

No. 698,045.

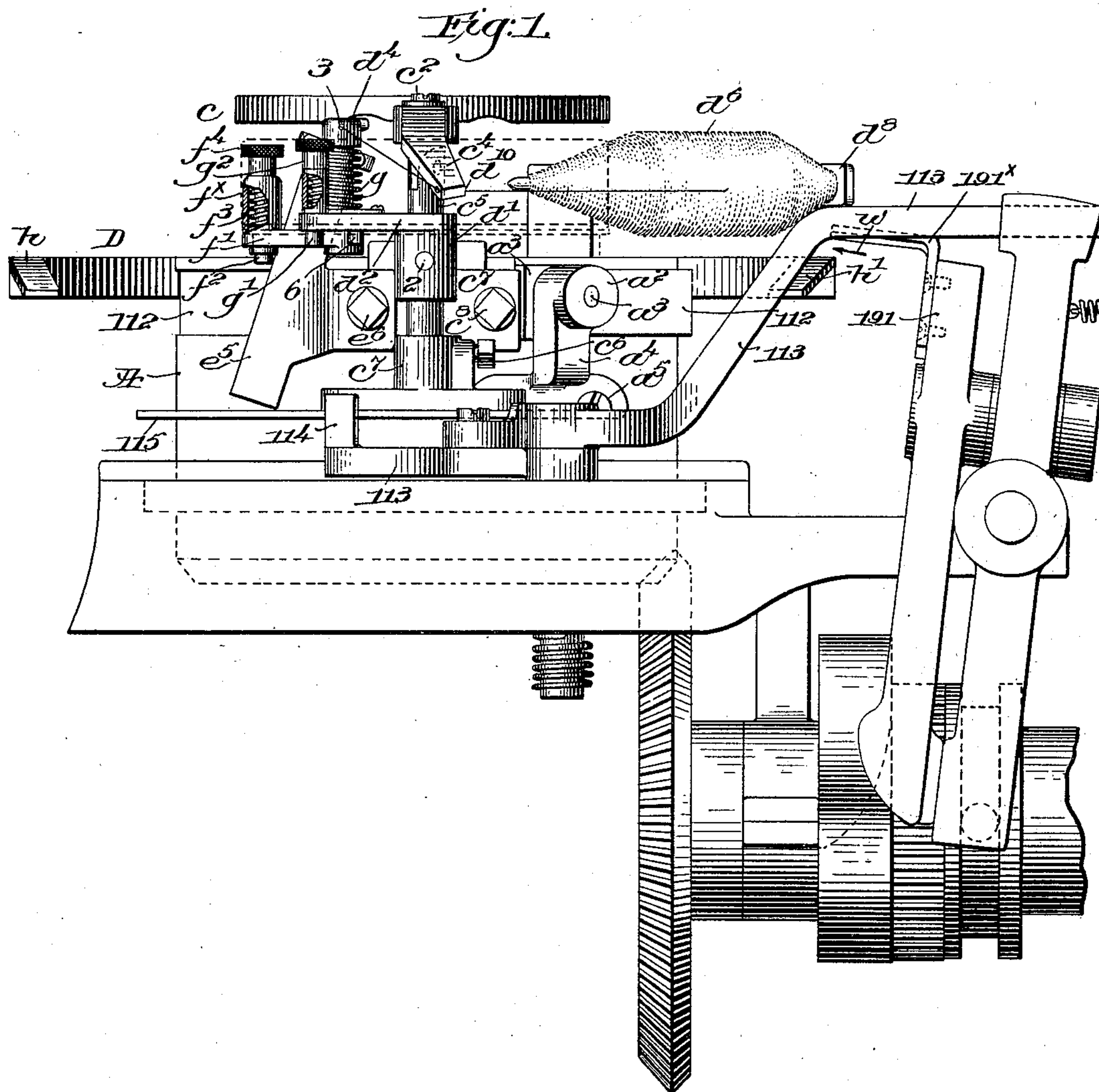
Patented Apr. 22, 1902.

J. J. O'BRIEN.
KNITTING MACHINE.

(Application filed Oct. 6, 1900.)

(No Model.)

