

(No Model.)

3 Sheets—Sheet 1.

F. A. NYE.
CIRCULAR KNITTING MACHINE.

No. 440,869.

Patented Nov. 18, 1890.

Fig. 1.

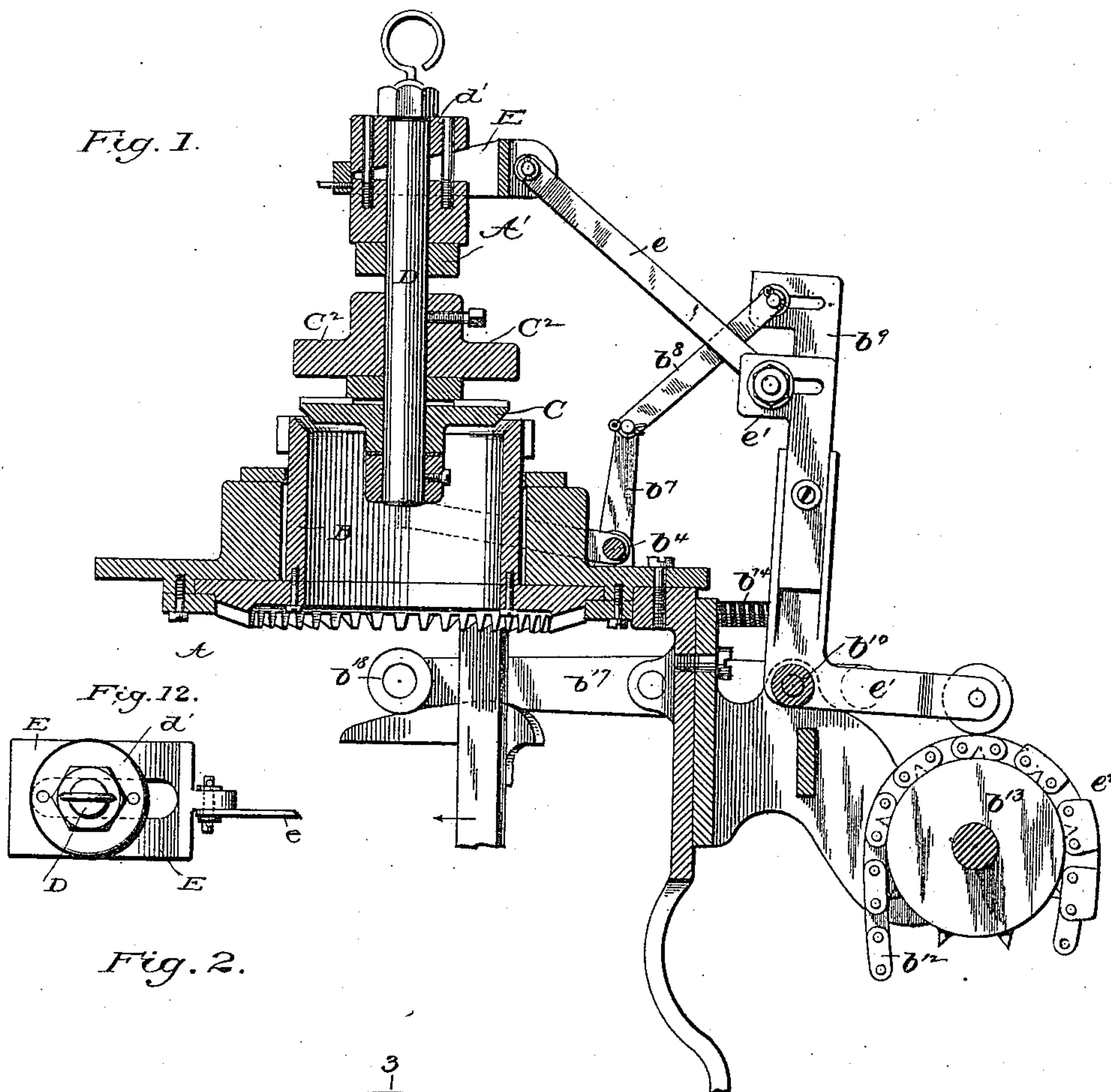


Fig. 12.

