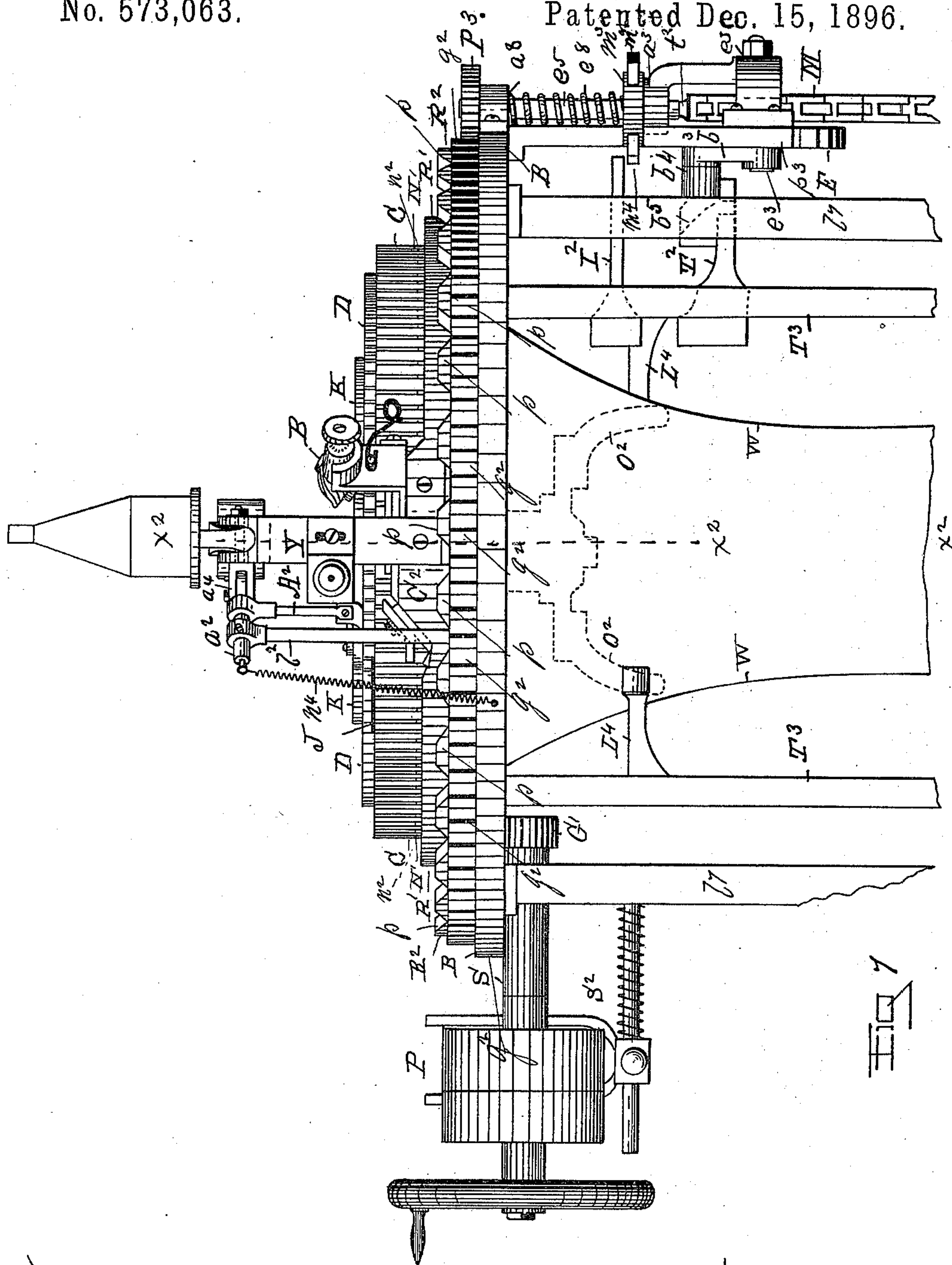


7 Sheets—Sheet 1.

No. 573,063.

Patented Dec. 15, 1896.



WITNESSES
William A. Sweet
Abner B. Brintnall

INVENTOR
Eugene Vermilyea
by W C Hagan atty

(No Model.)

7 Sheets—Sheet 2.

E. VERMILYEA.
ROTARY KNITTING MACHINE.

No. 573,063.

Patented Dec. 15, 1896.