3 Sheets—Sheet 1.



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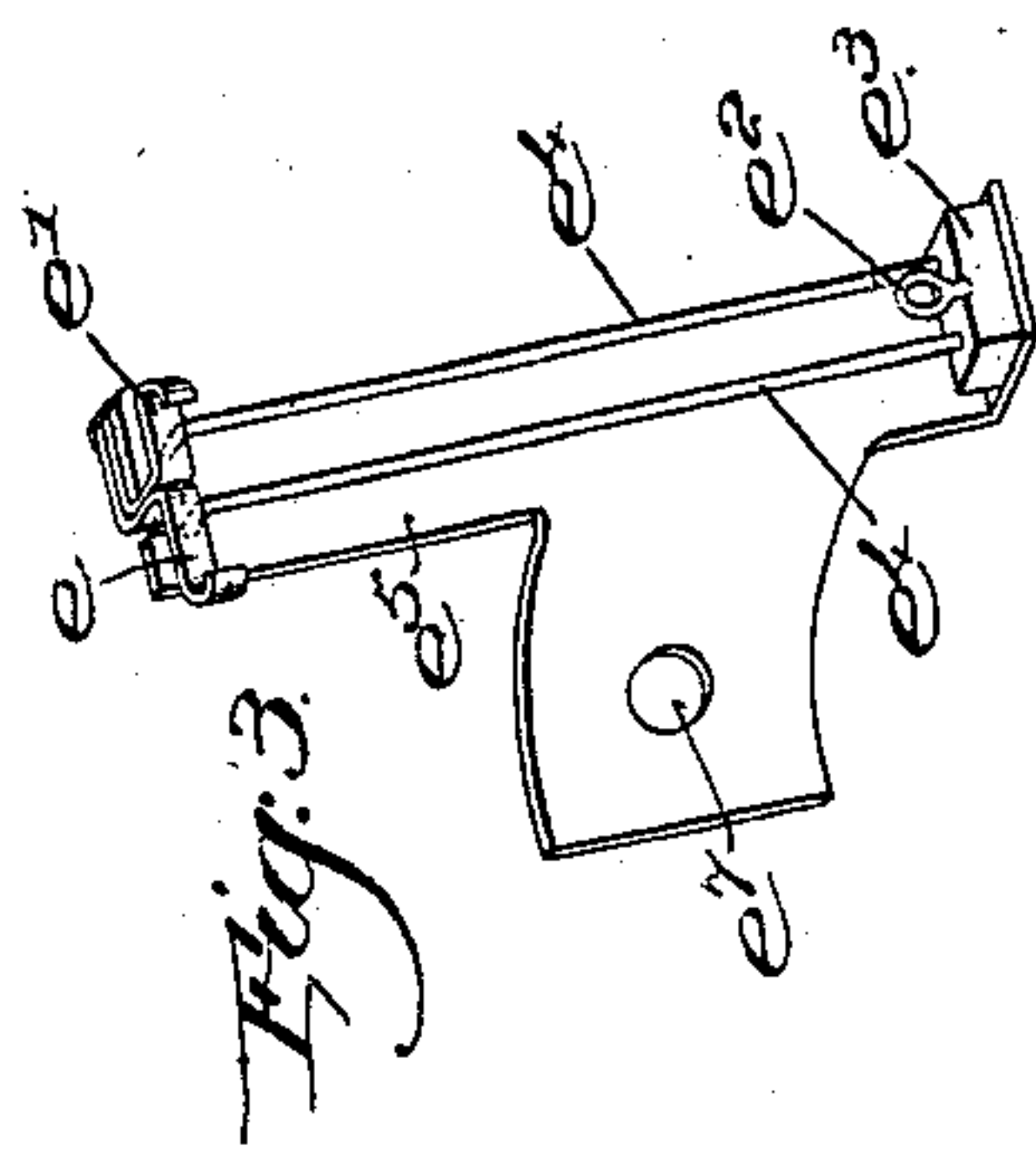
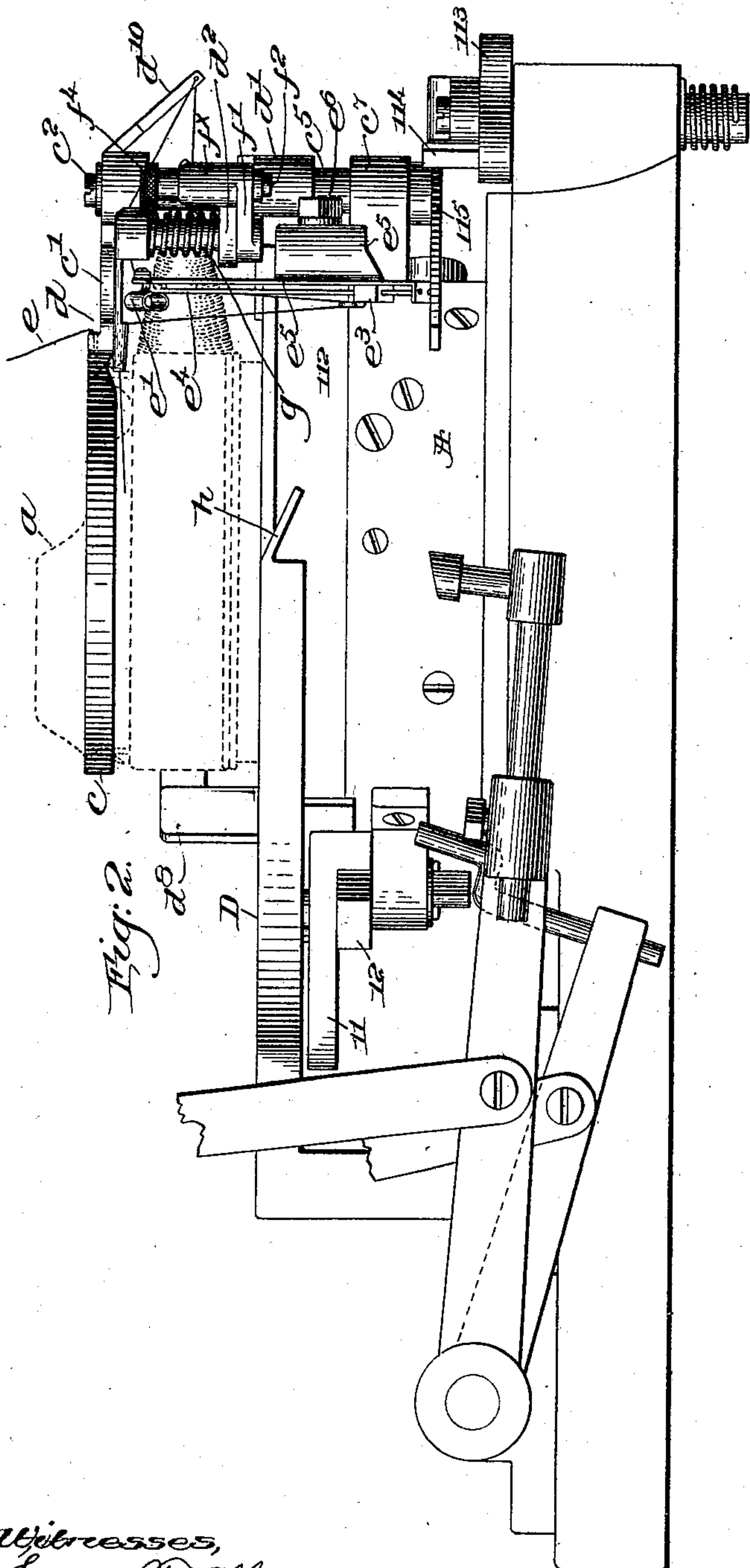
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3 Sheets—Sheet 2.