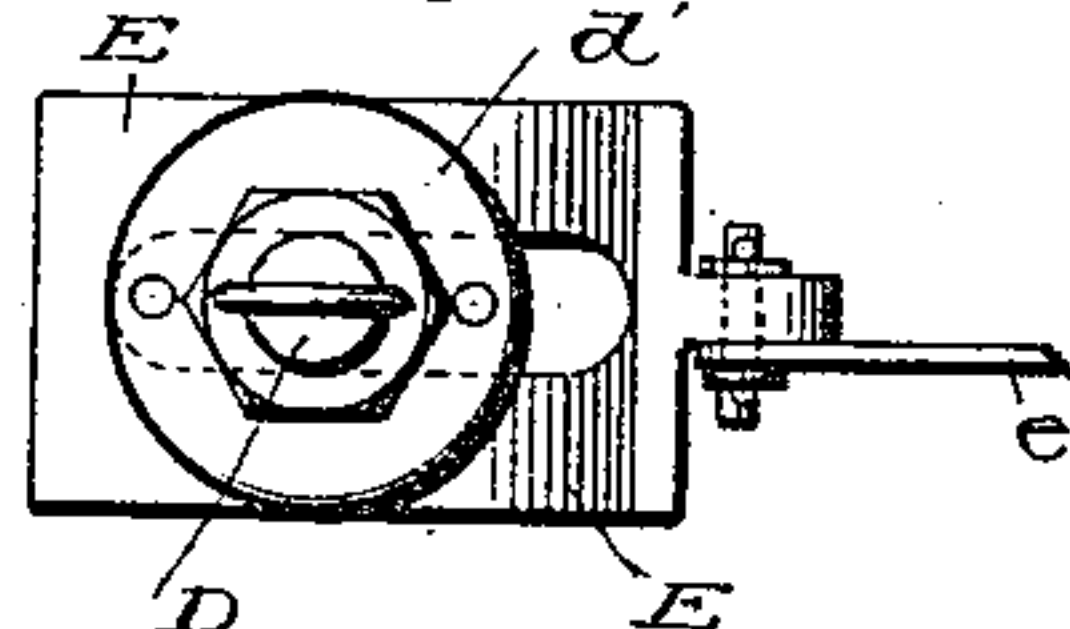
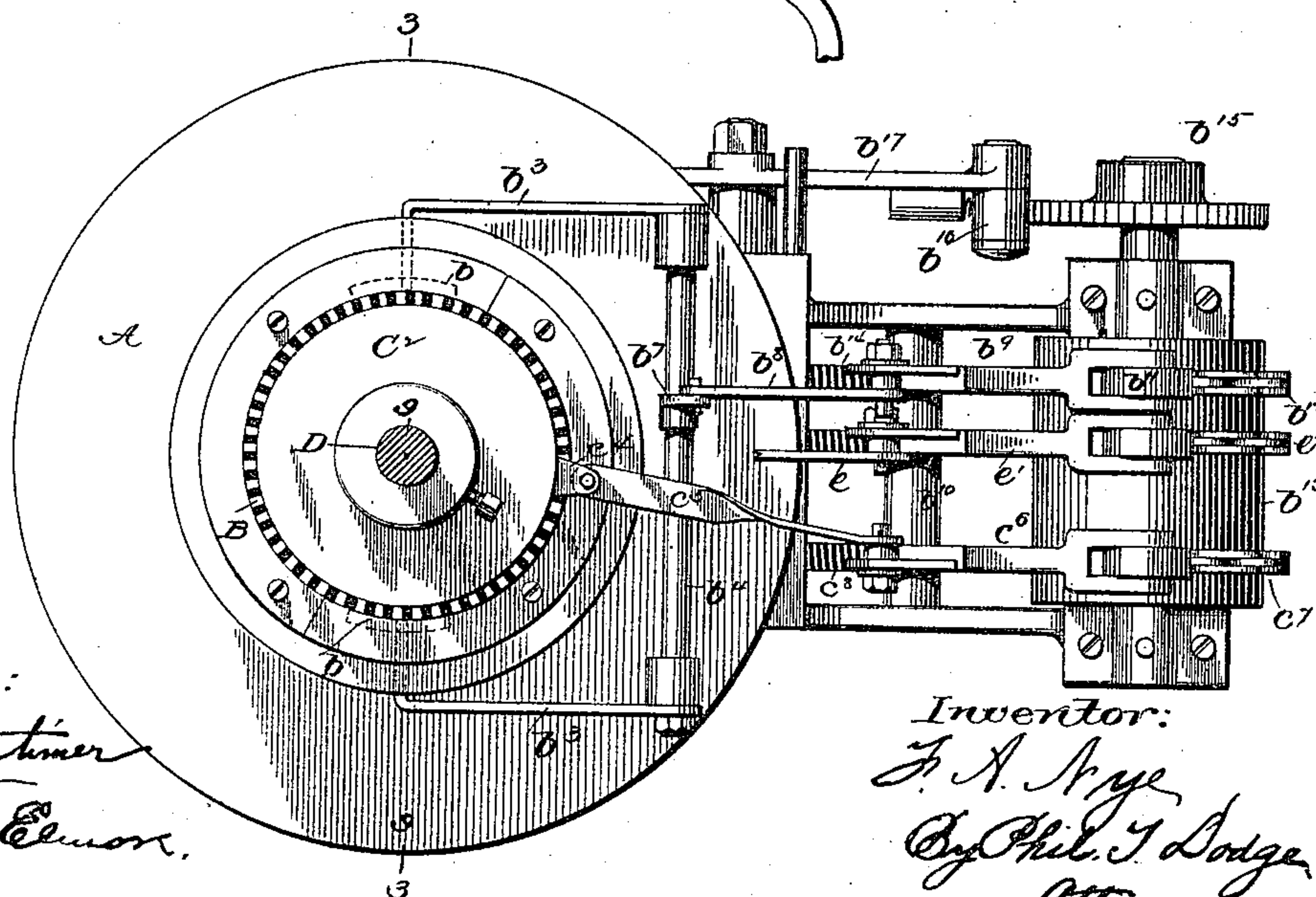


Fig. 2.



Witnesses:

W. H. Mortimer

F. J. Gault Elmore.

Inventor:

F. A. Nye
By Phil. T. Dodge
Atty.

(No Model.)

3 Sheets—Sheet 2.

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Fig. 3.
on line 3-3

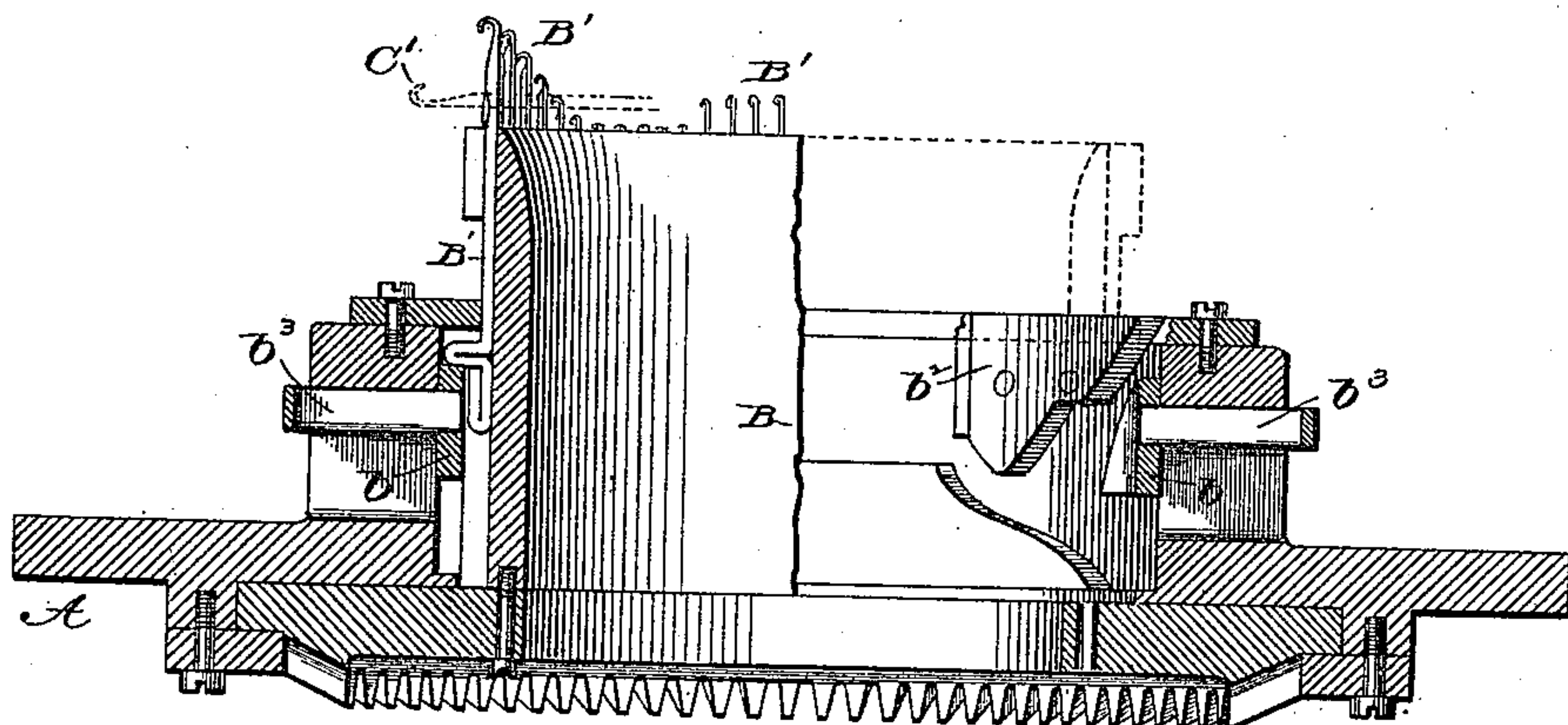


Fig. 4.