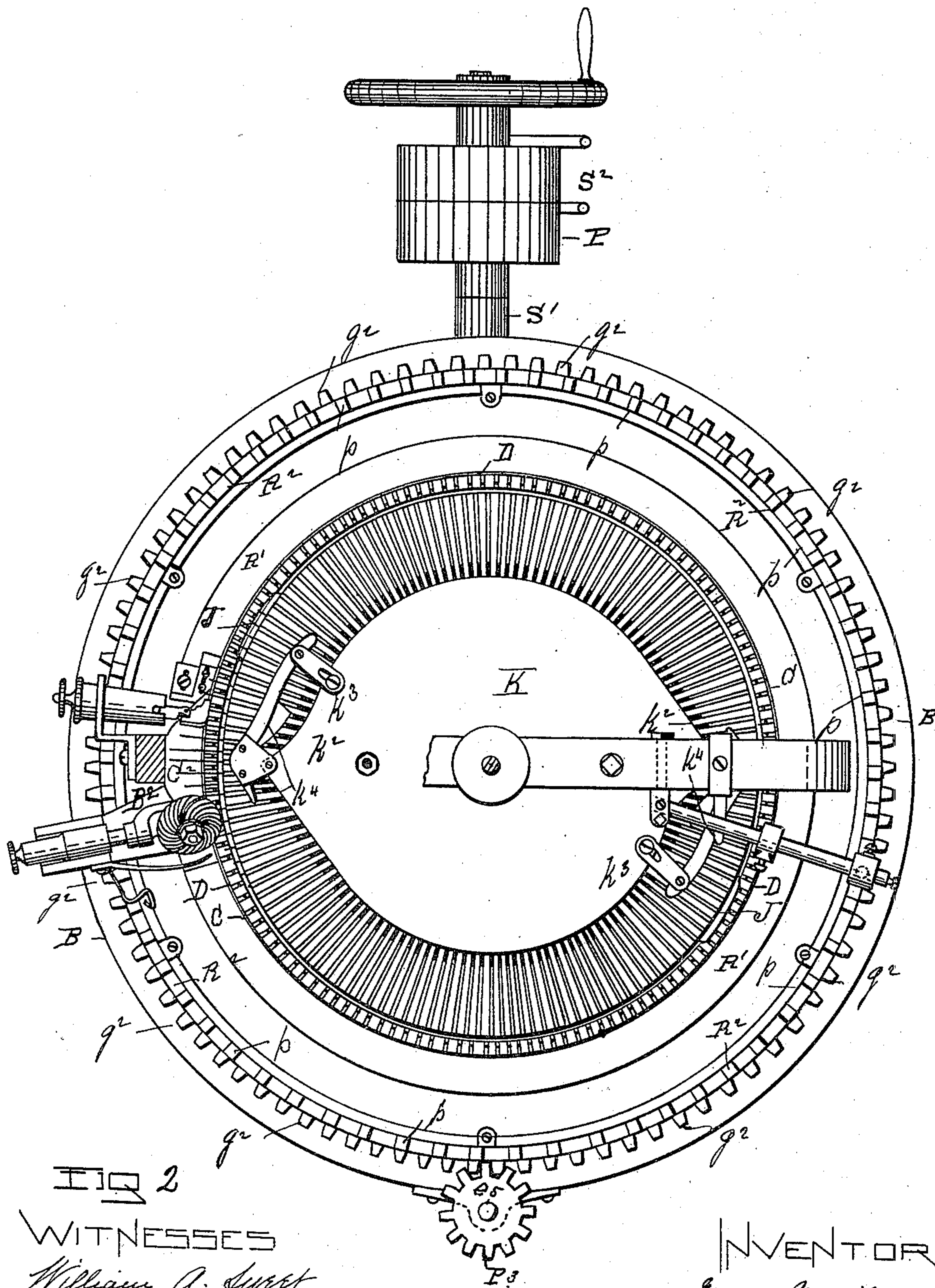


FIG 2

WITNESSES

William A. Sweet

Charles S. Brintnell

INVENTOR

Eugene Vermilyea

by W. E. Hagan atty

(No Model.)

7 Sheets—Sheet 3.

E. VERMILYEA.
ROTARY KNITTING MACHINE.

No. 573,063.

Patented Dec. 15, 1896.