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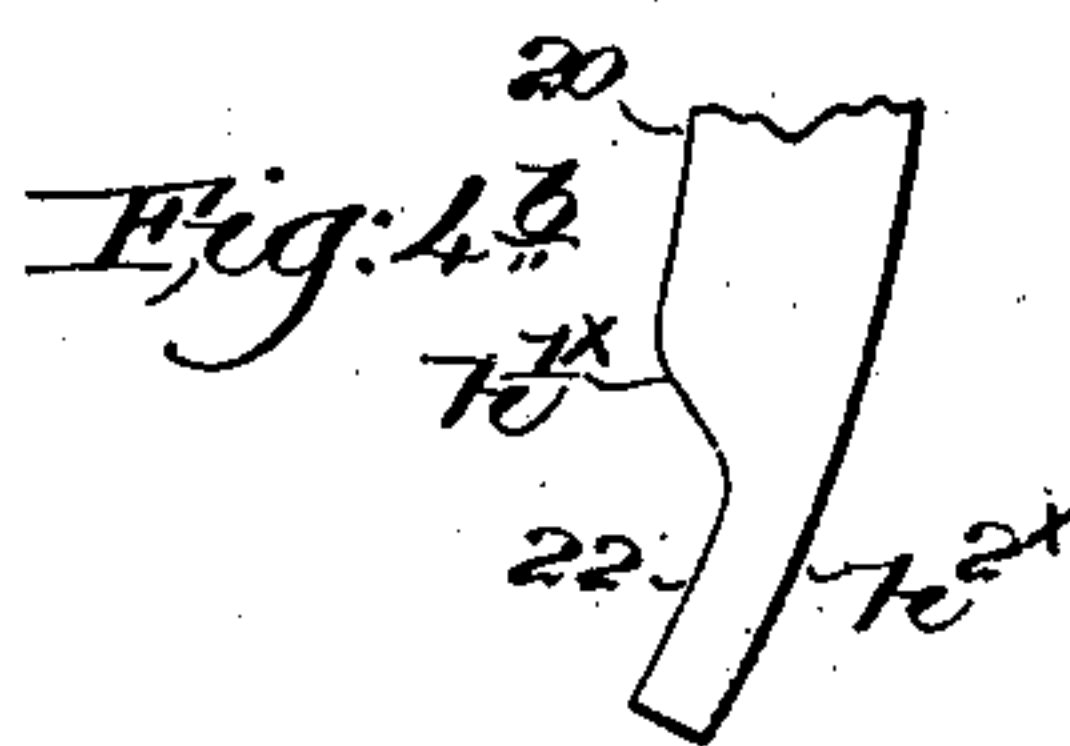
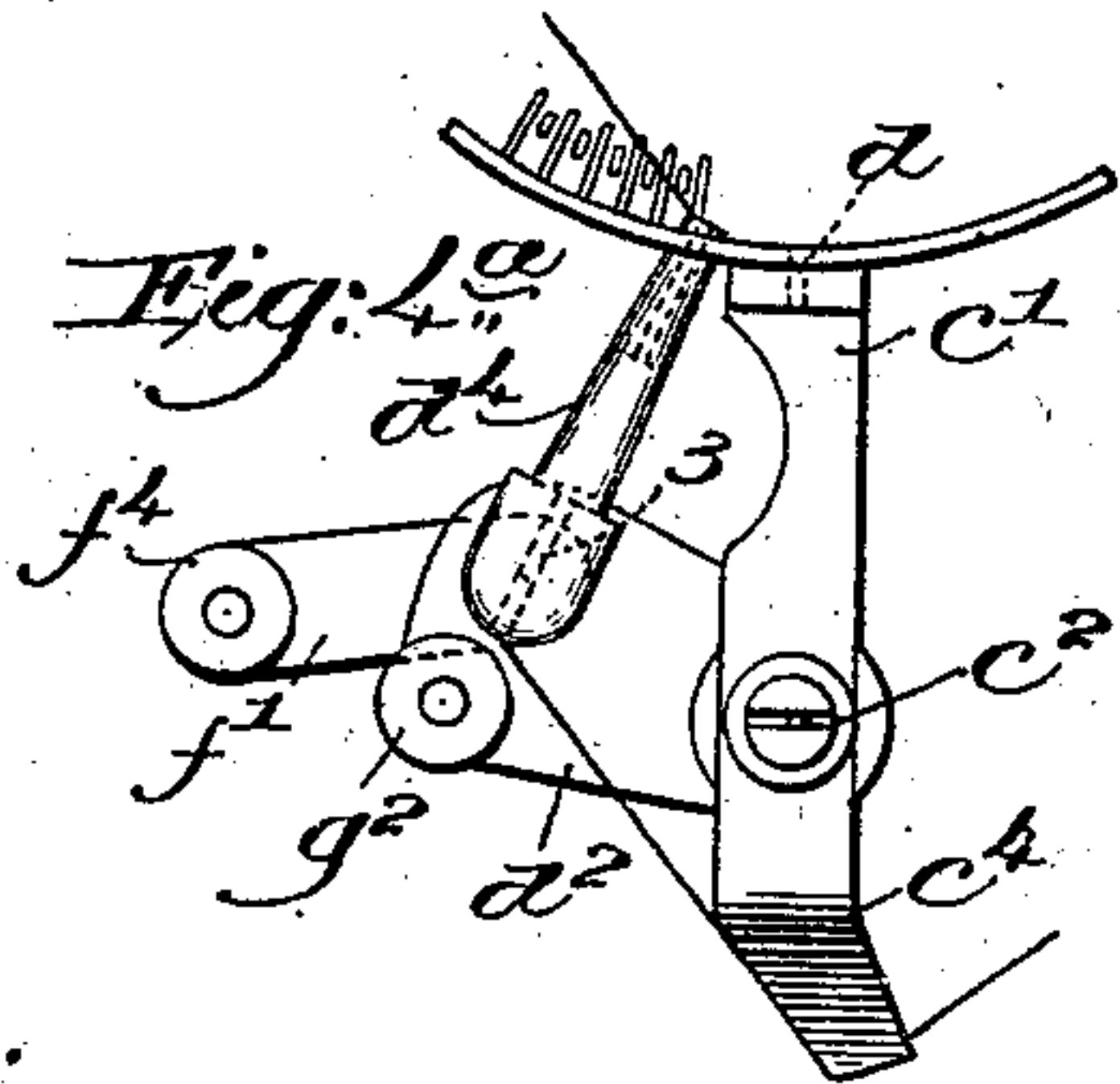