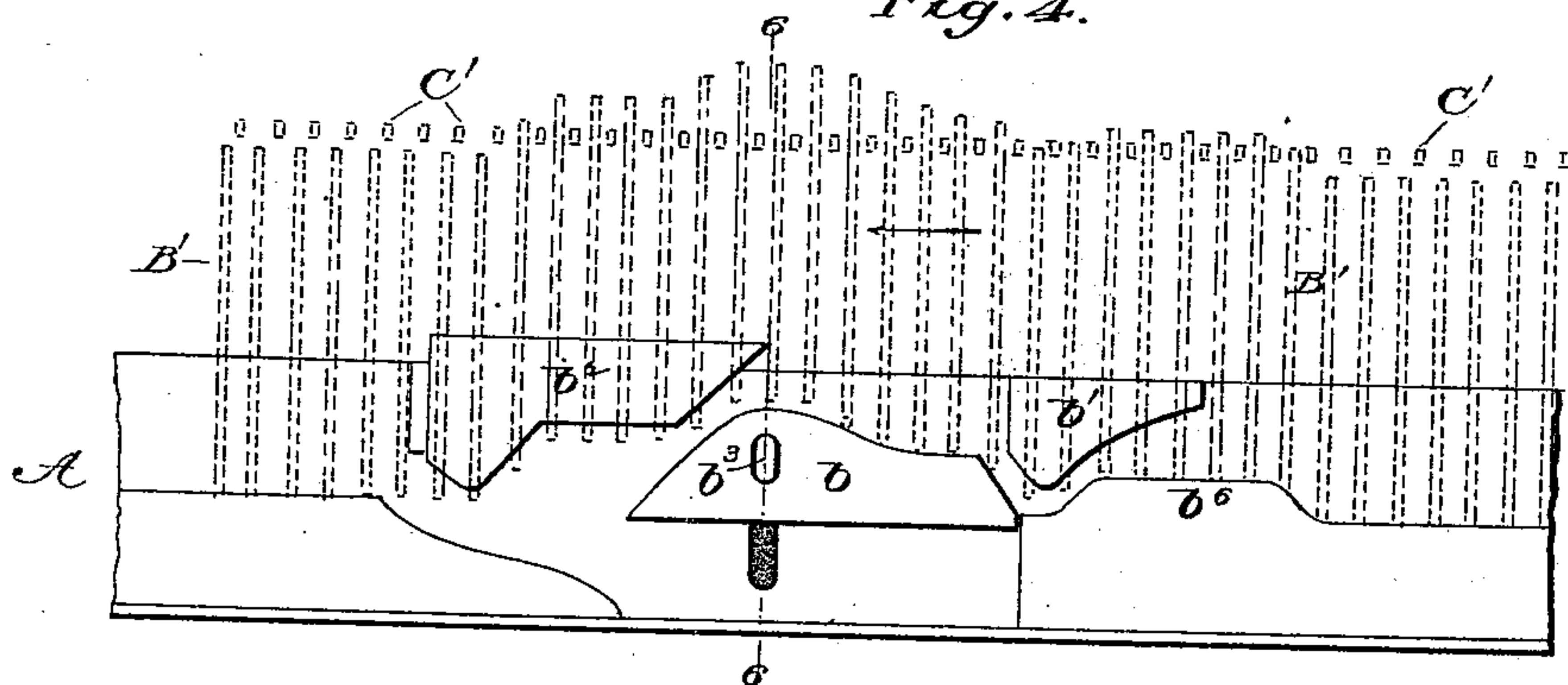


Fig. 5.