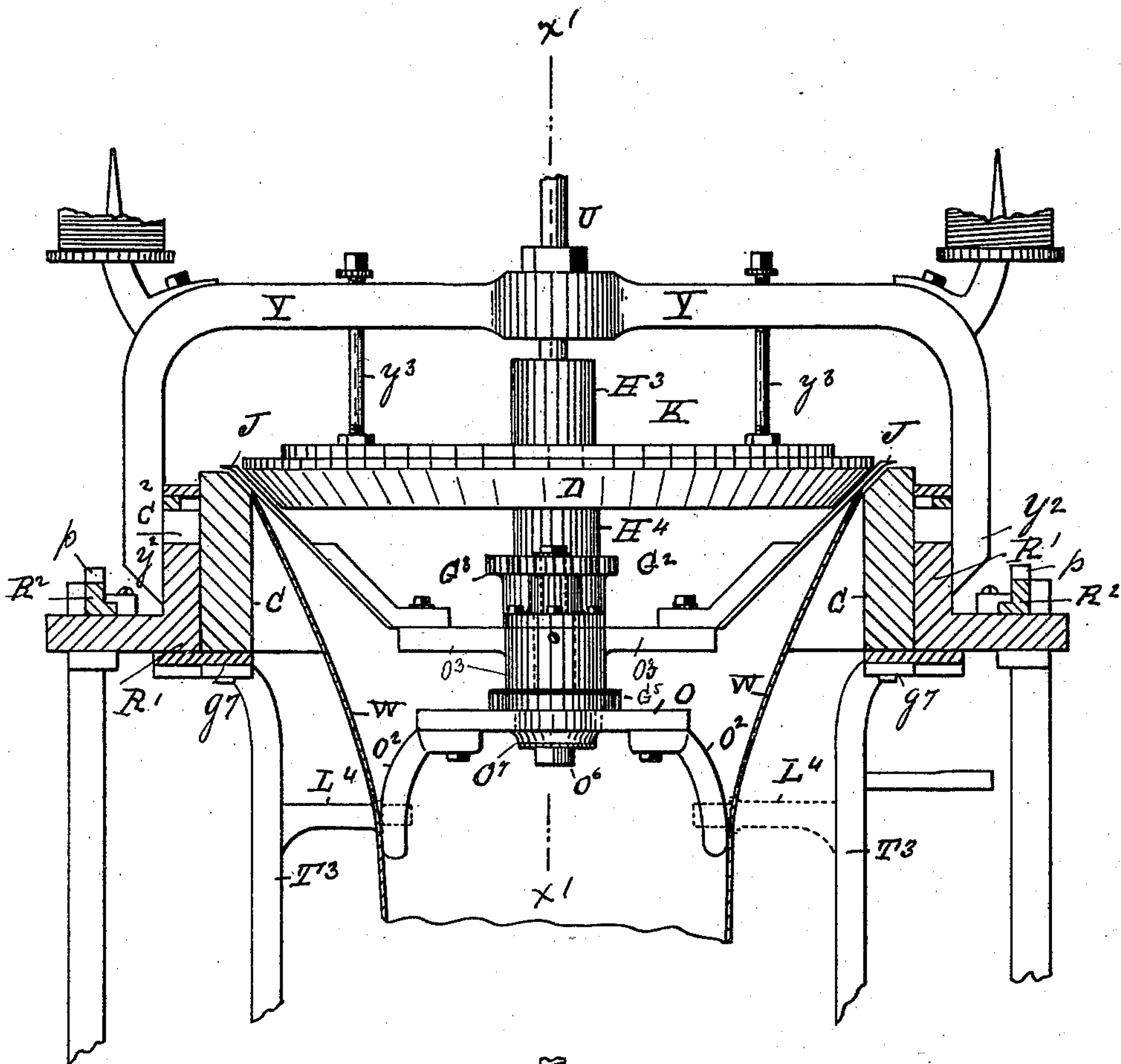


FIG 3

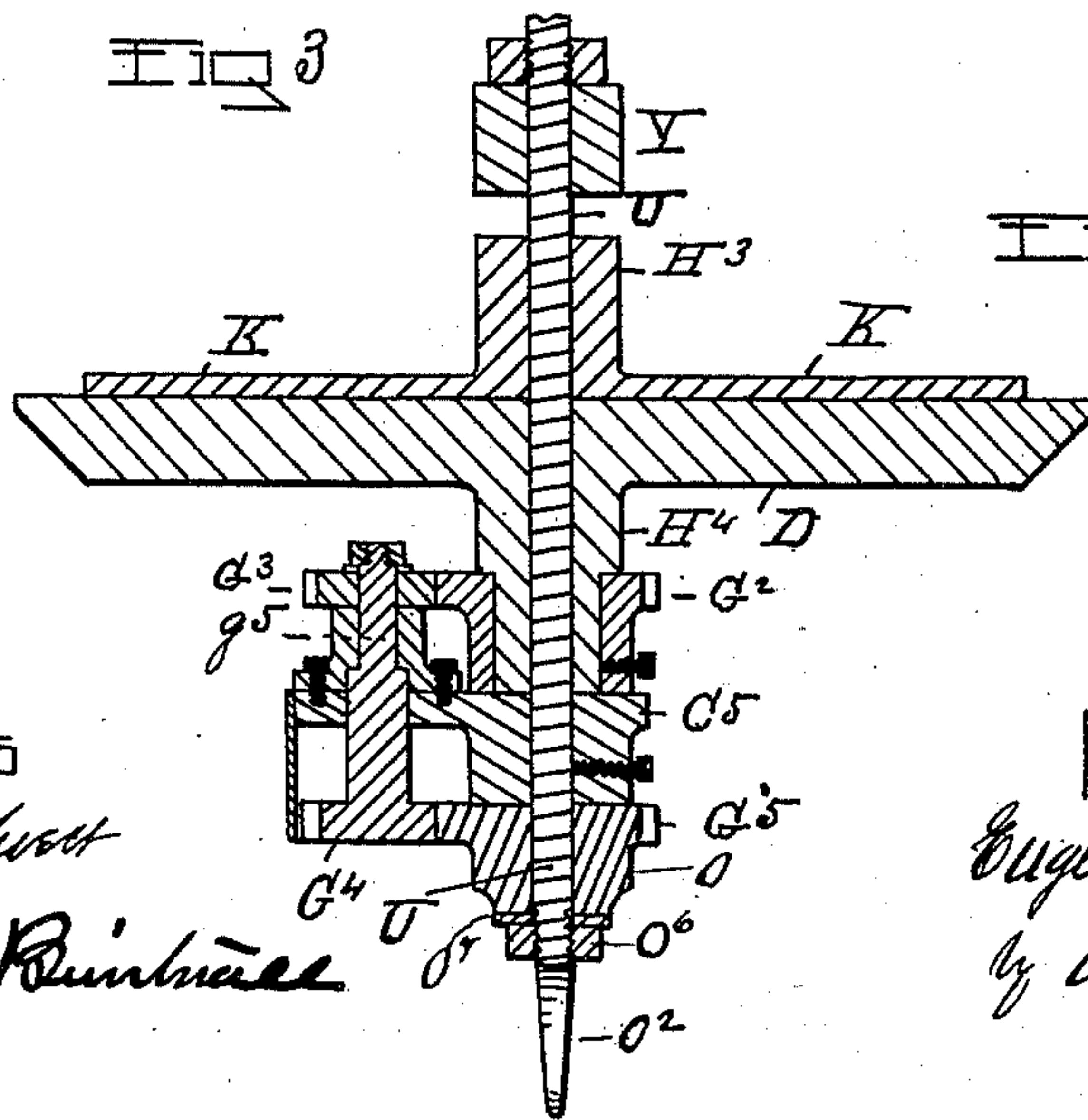


FIG 4

WITNESSES

William A. Sweet

Charles S. Buntline

INVENTOR

Eugene Vermilyea

by W. E. Hagan atty

(No Model.)

7 Sheets—Sheet 4.