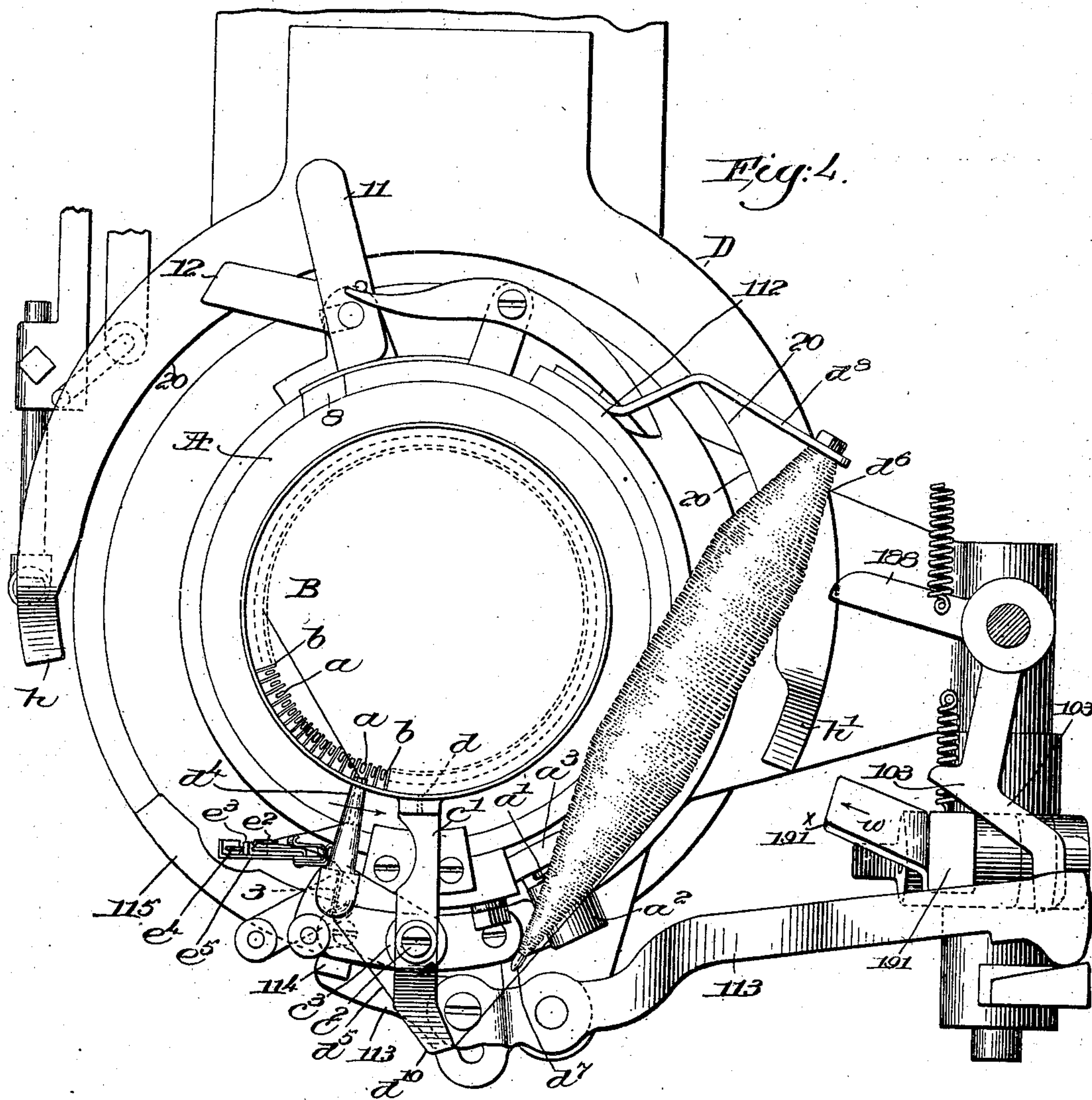
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

