be drawn back by the spring L³ to a greater or less extent, according to the arrangement of the pins *h*. If it is drawn back to its fullest
20 extent, the rod J will still work idly; but if, during the period while the lever L was held forward by the cam Q', a pin, *h*, has by the movement of the cylinder H been brought under the finger L*, it will forbid the full return
25 of the lever L. This will, during the succeeding half-revolution of the shaft F, cause the engagement of the hooked end J' of the bar J with one of the notches or spaces *c'*, and by the thrust or pull of the rod J will give the
30 disk C a partial revolution, so as to insure the moving forward of the next yarn-carrier B; otherwise the finger L* will rest upon the surface of the barrel H, and the position of the socket in the end of the lever L will keep the
35 rod J from making its engagement with the disk C.

The pattern-barrel H is provided with a series of holes, arranged spirally at uniform distances apart, adapted to receive pins *h*, so as
40 to provide one hole in the barrel for each course in the fabric—or, in other words, for one revolution of the knitting-head—throughout the whole length of the fabric. The pins *h* are removable, and can be placed at pleasure
45 wherever desired, in order to produce the required changes in the color, pattern, or style. As the barrel H turns upon the sleeve H', controlled by the screw-thread *h*³, of the same pitch as the spiral upon the barrel H, the pins
50 *h* or places for them are brought each in turn exactly under the finger L*, and the barrel advances or recedes as it turns upon the shaft I, which gives it motion through the spline *i*³. This contrivance of the pattern-barrel running
55 upon a sleeve with a screw-thread, &c., is the same as is shown in Letters Patent granted to me, dated February 11, 1879, No. 212,202, except that I now substitute removable pins for fixed cams.

60 With every revolution of the knitting-head G intermittent motion is imparted to the shaft I, and consequently to the barrel H, just sufficient to move one pattern-pin out of position and the next into position under the finger L*.
65 This motion is obtained immediately through the spur-wheel R and the pawls S S'.

Upon the shaft F is a cam, V⁴, which, acting against the projection V' upon a spur, V², formed on or attached to the sliding bar V, in connection with the spring V⁵, causes motion
70 to be communicated in both directions to the sliding bar V. Motion is imparted through the sliding bar V, by means of the bell-crank lever V³, to the pivoted bar or lever T. (Shown more clearly in Fig. 6.) The cam V⁴ is so
75 shaped that the motion given to the lever T will move the pawls S S' first to the left and back, and then to the right and back, to the position as shown in Fig. 6, and as one or the other of the pawls S or S' is, by the position
80 of the cross-bars *u'* *u*² in the movable slide U, left free to engage with the teeth upon the wheel R the barrel H will be turned intermittently in one direction or the other.

It will be understood that the slide U has
85 two bars, *u'* *u*², one bar, *u'*, standing under the pawl S and the other bar, *u*², standing under the pawl S'. If the slide U be placed so that the bar *u'* presses against S sufficiently to lift
90 it a little, when the movement takes place in the bar U the ratchet S cannot engage with the wheel R, and no movement of the barrel H will take place in that direction; but both bars *u'* *u*² being firmly attached to the slide U,
95 the bar *u*² under the pawl S' will so stand that it cannot support the pawl S', and the pawl S' will then act upon the spur-wheel R and turn the barrel H sufficiently to bring the next pin
100 *h* into position. At each reciprocation of the lever T the intermittent turning movement of the pattern-barrel H is repeated in this direction until the pattern-barrel H has advanced
105 to the last pin *h* at one end of the spiral, when a long pin, *h*⁴, (see Fig. 15,) set in the barrel H, presses upon the side projection on the end of the horizontal finger M' of the swinging
110 lever M M', which turns on the fixed center *m*. In one direction of the revolution of the barrel H the operation of the pin *h*⁴ will be downward, and in the other direction upward, there
115 being a long pin *h*⁴ at each end of the pattern-barrel for this purpose. When either end of the motion is reached the lever M M' withdraws or thrusts forward the rod M², which, acting upon the bell-crank M³ M⁴, causes the
120 arm M⁴ first to press down the catch T', which turns on a fixed center, *t*, pressed upward by a spring, T², thereby releasing its notch from its engagement with a fixed stop on the framing
125 *t'* from the slide, and then, pressing against one of the shoulders *u*⁴ or *u*⁵, moves the slide U, as desired, to lift out of engagement the pawl S or S' which has been acting, (see Figs. 7, 15, and 17,) at the same time releasing the
130 opposite one and allowing it to drop into the working position, and thus changing the direction of the intermittent motion of the wheel R, and consequently of the pattern-barrel H.