E. VERMILYEA.
ROTARY KNITTING MACHINE.

No. 573,063.

Patented Dec. 15, 1896.

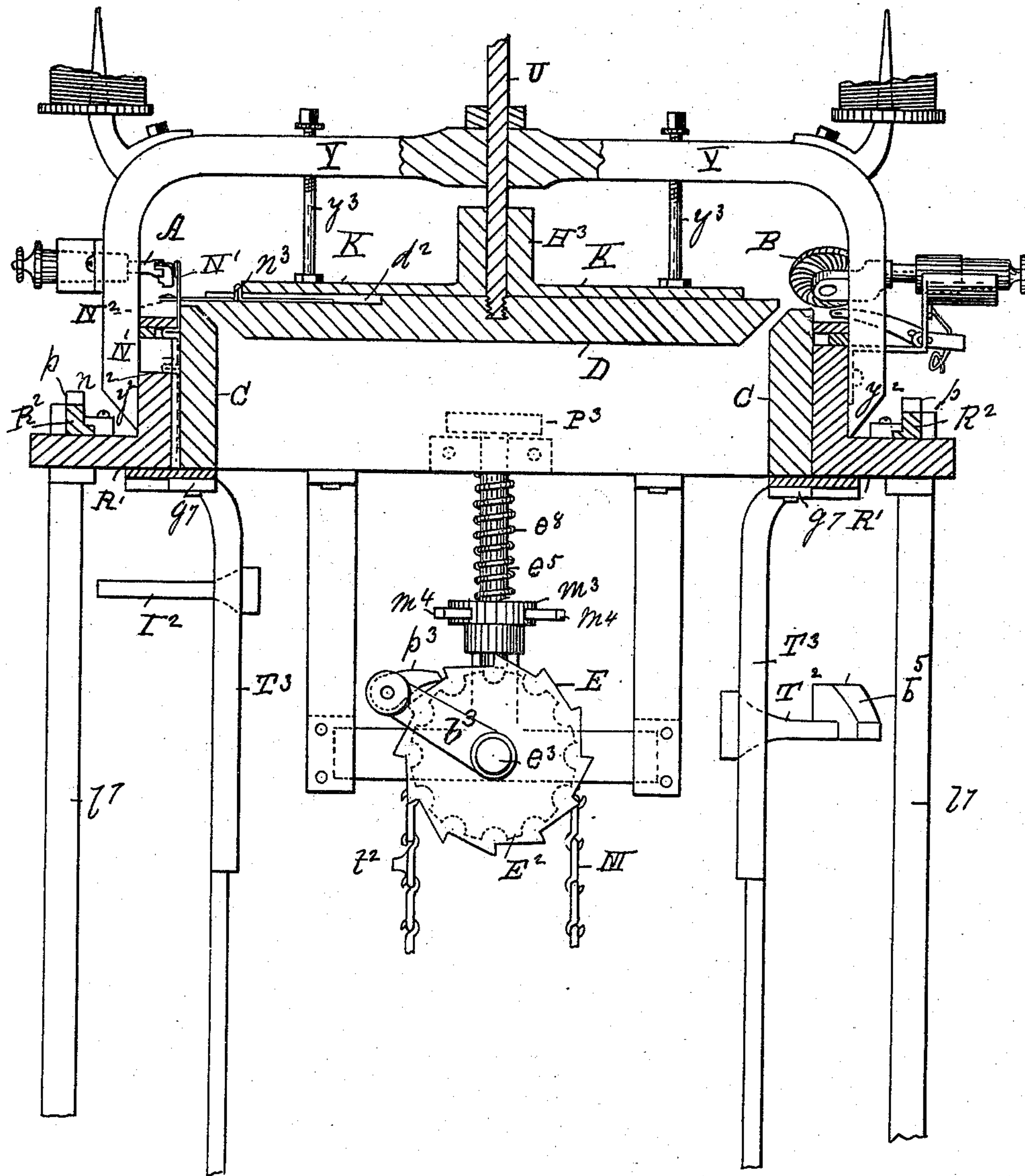


Fig 5

WITNESSES

William A. Sweet

Charles S. Brintnell

INVENTOR

Eugene Vermilyea

W E Hagan atty'