JAMES J. O'BRIEN, OF BOSTON, MASSACHUSETTS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 698,045, dated April 22, 1902.

Application filed October 6, 1900. Serial No. 32,210. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. O'BRIEN, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Knitting-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and numerals on the drawings representing like parts.

10 Prior to my invention knitting-machines employing a series of vertical needles held in grooves in a needle-bed have been actuated to knit by or through the revolution of a cam-cylinder, and for knitting stockings presenting heel and toe pouches formed by narrowing and widening the cam-cylinder had been reciprocated. In this class of machine a main thread supplied by a main-thread guide has been employed to knit the tubular parts of the stocking, as the leg and foot, and the main thread is also used while the machine is narrowing and widening to knit heels and toes, and during the knitting of heels and toes a reinforcing-thread has been introduced by an auxiliary-thread carrier, and said auxiliary thread when the toe and heel are completed has been cut off or disconnected automatically from the fabric. In this class of machine, wherein the reinforcing-thread is introduced only at the time that it is required to thicken the toe or heel, it frequently happens that the reinforcing-thread, usually carried in by the main thread, bunches or coils at its free end about the main thread, so that when the reinforcing-thread arrives in position to be taken by the needles the bunch is sufficient to injure the needles or break the running thread, thus causing imperfect work.

40 In my efforts to overcome any liability to injure the needles and produce perfect work I have devised means for introducing a reinforcing-thread at the proper times for narrowing and widening the fabric or whenever reciprocating knitting is being done, as in the production of toes and heels, and at the completion of a heel or toe I have provided means whereby the position of the thread-guide for introducing the reinforcing-thread may be changed, it yet holding its thread, so that said thread fails to be taken by the needles as they are moved to knit a circular web. The reinforcing-thread during circular knitting is

left connected with the fabric, it remaining inside the knit web, the reinforcing-thread stretched inside the knitted fabric being broken off or removed from the knitted fabric after the same has been removed from the machine.

To control the reinforcing-thread properly during the knitting of heels and toes or while reciprocating knitting is being done, as when the cam-cylinder is being reciprocated, I find it is necessary to provide the reinforcing-thread with a take-up, it moving with the cam-cylinder and acting upon the reinforcing-thread to take up the slack thread therein as the reinforcing-thread guide travels from the extreme of its stroke to the first needle of the series of needles to be used for knitting each narrowing or widening course.

My invention therefore comprehends a knitting-machine capable of being revolved for tubular knitting and for being reciprocated for narrowing and widening in the production of heels and toes in which an auxiliary-thread guide and a take-up, to be hereinafter described, are used, the auxiliary-thread guide being put into its operative position to deliver its thread to the needles at the commencement of narrowing and being put into its inoperative position to prevent the delivery of its thread to the needles at the ending of widening, the thread, however, being left connected with the fabric during circular knitting.

My invention may be incorporated with any circular machine adapted to knit a fashioned stocking or a stocking having a heel produced by narrowing and widening.

Inasmuch as my invention relates only to the introduction of a reinforcing-thread and its control, I have considered it unnecessary to show the main parts of a knitting-machine.

Figure 1 is a partial front side view of a sufficient portion of a circular-knitting machine of the class described with my improvement added to enable the same to be understood. Fig. 2 is a partial left-hand side of the machine represented in Fig. 1. Fig. 3 represents one form of take-up which operates successfully, and Fig. 4 represents a plan view of the machine shown in Fig. 1. Fig. 4^a is a detached view of the reinforcing-thread guide and some of the adjacent parts.

Fig. 4^b is a detail showing the shape of the end of the controller to be used when the reinforcing-thread is to be supplied continuously to all parts of the knitted fabric.

5 Referring to the drawings, A represents a portion of any usual cam-cylinder to actuate a series of needles *a*, the shanks of which are located in suitable grooves of any usual or
10 suitable needle cylinder or bed B, said cylinder having at its upper end dividing-walls *b*, from which the thread is drawn in making the stitch, and *c* represents a ring-like latch-guard, it surrounding the upper ends of the needles.

15 The guard *c* has an opening *d*, (see dotted lines, Fig. 2,) through which is led the main thread *e*, (see Fig. 1,) employed in knitting the leg and foot of the stocking, said thread coming from any suitable bobbin, (not here-
20 in shown,) located, preferably, above the machine.

From the above it will be understood that the guard *c* also performs the function of a main-thread guide.

25 The cam-cylinder may be provided internally with suitable cams to depress the needles for knitting, so that the hooks of the needles may take the main thread from the opening *d* of the guard *c*.

30 The cam-cylinder A is surrounded externally, as herein shown, at its upper end by a ring-shaped frictional slide 112, which is maintained in contact with said cylinder by friction determined by a spring *a'*, (see Fig. 4,) contained in a tubular boss *a*², said spring
35 surrounding the shank of the plunger *a*³, the face of which acts upon the outside of said slide, causing it to follow the cylinder except when the slide is arrested, as will be described. The boss *a*² forms a part of the stand
40 *a*⁴, secured to the cam-cylinder by suitable screws *a*⁵, so that said slide 112 may move in unison with said cylinder during circular knitting and be arrested just before said cyl-
45 inder in reciprocating knitting completes each stroke in order that at the next opposite stroke of the cylinder the thread-guide described and also the reinforcing-thread carrier to be described may be maintained in
50 proper relation to the knitting-cams in order that both the threads may be taken by the descending needles during reciprocating knitting.

The guard *c*, that it may be put out of its
55 operative position when it is desired to remove the needle-cylinder, has its arm *c'* connected by a screw *c*² with a block *c*³, mounted to be turned about a suitable pivot *c*⁴ (see dotted lines, Fig. 1) in a post *c*⁵, held by a
60 screw *c*⁶ in a stand *c*⁷, connected with said slide 112 by a suitable screw *c*⁸.

The cam-cylinder has pivotally mounted on it a cam, the elbow-lever having arms 11 12, which are struck and moved, one when the
65 circular movement of the cam-cylinder is to be changed to reciprocating motion for narrowing and widening and the other when the

reciprocating movement of said cylinder is to be changed to a circular movement for tubu-
lar knitting. The cam-lever also in its move- 70
ment controls and moves into and out of its operative position an auxiliary draw-down cam 8, which when in its operative position acts to depress into their operative position
75 the needles which have been left up at the completion of widening.