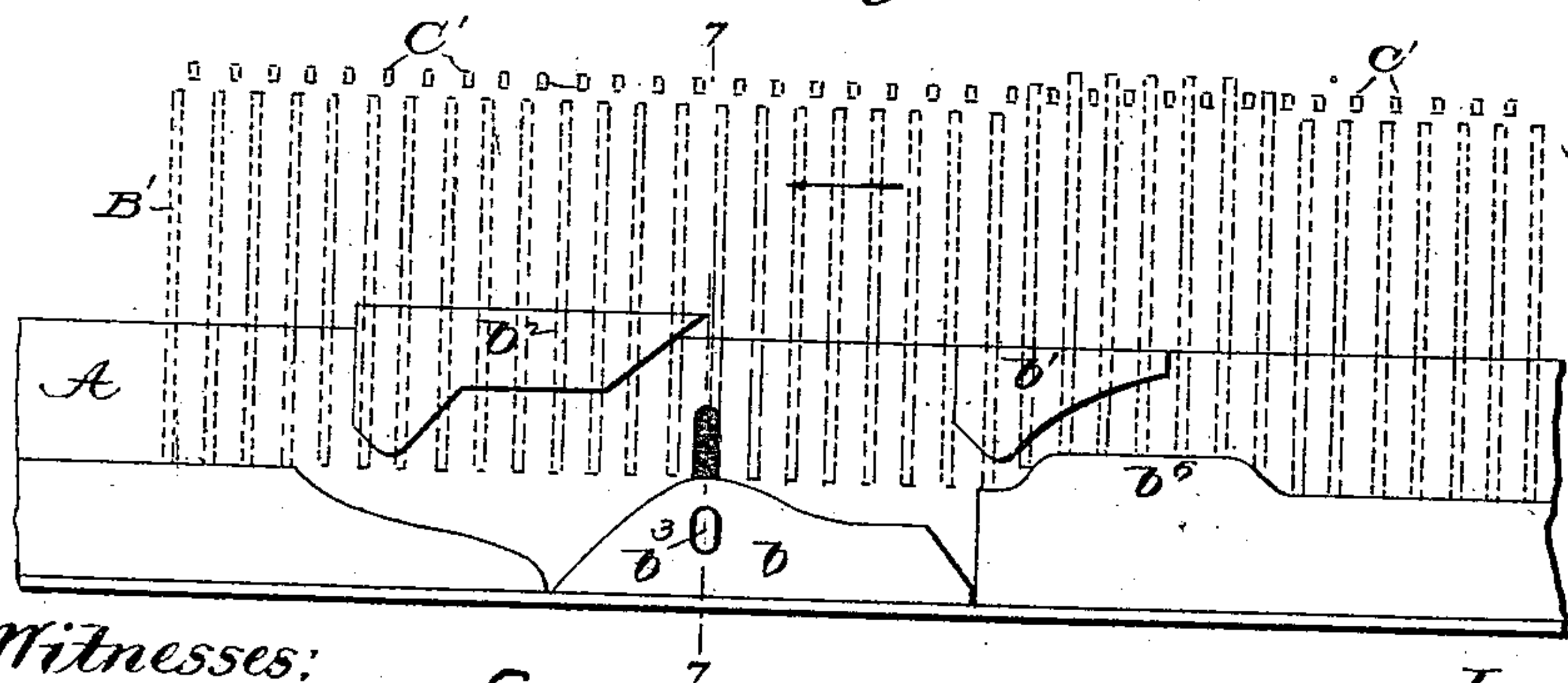


Fig. 6.
on line 6-6

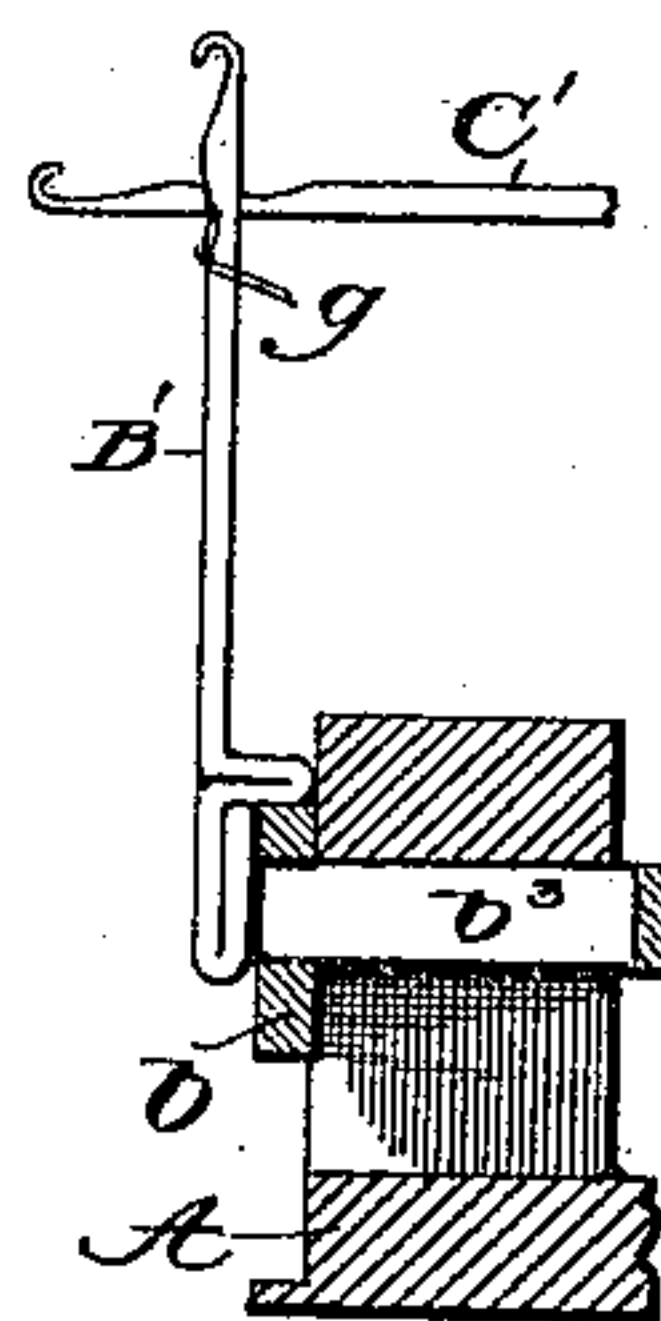
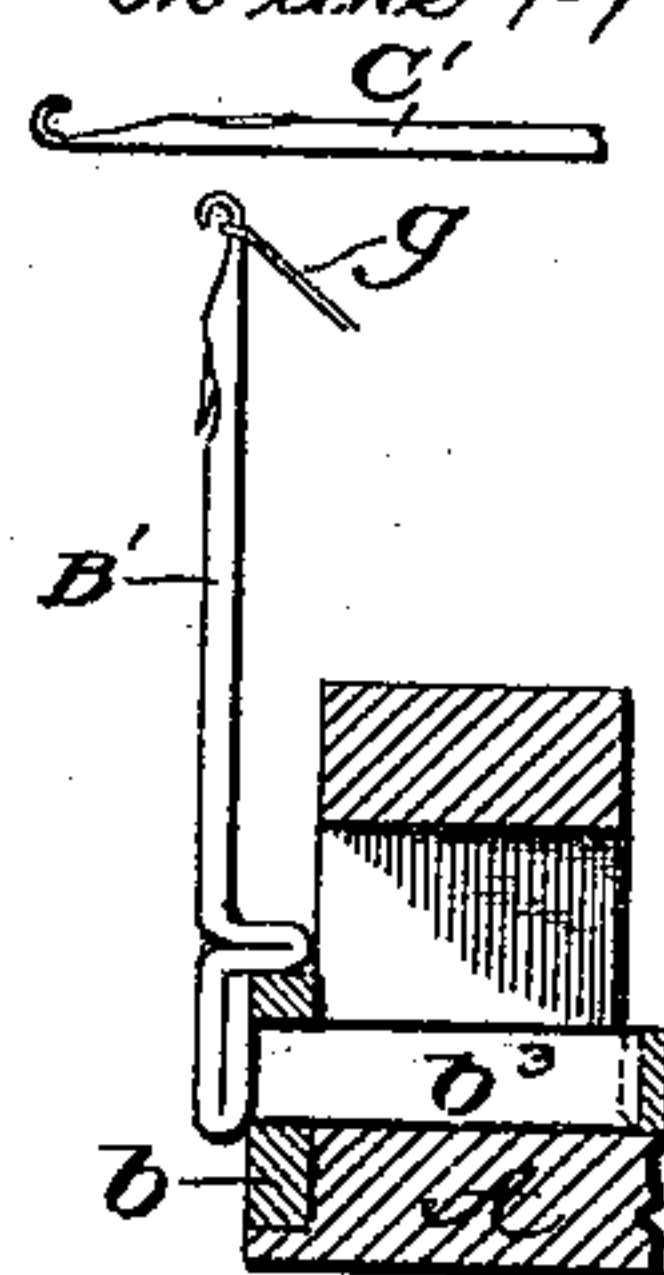


Fig. 7.
on line 7-7



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(No Model.)

3 Sheets—Sheet 3.

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Patented Nov. 18, 1890.