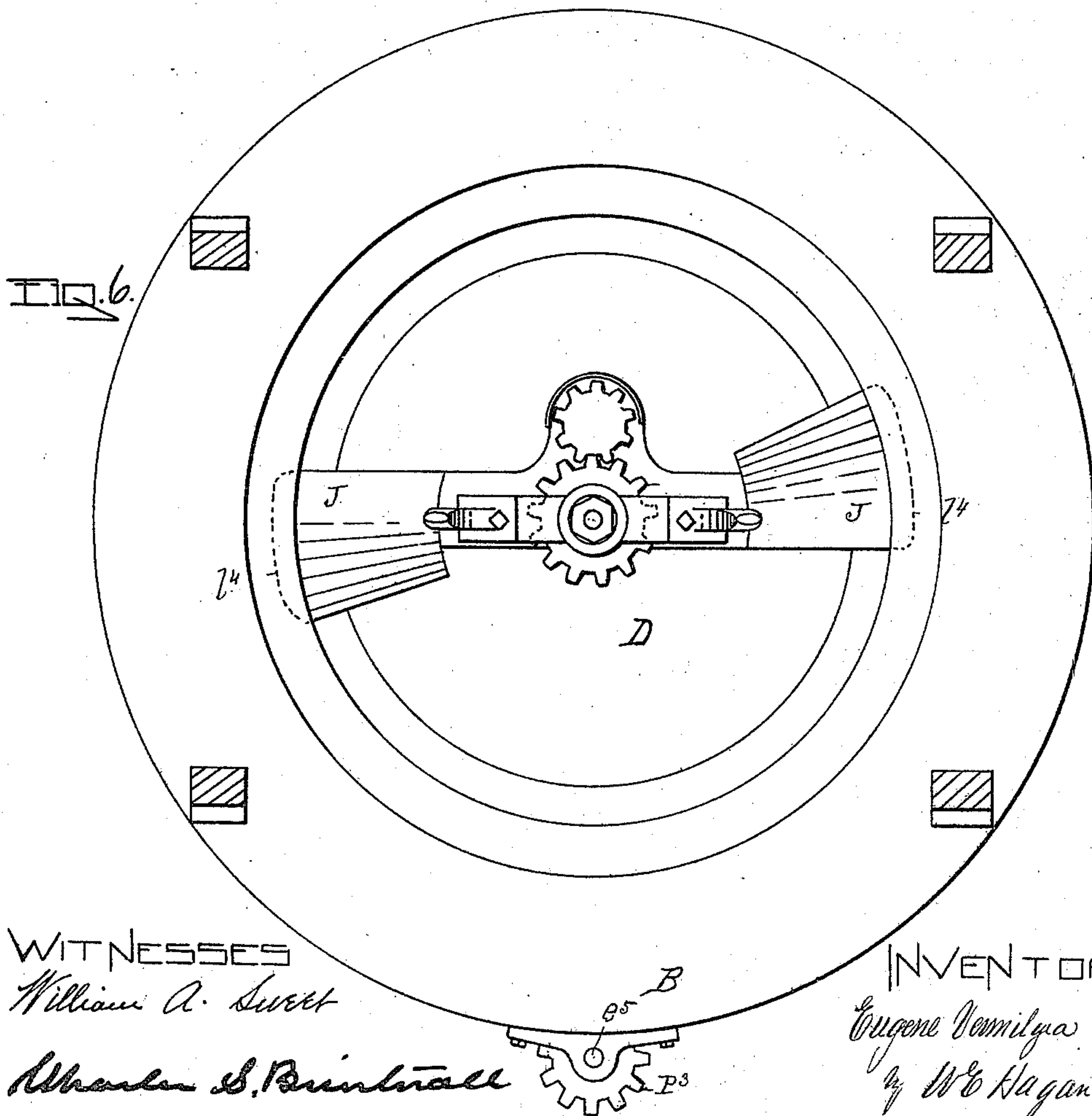
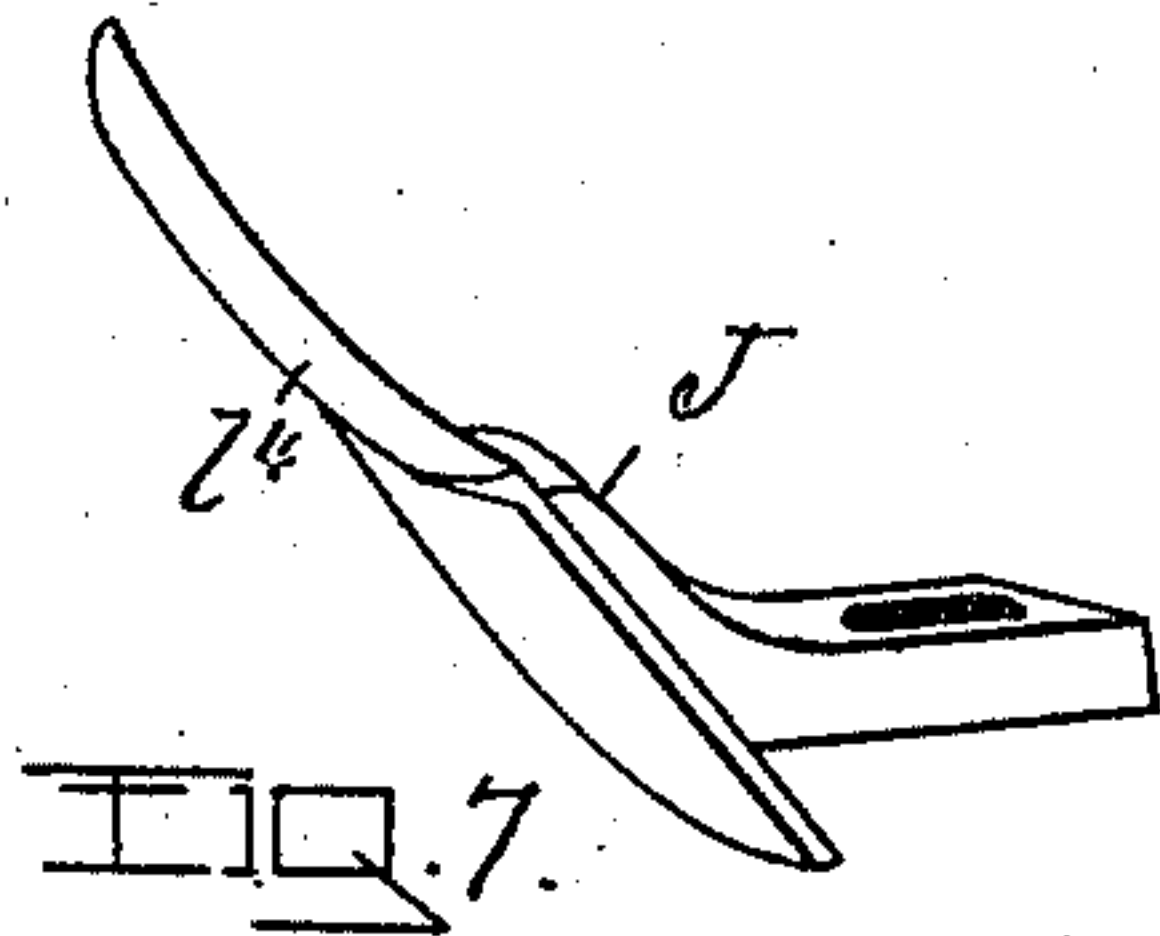
(No Model.)

7. Sheets—Sheet 5.

E. VERMILYEA.
ROTARY KNITTING MACHINE.

No. 573,063.

Patented Dec. 15, 1896.