The stand *c*⁷ sustains from its under side a segmental bar 115, which in the operation of the cam-cylinder during reciprocating knit-
80 ting meets a projection 114 of the lever 113 at the end of each reciprocation, said projection arresting movement of the slide 112, carrying the thread-guides.

The parts so far described and referred to by letter and number are found substantially
85 in United States Patent No. 484,610, dated October 18, 1892, and the cams at the interior of the cam-cylinder (not herein shown) are and will in practice be all as provided for in
90 said patent, the needles being drawn down to knit by stitch-cams, and the cam-cylinder may be both rotated and reciprocated for circular and for reciprocating knitting, and the
95 needles which are to be used in each course of narrowing and widening may be controlled and put simultaneously into position to be
moved and take thread and knit, all as provided for in said patent or as provided for in
usual machines of the Scott & Williams class.

I will now describe my improvements, 100
which for the sake of convenience I have represented as combined operatively upon a machine of the class referred to, premising, how-
ever, that my improvements are equally ap- 105
plicable to any usual circular-knitting machine capable of being reciprocated for heel and toe knitting.

The post *c*⁵ referred to is shown as being
surrounded in this instance of my invention
by a hub *d'*, having an arm *d*², the hub being 110
connected to the post by a suitable set-screw 2. The arm *d*² is employed as a support for
the reinforcing-thread guide *d*⁴, it being rep-
resented as a short finger having a longitudi- 115
nal opening 3 to receive and guide the reinforcing-thread *d*⁵, herein represented as
supplied by a proper bobbin *d*⁶, which may be
sustained in any suitable manner upon and
so that it may travel with the slide 112 and
the cam-cylinder. As herein shown, the 120
thread-supply is sustained on a spindle *d*⁷, held in the arm *d*⁸, connected at one end by
a screw *d*⁹ in any suitable manner with the
slide 112. The reinforcing-thread *d*⁵ after
leaving the bobbin *d*⁶ will be passed, prefer- 125
ably, through a suitable eye in the arm *d*¹⁰, which may for convenience of operation be
connected with the arm *c'* by the screw *c*²,
hereinbefore described. Between the point
where the reinforcing-thread enters the rein- 130
forcing-thread guide and the free end of said
guide through which the reinforcing-thread
is delivered to the needles when narrowing
and widening are being done said thread is

passed through a tension device (see Fig. 3) composed, as represented, of two spring-arms e' and then through an eye e^2 of the take-up e^3 , which may be, as herein represented, a block of suitable weight and adapted to slide up and down upon suitable guides, herein represented as composed of two like rods e^4 , sustained at their ends in suitable manner in a plate e^5 , which may be fixed to the hub d' , carried by and movable with said slide 112, traveling with the cam-cylinder, said connection, as herein shown, being effected by suitable set-screw, as e^6 , inserted through a hole e^7 in said plate.

The take-up herein represented acts continually upon the reinforcing-thread, the weight or equivalent, which may be a spring, rising under the strain on the thread as the cam-cylinder and thread-guide move in reciprocating knitting in carrying the thread-guides past the endmost needles used in each narrowing and widening course and while the cylinder and slide 112 complete their strokes, each stroke being of the same length for each course of narrowing and widening, or it rises as the reinforcing-thread is carried about the needles not in action for narrowing and widening and descends as the cam-cylinder returns with the reinforcing-thread guide, that it may present its thread to the needles to be used in the next narrowing and widening course.

The auxiliary-thread guide has a shank extended therefrom at right angles, which is passed loosely through a hole in the arm d^2 , the lower end of said shank receiving upon it the hub f of the arm f' , provided at its ends with a sleeve f^x , containing a vertical movable pin f^2 . This pin is supposed to have its lower end reduced in diameter to form a shoulder. This pin is surrounded within the sleeve f^x by a spring f^3 , acting normally to keep the lower end of the pin projected below the arm f' ; but this pin may be lifted by engaging the thumb-nut f^4 of the pin.

The shank of the reinforcing-thread guide is surrounded by a spiral spring g , which acts normally to put the reinforcing-thread in its inoperative position, at which time the delivery end of said guide is located at such a distance from the guide d , controlling the main knitting-thread, that the descending needles drawn down by the usual stitch-cams will not catch the reinforcing-thread and draw it down to knit to thus incorporate said thread in the fabric. When the said reinforcing-thread occupies its inoperative position, it is locked in that position by a suitable locking device, herein represented as a spring-controlled pin g' , a suitable spring surrounding said pin located in the sleeve g^2 , rising from the arm d^2 , said spring acting normally to project the lower end of the pin below the path of movement of the arm f' , connected with the reinforcing-thread guide. The pin g' may be lifted whenever it is desired to further turn or swing the reinforcing-

thread guide farther away from the needles, as when the needle-cylinder is to be withdrawn, for purposes as fully stated in said patent.

The movement of the arm f' under the action of the spring surrounding the thread-guide when the cylinder is to be withdrawn is controlled by a stud 6, (see Fig. 1,) and said thread-guide is held in its inoperative position during circular knitting by the lower end of the pin g' meeting that side of said arm f' which contacts with said stud.

I will now describe how the reinforcing-thread guide may be put automatically into its operative position.