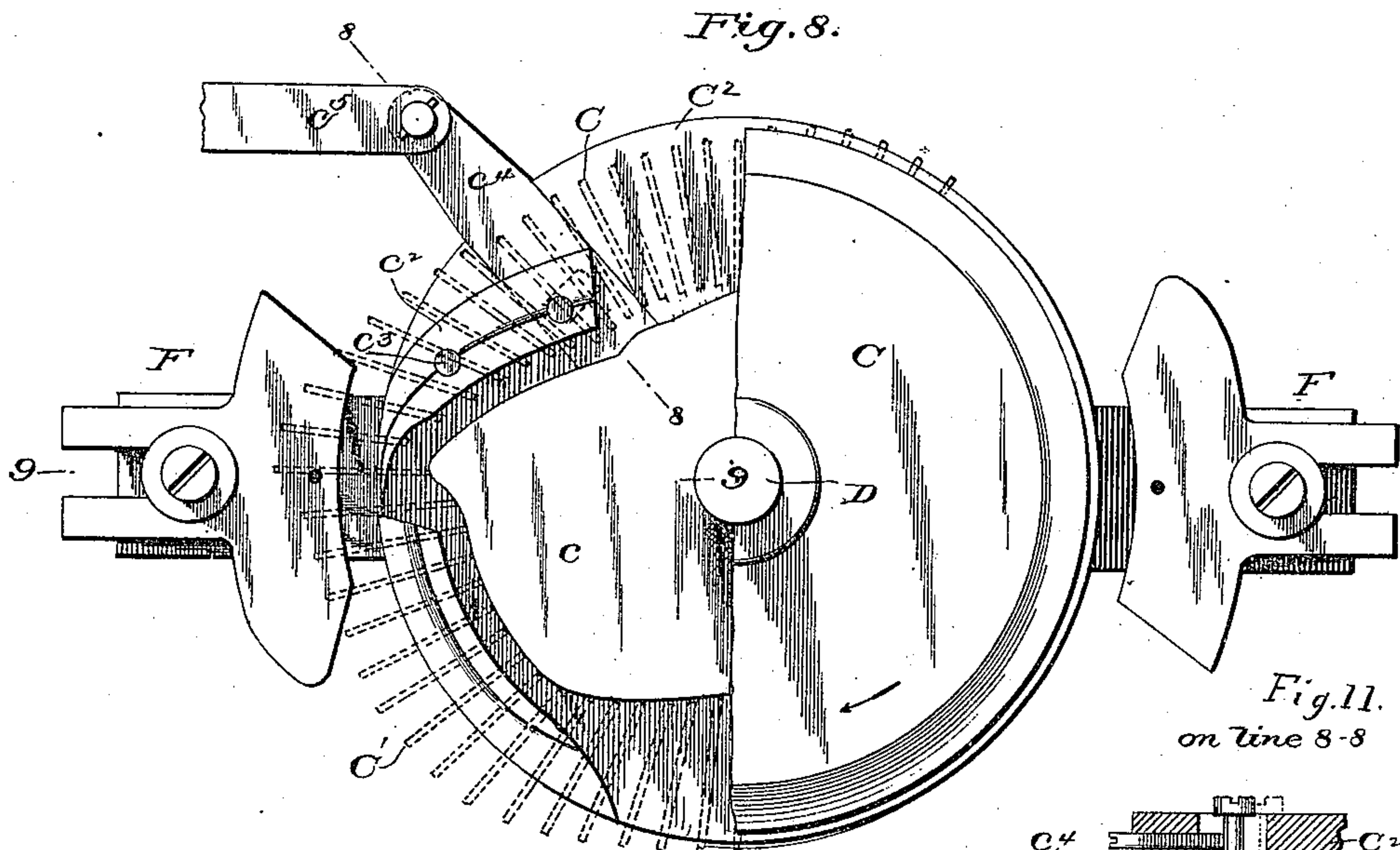
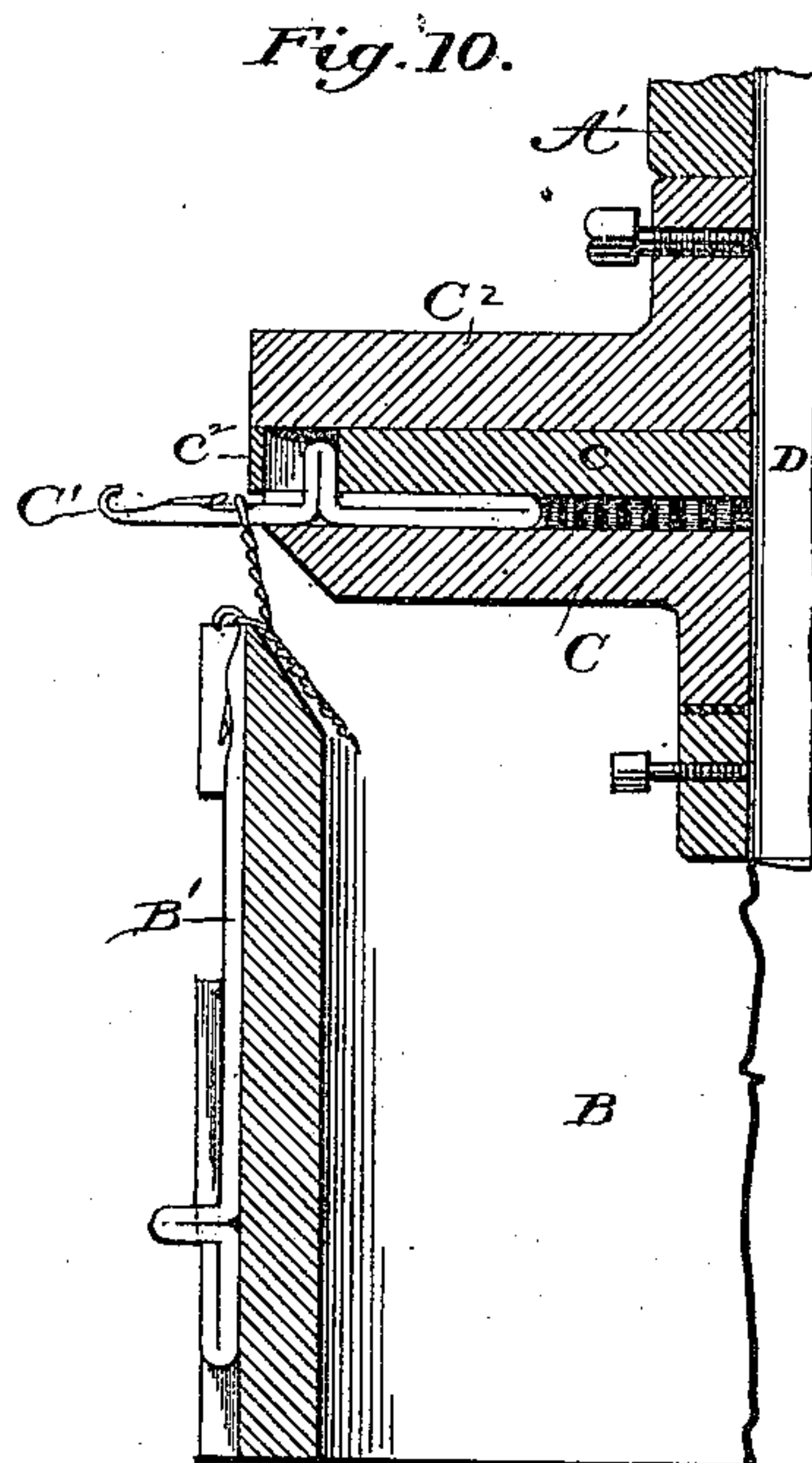
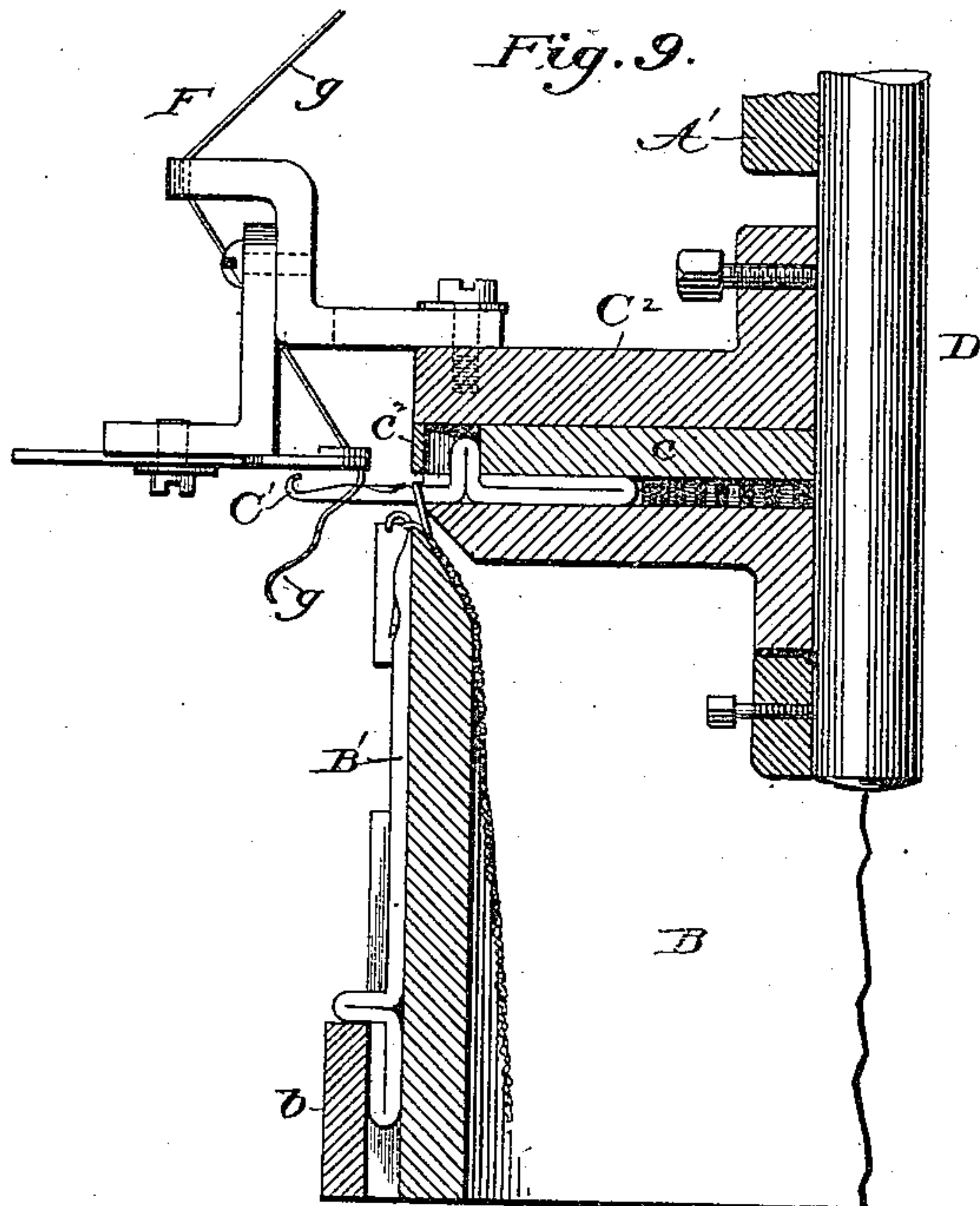
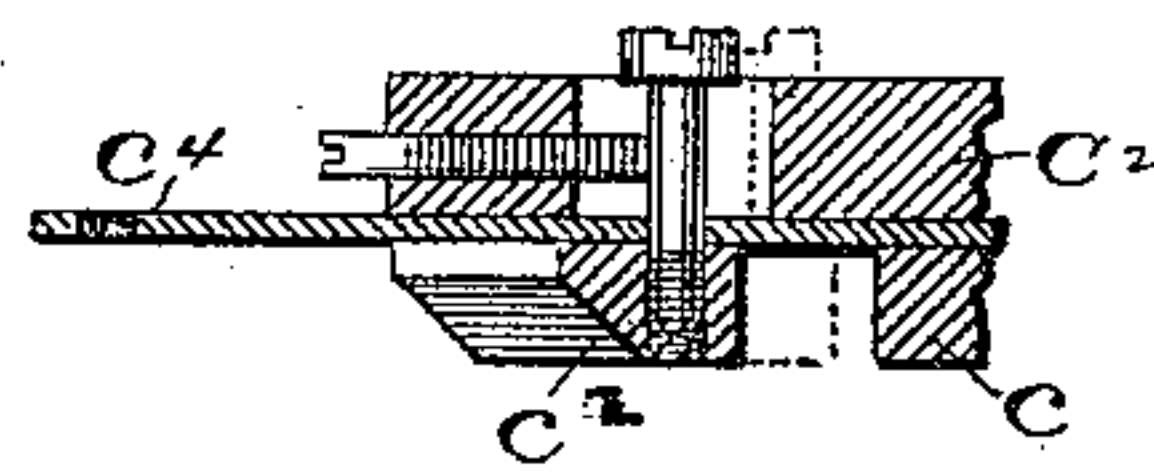