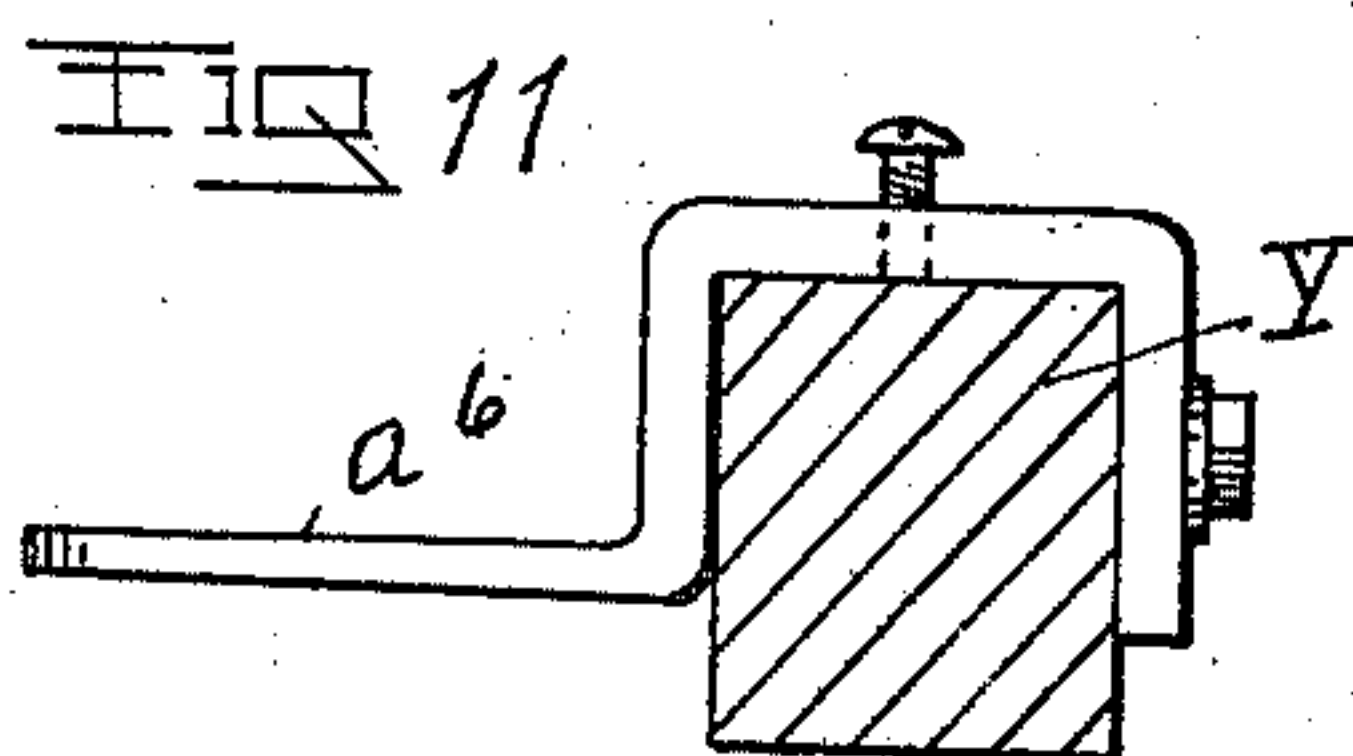
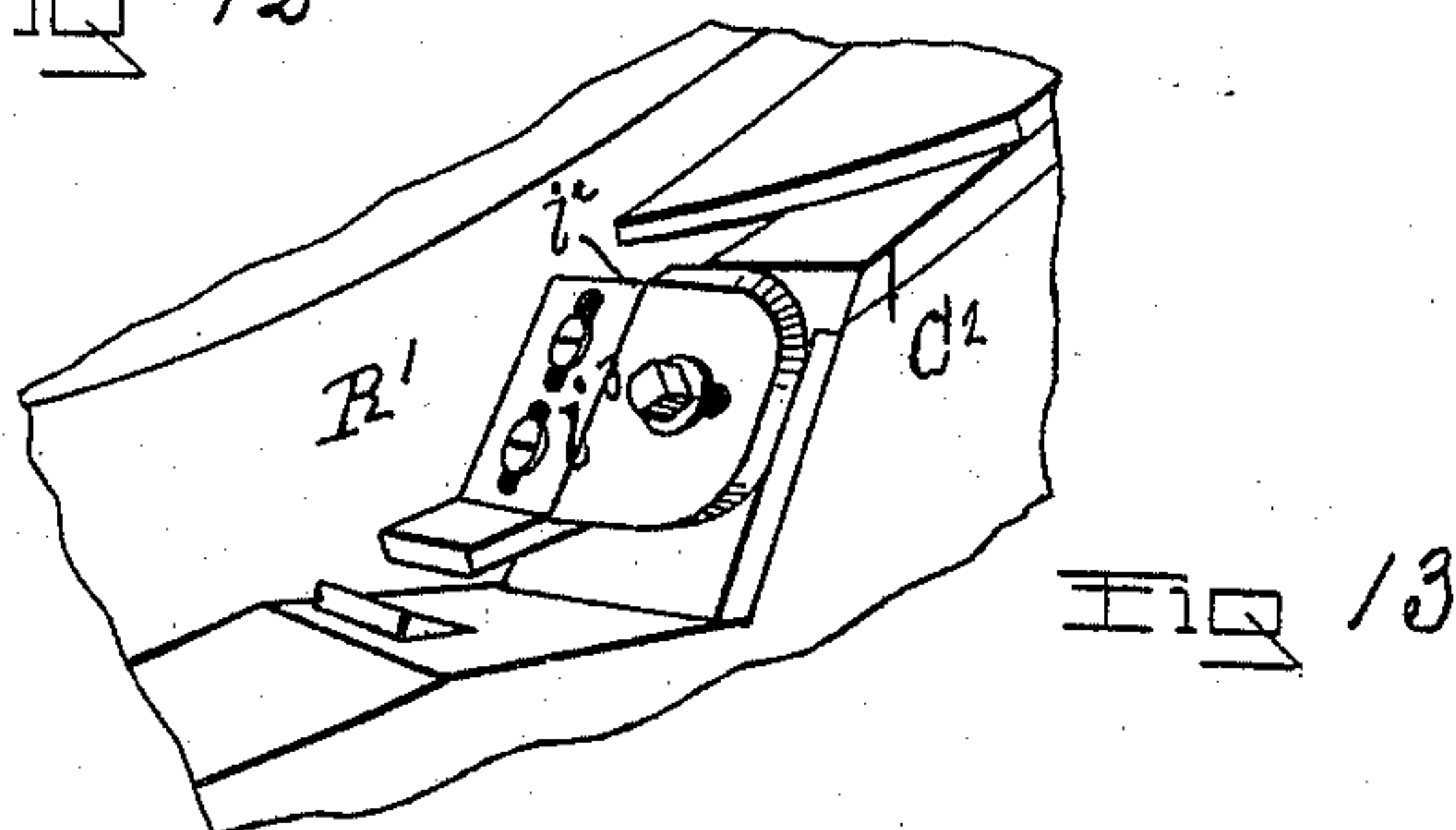
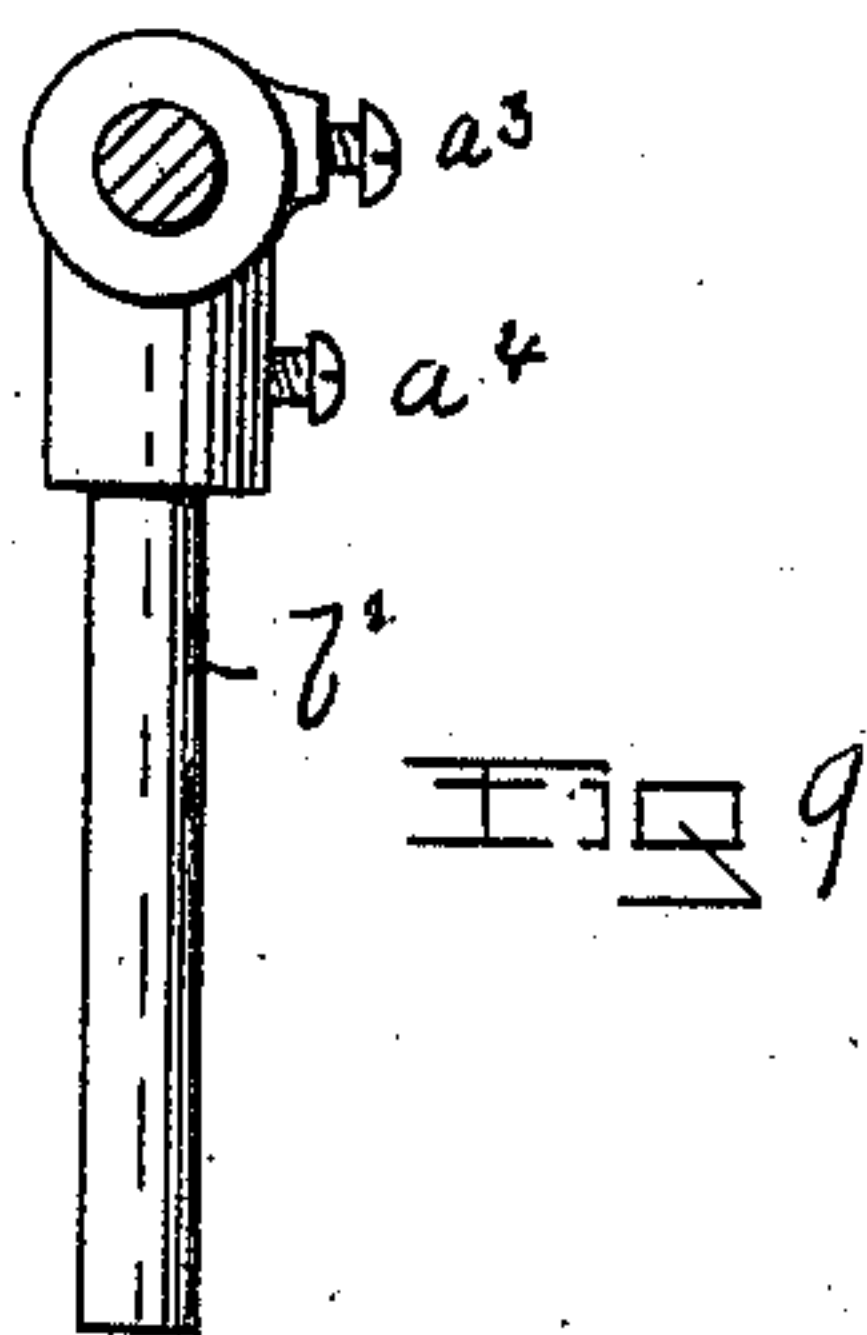