The machine described will contain pattern mechanism for changing automatically the times of rotation and of reciprocation of the cam-cylinder A and means for controlling the needles, which are to be lifted and put out of working position and then into working position at desired times. Herein for the purpose of putting the reinforcing-thread guide d^4 into its operative position for narrowing and widening I employ a controller D, represented as a semi-circular casting, it being supported on a fixed part of the framework and partially surrounding the cam-cylinder, as best represented in Fig. 4. The free end of this controller has downwardly-extended toes h h' , said toes being represented as narrower than the main body of the casting. During circular knitting the lower end of the spring-pressed pin f^2 meets one of the toes, as h' , and rides upon the upper side of the controller and drops off the toe h at the opposite end thereof, and as the thread-guide d^4 is locked by the pin g' the reinforcing-thread guide is not changed in its position, and it therefore occupies its inoperative position.

The reinforcing-thread guide during reciprocating knitting is always put into its operative position when the cam-cylinder is moving in the direction to do circular knitting, and to provide for changing the reinforcing-thread guide from its inoperative position into its operative position at this time I employ near the toe h' , which is met by the pin f^2 during circular knitting, a dog or device 191, the same as the dog having like number and fully represented in United States Patent No. 552,806, dated January 7, 1896, said dog at the end of the last stroke made in circular knitting being moved by the change of position of the cam-lever 11 12, said lever being moved as demanded by the pattern-surface, fully provided for in said patent, preparatory to changing from circular to reciprocating knitting. The change of position of the lever 11 12 from the position shown in Fig. 4 by full lines pulls outwardly the drawing-down cam 8, so that it may operate as provided for in Patent No. 484,610, and said lever in its continued travel meets an arm 188 (see Fig. 4) of the elbow-lever, also common to Patent No. 552,806, turning said lever so that its other arm 103, having an in-

cline, meets and turns the lever 191, causing it by its lower end to effect such change of position of the clutch mechanism, common to said patent, to insure that the cam-cylinder be reciprocated for narrowing and widening instead of rotated for circular knitting. To enable me to use the lever 191, moved as provided for in said patent, and to put the reinforcing-thread guide in its operative position, I have provided said lever with an actuator 191^x, the end of which by the movement of said lever 191 in the direction of the arrow *w*, to effect the change from circular to reciprocating knitting, is put into the path of movement of the lower end of the pin *f*², so that said pin in its second and each alternate course as it thereafter approaches said toe *h*² in the direction of circular knitting strikes the said actuator 191^x, and the latter being stationary turns the thread-guide in the direction of the arrow thereon in Fig. 4, thus causing said pin during said second and each alternate course thereafter in the same direction to ride against the semicircular inner edge 20 of the controller D, and as the strokes in reciprocating knitting made in the direction of circular knitting are completed the pin passes beyond the toe *h*. During the first stroke of reciprocating knitting and during all the strokes in reciprocating knitting which are opposite the direction of the strokes for circular knitting the pin *f*² meets the toe *h* and rides up on the controller and then off the toe *h*', and during these strokes the spring *g* keeps the arm *f*' of said reinforcing-thread guide against the pin *g*', or, in other words, the reinforcing-thread guide during the strokes of reciprocating knitting which are opposite in direction to that of the movement of the cam-cylinder for circular knitting is maintained in its inoperative position. During the first stroke of reciprocating knitting and each alternate stroke thereafter the reinforcing-thread guide presents its thread to the descending needles a little in advance of the presentation of the main thread *e* to said needles, and at each intermediate stroke the reinforcing-thread guide occupies the position named as its "inoperative" position for circular knitting; but when the cam-cylinder in reciprocating knitting is moving in the direction of circular knitting, then in order that the said reinforcing-thread guide may be in the position to deliver its thread to the descending needles the delivery end of said thread-guide has to be moved closer to the main thread-guide, so that the descending needles may catch both threads.

Having described one practical means for automatically changing the position of the auxiliary-thread guide during reciprocating knitting, means for moving said thread-guide toward the main-thread guide and holding it in such position during the strokes of reciprocating knitting made in the direction of circular knitting I desire to state that this

invention is not limited to the particular means shown for effecting this change of position of the auxiliary-thread guide and instead I may employ any other usual or suitable devices for alternately moving the auxiliary-thread guide in order that it may present its thread with the main thread as the needles descend under the action of the stitch-cam to make stitches.

In the description of my invention as I have thus far given the same I have described that the auxiliary thread is knitted with the main thread into the fabric during narrowing and widening and that the thread is not disengaged from the fabric at the end of widening, but is continued connected with the fabric, so that it may be unerringly fed again to the needles whenever narrowing is to be again resumed, thus avoiding any skipping or dropping of stitches, and thereby avoiding delays, which are customary in all machines wherein the reinforcing-thread is cut off.

I desire to state that the auxiliary-thread guide may be continued in operation during the knitting of the circular part of the foot of the stocking between the toe and heel pouches, using said reinforcing-thread to thicken the sole of the foot-covering portion, and it may be continued in operation to high-splice the heel of the stocking or to splice or reinforce the rear side of the leg of the stocking to the upper end thereof, and this splicing may terminate at any point in the knitting of the leg. To enable this reinforcing-thread to so act throughout the foot and also, it may be, the leg, I need only to remove from the lever 191 the actuator 191^x, hereinbefore described, and change the shape of the toe *h*' to the shape represented in Fig. 4^b, so that at each time during reciprocating knitting that the cam-cylinder is moving in the direction of circular knitting the pin *f*² may enter the notch 22 at the inner side of said toe, said pin meeting the cam *h*^x and thereafter riding against the inner circle 20 of the controller, thus causing the auxiliary-thread guide to be moved toward the main-thread guide, where it will remain during the rest of that stroke of reciprocating knitting, it passing from the toe *h*, as hereinbefore provided for, at the end of such reciprocating stroke, and as the reinforcing-thread guide occupies its operative position only during the movement of the cylinder in the direction of circular knitting it will be obvious when the foot and leg are being knitted that the said reinforcing-thread will be introduced in the fabric during one-half of each knitted course, the distance with relation to the circumference of the knitted fabric in which this reinforcing-thread may be introduced depending upon the position of the toes *h* and *h*' with relation to each other.