Fig. 11.
on line 8-8



Witnesses:

M. H. Mortimer
F. Stanley Elmore.

Inventor:

F. A. Nye
By Phil. J. Lodge
Atty.

UNITED STATES PATENT OFFICE.

FRANK A. NYE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO GEO.
E. NYE AND EDWARD TREDICK, OF SAME PLACE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 440,869, dated November 18, 1890.

Application filed November 22, 1889. Serial No. 331,221. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. NYE, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain
5 Improvements in Circular-Knitting Machines, of which the following is a specification.

My invention relates to so-called "cylinder machines" in which reciprocating needles in an upright tubular cylinder co-operate with
10 horizontal reciprocating needles in an overlying dial-plate, and has reference more particularly to machines which are employed for knitting stocking-legs, sleeves, and other tubular fabrics knit in continuous lengths, in which
15 welts and slack courses are produced at regular intervals at the points where the fabric is to be cut into lengths for use.

In machines as ordinarily constructed the welts are produced on the cylinder-needles,
20 the dial-needles being temporarily thrown out of action. It has also been the general custom to produce the slack courses in the fabric by the cylinder-needles, which were given an increased movement for the time being in
25 order to draw longer stitches.

My improved machine is constructed to produce welts by the constant action of the dial-needles instead of the cylinder-needles, the dial-needles remaining in action while the
30 cam for elevating the cylinder-needles is lowered, so that all the cylinder-needles are for the time being inactive.

I combine with the vertically-movable cylinder-cam automatic means for raising and
35 lowering it at the predetermined times, this mechanism being preferably in the form of a pattern-chain and intermediate levers, though other equivalent pattern mechanism—such as is familiar to every person skilled in the
40 art—may be employed.