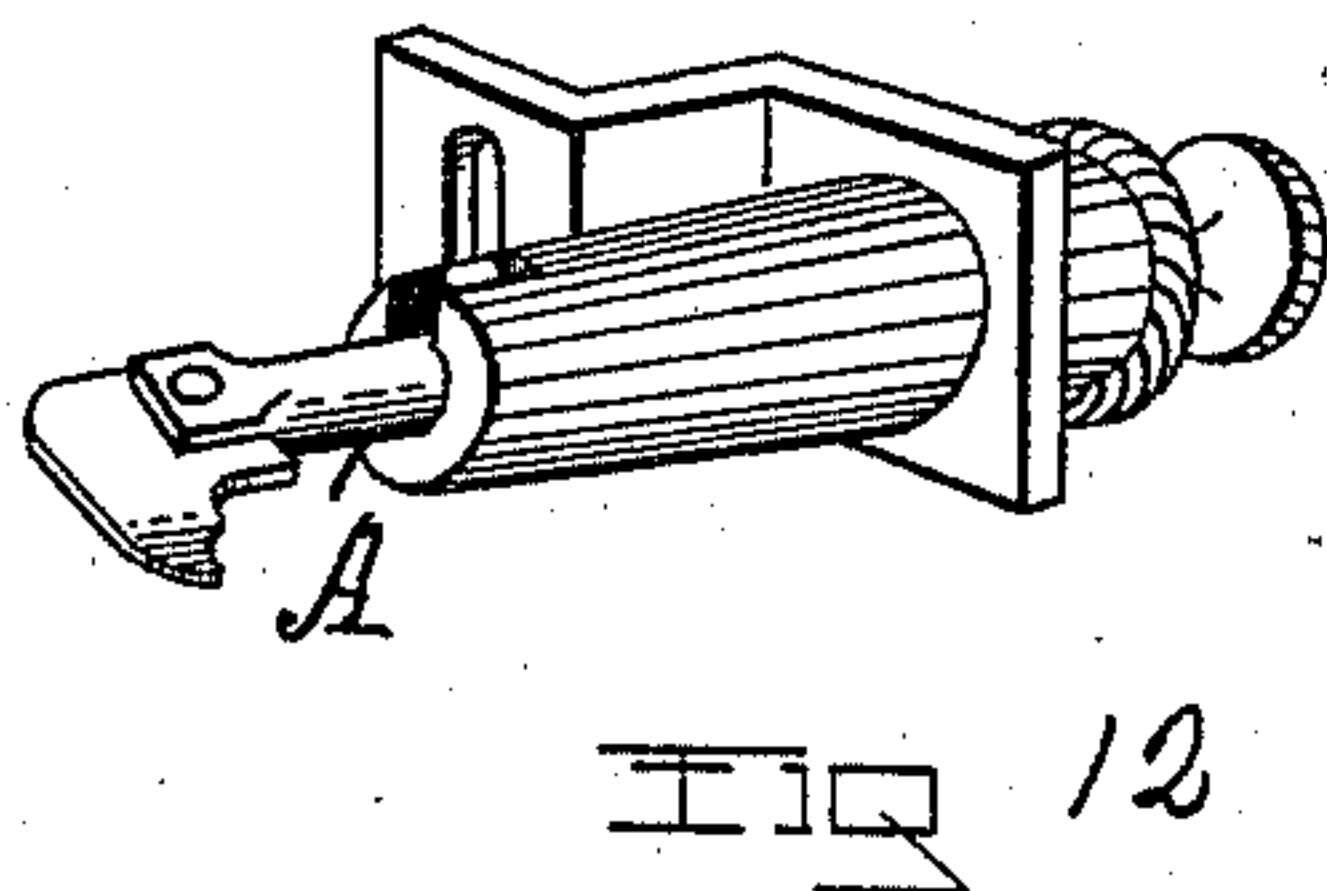
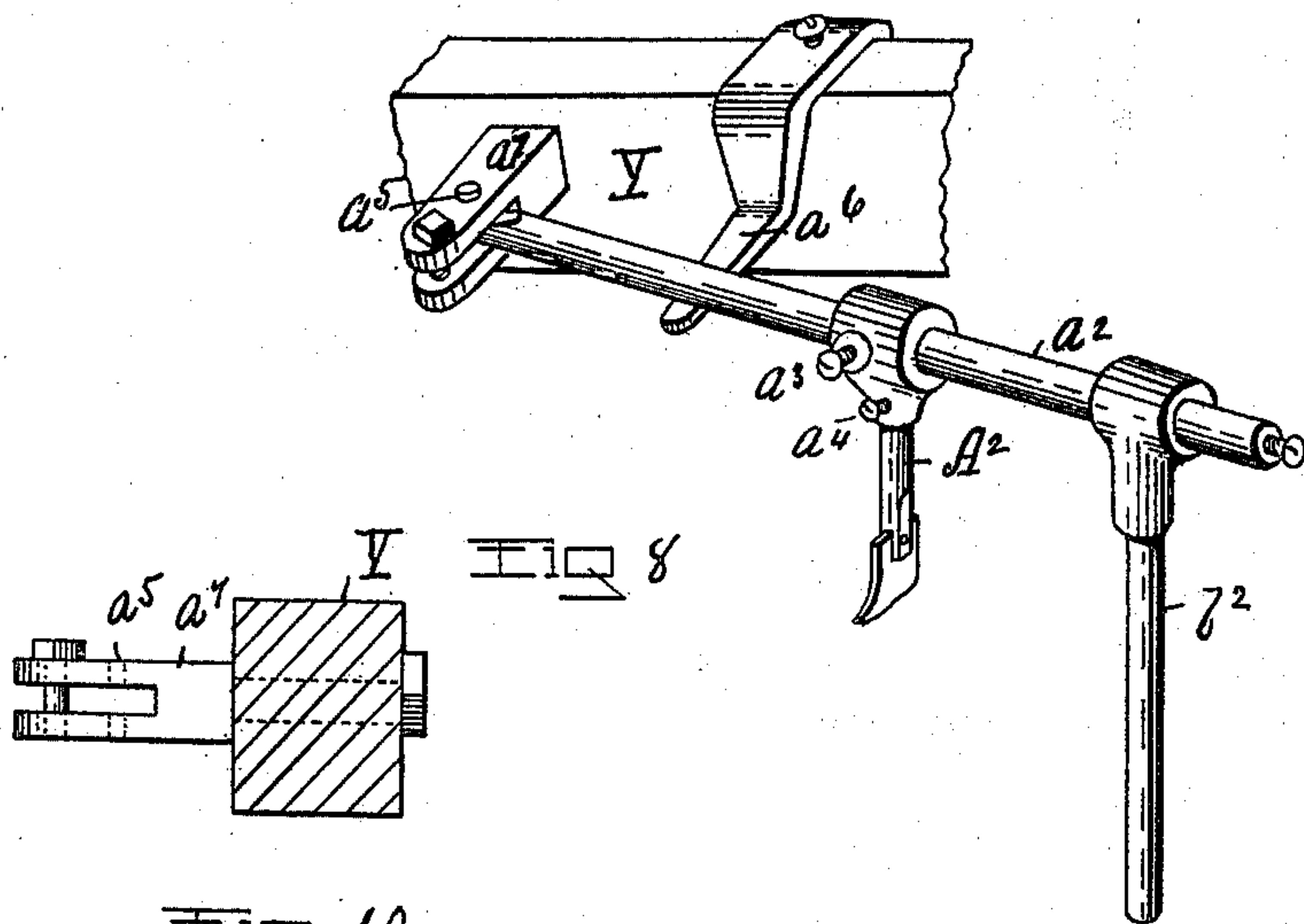
(No Model.)