From the description hereinbefore made it will be understood that the reinforcing-thread guide can supply its thread to the needles

during that movement of the cam-cylinder which is effectual in circular knitting only when the said thread-guide has its delivery end moved toward the main-thread guide, and it will be understood that during circular knitting by the toe h^{2x} , hereinbefore last described, that the said thread-guide is held in working position only during one half of the time of rotation of the cam-cylinder and that during the other half of said rotation the pin f^2 , having slid off the toe h , enables the spring g to turn the thread-guide so that for the next half-rotation the thread is not delivered to the needles, and when the reinforcing-thread is not being taken by the needles in circular knitting the position of the reinforcing-thread guide is such with relation to the stitch-cams carried by the cam-cylinder that the thread leading from the end of the reinforcing-thread guide then in its inoperative position to the interior of the work is maintained in the depressed wave of the motion of the needles, or, in other words, is maintained just above the tops of the needles in their most depressed positions.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a circular-knitting machine adapted for circular and reciprocating knitting, the combination with the cam-cylinder of a reinforcing-thread guide outside of said cylinder to contain a reinforcing-thread and deliver it to the needles and the fabric, of a take-up located below the tops of the needles and acting on said reinforcing-thread when the latter is being knitted course after course into the fabric.

2. In a knitting-machine, the combination with a series of needles and a cam-cylinder capable of being rotated and reciprocated, a reinforcing-thread guide outside of said cylinder, means to put the delivery end of said thread-guide automatically in position to deliver its thread to the needles to be knit into the fabric with the usual main thread during reciprocating knitting, of means to automatically turn the delivery end of the thread-guide for the reinforcing-thread into position in which said thread-guide will hold but not deliver its thread to the needles to be taken and knit with the main thread, said thread-guide in its inoperative position, however, permitting the reinforcing-thread to be drawn through it as the knitting progresses, thus leaving the reinforcing-thread always connected with the fabric, thereby avoiding knots and other irregularities which result in breaking off the thread and damaging the work, and a take-up adjacent the reinforcing-thread guide to act upon the part of said reinforcing-thread passing through said guide said take-up being below the knitting-line.

3. In a circular-knitting machine adapted for circular and reciprocating knitting, a cam-cylinder, means to retain a cop or bobbin of reinforcing-thread, a reinforcing-thread

guide to present said thread to the needles in knitting; means for changing the position of said reinforcing-thread guide with relation to the main-thread guide at alternate strokes to thereby enable said reinforcing-thread guide to deliver its thread to the needles throughout reciprocating knitting.

4. In a circular-knitting machine adapted for circular and reciprocating knitting, the combination with the cam-cylinder, of a controller, and a reinforcing-thread guide having a spring-operated pin and coacting with said controller, the latter effecting a change of position of the thread-guide between successive strokes in reciprocating knitting that said thread-guide may deliver its thread continuously to the needles throughout reciprocating knitting.

5. In a circular-knitting machine adapted for circular and reciprocating knitting, a cam-cylinder having a support for the reinforcing-thread, a reinforcing-thread guide movable with said cam-cylinder, means to turn said thread-guide toward the main-thread guide during each alternate stroke of reciprocating knitting, and a take-up acting on said reinforcing-thread.

6. In a circular-knitting machine adapted for circular and reciprocating knitting, the combination with the cam-cylinder, and a reinforcing-thread guide to contain a reinforcing-thread and to deliver it to the fabric being knitted together with the main thread, of a tension device acting upon said reinforcing-thread, and a take-up sustained on said thread between said tension device and the delivery end of said thread-guide.

7. In a circular-knitting machine adapted for circular and reciprocating knitting, the combination with the cam-cylinder of a slide connected frictionally therewith and movable independently thereof and containing a main-thread guide, of a reinforcing-thread guide movable with said slide and containing a reinforcing-thread, and a take-up located below the knitting-line also movable with said slide and cam-cylinder, said take-up acting continuously on the reinforcing-thread.

8. In a circular-knitting machine adapted for circular and reciprocating knitting, the combination with the cam-cylinder of a slide connected frictionally therewith, of a reinforcing-thread guide movable with said slide and containing a reinforcing-thread, which it guides and delivers direct to the needles, a take-up also movable with said slide and acting continuously on the reinforcing-thread, and means to guide the take-up in its movements due to the slack in said reinforcing-thread.

9. In a circular-knitting machine adapted for circular and for reciprocating knitting, a series of needles, a cam-cylinder, a main-thread guide, and a reinforcing-thread guide partaking of the movements of the cam-cylinder in circular and in reciprocating knitting, a take-up coacting with the reinforcing-

thread, and means to cause said reinforcing-thread to be put into its operative position during a part of each course of knitting while the cam-cylinder is being moved in the direction of circular knitting and to change its position on reverse movement thereof.

10. In a circular-knitting machine adapted for circular and reciprocating knitting, the combination with the cam-cylinder having a reinforcing-thread guide outside of said cylinder to contain a reinforcing-thread, of means to move said thread-guide that it may deliver its thread to the needles when the fabric is to be thickened, and put said reinforcing-thread

guide in its inoperative position when it is desired to omit the reinforcing-thread, said thread-guide holding the thread unbroken between itself and the fabric, and a take-up acting as a weight on the reinforcing-thread and occupying a position below the knitting-point.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES J. O'BRIEN.

Witnesses:

GEO. W. GREGORY,
EDITH M. STODDARD.