As the slide U is moved only enough to prevent either pawl S or S' from turning the
135 wheel R, or only sufficient to prevent each from more than just touching the tooth *r* below the

one it would have acted upon, it will be seen that the action of the reversing mechanism will be to move the bar w' or w'' under its respective pawl S or S' as the pawl itself moves outward, and the pawl will be prevented from acting until its next outward movement, when the other pawl will be lifted into action. The spur-wheel R, and consequently the pattern-barrel H, are kept steadily in position by the catch w of the pawl W acting in one or other of the notches between the teeth r of the wheel R. At the free end of this pawl W is a double cam, W' , actuated by a spur, t^4 , at the end of the swinging lever T, which at the commencement of the movement of the lever T will momentarily lift the pawl W out of engagement with the spur-wheel R and permit its movement by the pawl S or S'.

Various modifications may be made in some of the details without sacrificing the advantages of the invention. Instead of the single cam V^4 acting against the arm V' V^2 on the bar V with a spring, V^5 , inducing a reverse motion, I can employ a double cam with a pin received in a groove in the face, and thus secure a positive motion at the right time in both directions and without the use of a spring. In place of using the cam of the form shown in Fig. 15, I can modify the form of the cam, as shown by Fig. 16, so as to throw the lever T at one movement to the extreme of its motion in one direction or the other—or, in other words, the full throw of the pawls S S'—and allow the resting point of the lever T to be at one extremity of its throw, instead of at a central point between the two extremities of the throw. Instead of placing the long pin h^4 at the extreme ends of the series of holes in the pattern-cylinder H, I can fix one or both at a position nearer the center of the length, with an effect to induce the reverse of the motion of the pattern-cylinder, and consequently the reverse repetition of the entire series of changes, sooner than before.

I claim as my invention—

1. The combination, with the knitting-head and rotary disk C, of a thread-carrier, B, provided with spring B^2 and means for operating the carriers, said tension-spring being adapted to be closed and opened by the movement of the carriers, substantially as herein specified.

2. In combination with the knitting-head G and loop-wheel g' , a yarn-carrier, B, having a guide for the yarn, means for operating it with a to-and-fro linear movement, tension-springs B^2 , adapted to confine and release the yarn, the springs B^3 B^4 , and means for operating the latter to cause it to bear upon or release the spring B^2 by the motion of the carrier, all substantially as and for the purpose herein specified.

3. The yarn-carriers B, in combination with the disk C, a stationary plate having a cam-groove to protrude the carriers and draw them

back again, with the pattern-wheel H, and suitable connections, whereby the carriers are automatically operated, substantially as set forth.

4. The yarn-carriers B, mechanism for imparting thereto an alternate protruding and withdrawing motion, disk C, and mechanism for imparting thereto a step-by-step revolving motion, in combination with means for reversing the direction of the revolution of the disk, substantially as set forth.

5. In combination with the series of yarn-carriers B and means for changing their position step by step in one direction and in the other, as shown, the cutters D, and means for operating the same as the disk C, supporting the carriers B, begins to move, so that each thread is severed as its carrier is withdrawn, while the disk is being turned in either direction, as herein specified.

6. The pattern-cylinder H, connected gear-wheel R, and holding-pawl W, in combination with each other and with the operating-pawls S S', lever T, means for rocking the latter, the movable slide U w' w'' , and means for operating the same to induce the reversing of the pattern-cylinder H, as herein specified.

7. The vibrating lever M^4 and its operating means, in combination with the catch T' t' and slide U, operated substantially as set forth, for the purpose specified.

8. The eccentric K and rod J, in combination with the lever L, slotted lever N, having the pin n , cam Q' , pattern-cylinder H, means for operating it, and disk C, substantially as set forth.

9. The knitting-head G, loop-wheel g' , partially-revolving disk, means for operating the same in one direction or the other, series of carriers B, and means for protruding and withdrawing them, pattern-cylinder H, suitable connections, and means for moving and reversing the motion of the pattern-cylinder, all combined and arranged for joint operation as herein set forth.

10. In combination with a series of yarn-carriers, B, provided with pins b , the disk C and stationary plate A, provided with a cam-groove, substantially as herein specified.

11. The lever L, provided with the movable piece L' and spring L^2 , and rod J, in combination with the eccentric K, disk C, and means for holding the rod J in engagement with the disk, as herein specified.

In testimony whereof I have hereunto set my hand, at New York city, this 28th day of October, 1880, in presence of two subscribing witnesses.

JOSIAH DOW.

Witnesses:

W. COLBORNE BROOKES,
W. L. BENNEM.