I am aware that a lifting-cam acting on cylinder-needles has been combined with automatic mechanism for raising and lowering the same to a very limited extent for the production of fancy fabrics; but I believe myself to
45 be the first to provide for lowering the cam to such an extent that the needles are all thrown temporarily out of action.

Under another part of my invention, which
50 relates to the production of welts, the dial-plate is mounted so that it may rise and fall,

combined with means by which it is gradually elevated during the production of the welt by the dial-needles.

I do not claim, broadly, a vertically-movable dial, as I am aware that the same has
55 been used in a machine in which welts were knitted by the cylinder-needles. My invention, however, includes a vertically-movable dial in any machine that is arranged to knit
60 the welts upon the dial-needles, the movement of the dial in one case having a materially different effect from its movement in the other.

Another part of my invention relates to the production of slack courses by means of the
65 dial-needles, the drawing-in cam or cams for said needles being combined with automatic mechanism by which the needles are caused to draw long stitches during the proper intervals.
70

In the accompanying drawings, Figure 1 is a central vertical section through so much of a knitting-machine as is necessary for an understanding of my invention. Fig. 2 is a top
75 plan view of the same. Fig. 3 is a cross-section on the line 3 3 of Fig. 2. Figs. 4 and 5 are developments or plane projections of the cams for controlling the cylinder-needles, the lifting-cam being shown in its two positions. Fig.
80 6 is a section on the line 6 6 of Fig. 4. Fig. 7 is a section on the line 7 7 of Fig. 5. Fig. 8 is an under face view of the dial-plate and the cams for operating the dial-needles and the attendant parts, a portion of the dial-plate being
85 broken away to show the cam mechanism and cap-plate thereover. Figs. 9 and 10 are vertical sections on the line 9 9 of Figs. 2 and 8, showing more particularly the manner in which the thread is laid to the dial-needles in
90 forming a welt and the manner in which the dial is lifted as the operation progresses. Fig. 11 is a vertical section on the line 8 8 of Fig. 8, showing the movable drawing-in cam and the attendant parts. Fig. 12 is a plan of the dial-adjusting wedge and adjacent parts.
95

Referring to the drawings, A represents a bed or frame; B, the vertical cylinder mounted to rotate therein; B', the vertical cylinder-needles reciprocated by cams on the inside of the surrounding frame; C, the rotary dial-plate
100 overlying the cylinder; C', the dial-needles; C², the non-rotating cap-plate overlying the

dial and provided with cams to actuate the dial-needles; D, a vertical spindle sustaining the dial and cap-plate and in turn sustained by a cross-bar A', forming part of the main frame.

In their general construction and mode of operation the foregoing parts are similar to those in ordinary cylinder knitting-machines, although they differ as to certain details forming the subject of the present invention.

The first improvement relates to means for throwing the cylinder-needles out of action in producing welts, and is clearly shown in Figs. 1 to 7, in which b represents the needle-lifting cam; b' b^2 , the needle-depressing cams. The lifting-cam b is arranged to slide vertically on the inside of the frame, and is raised and lowered on the end of a lever b^3 , lying outside of the cylinder, mounted on a rock-shaft b^4 . The drawings represent a double-feed machine receiving two threads at opposite sides of the cylinder, as usual, and having therefore, as usual, needle-operating cams in duplicate on opposite sides. The one rock-shaft carries at opposite ends arms for operating both of the lifting-cams b .

The lifting-cams and attendant parts are so constructed that the cam may be lowered from its operative position (shown in Fig. 4) to the position shown in Fig. 5. In the latter position the cam is entirely out of action and permits the cylinder-needles to pass over it without lifting them to an operative position. In other words, the needles depressed by the cam b' and holding the stitches thereon remain in this depressed position while the dial-needles continue to operate, so that the welt is formed by the dial-needles. The essential feature of my invention in this connection lies in mounting and operating the lifting-cam b in such manner that it will permit the cylinder-needles to remain inactive during the formation of welts on the dial-needles, and it will be apparent to the skilled mechanic that the cam may be guided in various ways and operated by various devices without changing, essentially, the mode of action or passing beyond the limits of my invention.

Under certain conditions encountered in practice there is a tendency of the stitches on the dial-needles to be carried outward with the needles as the latter are projected. In order to remedy the difficulties which result from this action, I provide on the inside of the frame, as shown in Figs. 4 and 5, a cam b^6 , by which the needles are elevated slightly above the position in which they were left by the depressing-cams. This rising action occurs before the needles reach the knitting-point, and the result is that although the cylinder-needles may not be elevated to a knitting position they are elevated so as to stand between the dial-needles when the latter are thrust outward, so that they act as sinkers to hold the stitches of the dial-needles inward upon said needles. This arrangement of the

non-active cylinder-needles to act as the sinkers during the knitting of the welt upon the dial-needles is of great practical advantage.

The levers b^3 for operating the lifting-cams b may be operated by various mechanisms; but, as shown in the drawings, the rock-shaft b^4 , provided with the upright arm b^7 , is connected by link b^8 to an elbow-lever b^9 , mounted on a horizontal fixed pivot b^{10} , and provided at its heel end with a roller b^{11} , acted upon by a pattern-chain b^{12} on a pattern-roll b^{13} . A spring b^{14} tends to move the parts in opposition to the chain and to keep the cams in their elevated or knitting position. The chain is composed of high and low links in such number and arrangement as is necessary to produce the desired fabric. As shown, the roll is provided at one end with a ratchet-wheel b^{15} , operated by a pawl b^{16} on the end of a lever b^{17} , pivoted to the main frame and operated by a cam b^{18} on the rotary cylinder.

I do not claim the elbow-lever, pattern-chain, its roll, or the mechanism for operating the same, these parts being of a construction now in common use for controlling other parts of a knitting-machine.

During the formation of a welt on the dial-needles the fabric of course grows longer on its inner than its outer surface, and consequently the tension is received almost wholly upon the cylinder-needles. This results in a tendency of the stitches to work outward on the dial-needles and in an occasional imperfect action of the dial-needles. To remedy this difficulty I arrange the spindle D, which sustains the dial-plate, so that it may slide vertically through the cross-head A' and sustain it by means of a horizontal wedge E, which slides between a fixed bearing-plate on the cross-head and a cap-plate d' on the top of the spindle. The wedge, which is slotted to straddle the spindle or shaft D, as shown in Figs. 1 and 12, is connected by a link e to an elbow-lever e' , mounted on a horizontal axis and acted upon by a pattern-chain e^2 on the pattern-roll. The pattern-chain has links of various heights, and as the chain is advanced step by step during the formation of the welt the wedge is caused to move forward and lift the spindle and dial-plate, thereby increasing the distance between the edge of the dial-plate and the upper ends of the cylinder-needles, thus giving increased room for the welt-stitches on the inside of the fabric and causing a maintenance of the tension on said welt-stitches.

I prefer to arrange for the gradual elevation of the dial as the welt progresses. I generally knit about three courses of stitches in the welt, then lift the dial slightly and knit two additional courses, again lift the dial, and thereafter lay in the final courses. By thus knitting the welt-stitches upon the dial-needles and raising the dial, as described, I am enabled to lay a greater number of courses into the welt than would otherwise be possible, and thus to produce a welt which will

curl over the edge of the garment and produce a round edge or bead, giving a finish far superior to that produced by the ordinary welt in which the number of courses is very limited. It will of course be understood that the dial may be raised and lowered by any arrangement the mechanical equivalent of that herein shown, as I believe myself to be the first to provide for the raising of the dial during the formation of a welt upon its needles.

Referring now to the arrangement for producing the slack courses, attention is directed to Fig. 8, in which c represents a stationary cam for projecting the dial-needles, and c^2 the drawing-in cam. This is mounted at its outer or heel end on the vertical pivot c^3 , so that its opposite end may swing inward and outward. To the free end is connected the arm c^4 , which is in turn connected by link c^5 to an elbow-lever c^6 , mounted on the main frame and acted upon by a special pattern-chain c^7 . A spring c^8 acts upon the parts in opposition to the chain. The chain is constructed, like the others, with high and low links suitably arranged. When the high link actuates the lever c^6 , the end of the drawing-in cam is thrown inward nearer the center of the dial and caused to increase the distance to which the dial-needles are retracted, thus causing them to produce stitches of abnormal length and producing in the fabric a slack course.

I am aware that cams controlling the dial-needles have been combined with a pattern mechanism to vary the length of movement of the needle to a limited extent, so as to cause the action or non-action of their latches; but these machines were not adapted for the production of a slack course by the dial-needles.

In the present machine in knitting the slack course on the dial-needles the "right" face of the fabric is knitted on the inside of the tube, the tubular fabric being turned inside out after it leaves the machine. In the old machines referred to the right side of the fabric was necessarily on the outside of the tube as formed in the machine, and therefore it was not possible to knit the slack course on the dial-needles.

The formation of the slack course on the dial-needles is advantageous not only in that the machine may be constructed with extreme simplicity, but because the dial-needles can be practically operated to produce longer stitches, and consequently a greater slackness than is possible when the slack course is formed by the cylinder-needles.

In forming the slack course on the cylinder-needles, as usual, it is found that if the stitch is drawn to great length on the descending needle it is liable to fly over the needle when the latter rises and relieves it from tension, while on the contrary the long stitches formed on the dial-needles remain under constant

tension and are not liable to escape accidentally.

In using my machine in ribbed work it is found that the drawing of the loops for the surface or right side of the fabric on the dial-needles is highly advantageous, for, although the reason is not entirely clear, it is a fact that the ribs thus formed are fuller and rounder and of better form than those knit in the ordinary way.

In constructing my machine I prefer to arrange the thread-guide F , as shown in Figs. 8 and 9, in such position that it delivers the thread g directly upon the projected or extended dial-needles outside of or beyond the cylinder-needles, so that when the dial-needles are retracted they draw the stitches inward against and between the cylinder-needles in position to be grasped by the latter as they descend. In practice I find that this presentation of the thread primarily to the dial-needles instead of to the cylinder-needles, as usual, renders the knitting action more certain and uniform.

Having thus described my invention, what I claim is—

1. In a knitting-machine, a dial, dial-needles, and operating-cams for said needles, in combination with the cylinder, its needles, cams to depress said needles, the elevating-cam for the cylinder-needles, and an automatic pattern mechanism acting to lower said elevating-cam and allow all the cylinder-needles to remain out of action at one time, while the dial-needles remain in action, whereby the machine is adapted to produce automatically a tubular fabric on the two sets of needles and to produce welts on the inside of said fabric at predetermined intervals by the action of the dial-needles alone.

2. In a cylinder and dial knitting-machine, the needle-cylinder and an elevating-cam for the cylinder-needles adapted to be vertically adjusted to permit said needles to remain inactive, in combination with a dial adapted to be adjusted vertically in relation to the cylinder, whereby the machine is adapted to knit a welt upon the dial-needles and to maintain a proper tension upon the successive welt-stitches.

3. In a cylinder and dial knitting-machine having the usual cylinder-needles and operating-cams, the lifting-cam for the cylinder-needles, mounted to move vertically, pattern mechanism for depressing said cam to render the cylinder-needles inoperative, a dial movable vertically in relation to the cylinder, and a pattern mechanism for lifting the dial during the time that the cylinder-needles are inactive, whereby welts are produced on the dial-needles automatically and at predetermined points in the fabric and the welt-stitches maintained under tension to admit of a great number of courses being laid into the welt to give the latter a rounded form in cross-section.

4. In a cylinder and dial knitting-machine adapted to knit welts upon the dial-needles, a vertically-adjustable dial and pattern mechanism for elevating said dial step by step as the successive courses of stitches are laid into the welt.

5. In a cylinder and dial knitting-machine, the dial adjustable vertically in relation to the cylinder, in combination with a pattern-chain and intermediate mechanism for raising and lowering the dial, the pattern-chain being constructed with links of different heights arranged to elevate the dial-plate step by step.

6. In a cylinder and dial knitting-machine provided with reciprocating needles, as usual, a cam for retracting the dial-needles, in combination with a pattern mechanism arranged to move said cam inward beyond its normal limit of movement, whereby the machine is adapted for knitting a slack course upon the dial-needles.

7. In a cylinder and dial knitting-machine and in combination with two needle-elevating cams mounted to move vertically, the rock-shaft and its arms connected to the respective cams, a pattern-chain mechanism, and intermediate devices through which said chain acts to operate the rock-shaft.

8. In a cylinder and dial knitting-machine, the dial-supporting shaft mounted to slide vertically through the top of the main frame, in combination with the slotted sliding wedge straddling the shaft and acting to raise and lower the same.

9. In a cylinder and dial knitting-machine and in combination, the cylinder, the cylinder-needles, the vertically-movable needle-lifting cam, and means for raising and lowering the same, whereby the cylinder-needles are permitted to remain in a depressed and inactive position during the formation of the welt on the dial-needles, the cam b^6 , and needle-depressing cam b' , whereby the cylinder-needles are elevated between the dial-needles previous to the projection of the latter in order to serve as sinkers to hold the stitches inward upon the dial-needles without themselves performing the knitting operation.

10. In a cylinder and dial knitting-machine, the combination of the cylinder, the dial, and the cylinder and dial needles, as usual, a thread-guide arranged to lay the thread upon and within the grasp of the dial-needles, and needle-operating cams, whereby the dial-needles are projected to receive the thread while the cylinder-needles are operated, and the dial-needles then drawn inward previous to the descent of the cylinder-needles to carry the thread positively within the reach of the latter.

In testimony whereof I hereunto set my hand, this 20th day of November, 1889, in the presence of two attesting witnesses.

FRANK A. NYE.

Witnesses:

JOHN C. BREWIN,
GEORGE E. NYE.