7 Sheets—Sheet 6.

E. VERMILYEA.
ROTARY KNITTING MACHINE.

No. 573,063.

Patented Dec. 15, 1896.



WITNESSES.

William A. Sweet

Alfred S. Brinton

INVENTOR

Eugene Vermilyea
by *W. E. Hagan atty*

(No Model.)

7 Sheets—Sheet 7.

E. VERMILYEA.
ROTARY KNITTING MACHINE.

No. 573,063.

Patented Dec. 15, 1896.

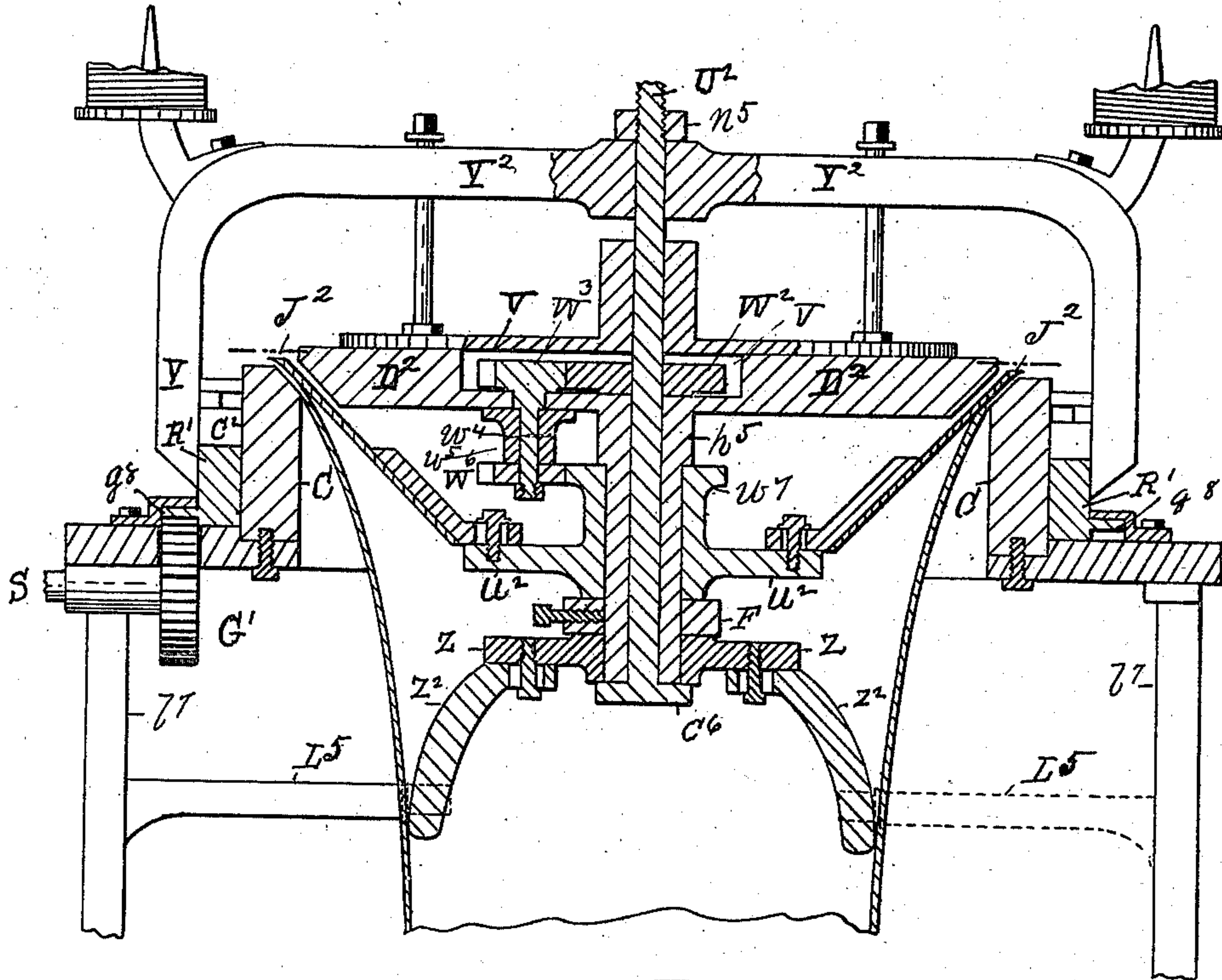


FIG 14

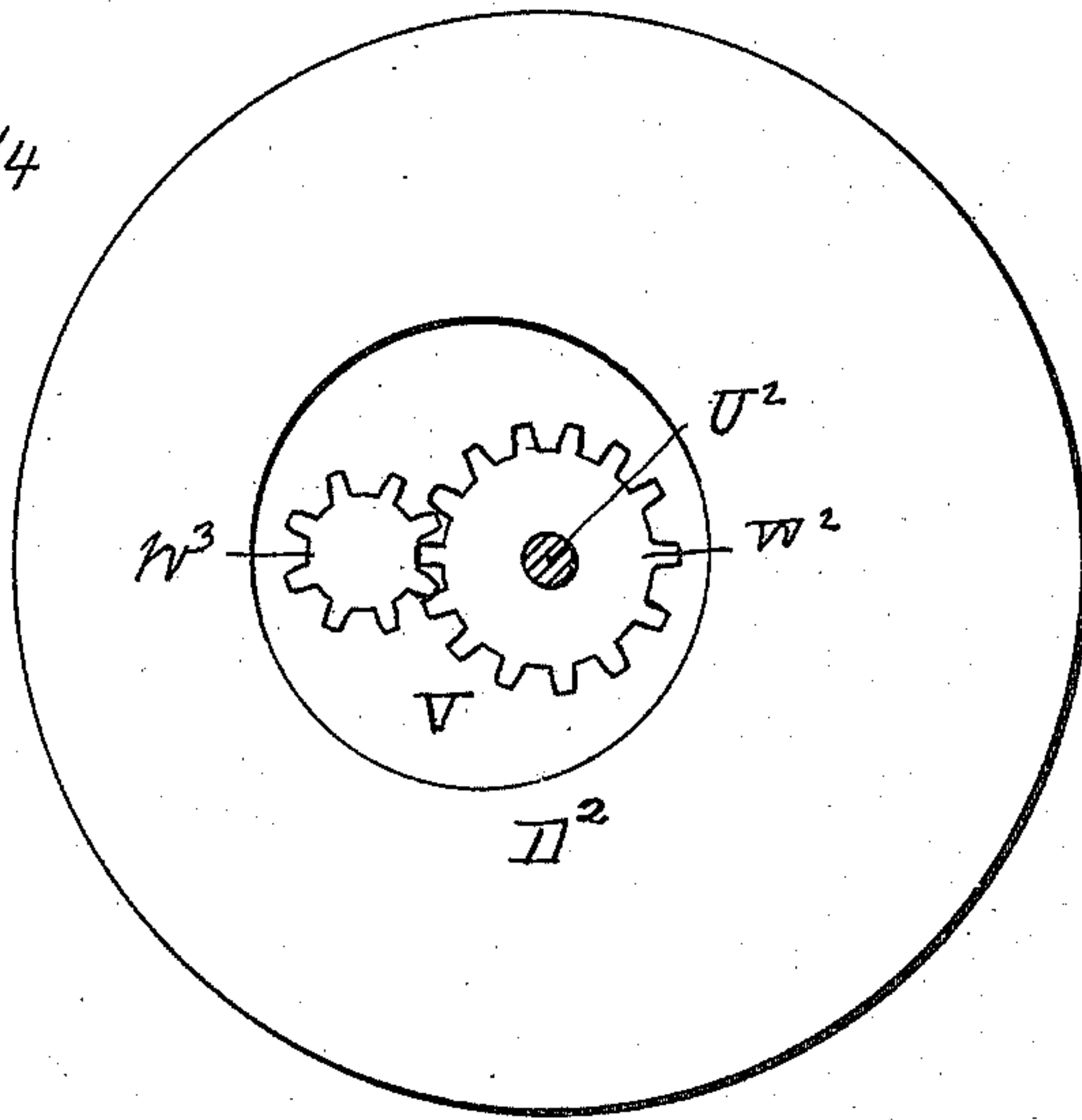


FIG 15

WITNESSES

William A. Scott

Albion S. Brinton

INVENTOR

Eugene Vermilyea
by W. Hagan atty

UNITED STATES PATENT OFFICE.

EUGENE VERMILYEA, OF WATERFORD, NEW YORK, ASSIGNOR OF TWO-THIRDS TO SETH T. HARSHAW, OF LANSINGBURG, AND CAMPBELL & CLUTE, OF COHOES, NEW YORK.

ROTARY KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 573,063, dated December 15, 1896.

Application filed June 21, 1895. Serial No. 553,601. (No model.)

To all whom it may concern:

Be it known that I, EUGENE VERMILYEA, of the village of Waterford, county of Saratoga, State of New York, have invented new and
5 useful Improvements in Rotary Knitting-Machines, of which the following is a specification.

My invention relates to improvements in rotary knitting-machines for producing ribbed
10 goods by the combined action of vertical spring-needles and dial spring-needles, it being the object and purpose of my invention to make such a combined arrangement of these needles as will by their operation produce a
15 closely-knit web which will be more elastic laterally than longitudinally, from having shorter stitches than can be produced by latch-needles when employed to make similar kinds of goods.

20 Accompanying this specification to form a part of it there are seven plates of drawings, containing fifteen figures, illustrating my invention, with the same designation of parts by letter reference used in all of them.

25 Of the illustrations, Figure 1 is a side elevation of a rotary knitting-machine containing my invention and improvements. Fig. 2 is a top view of the machine shown at Fig. 1 with a part of the yoke broken out. Fig. 3 is
30 a diametrical section taken through the table or bed, the vertical-needle cylinder, the cam-ring which operates the vertical needles, the pattern-ring, and with the rest of the parts shown in side elevation. Fig. 4 is a section
35 taken on the line $x'x'$ of Fig. 3. Fig. 5 is a vertical central section on a plane indicated by line x^2x^2 of Fig. 1, but through a machine differing in some slight details from that shown in said figure. Fig. 6 is a view of the
40 underside of the bed, showing the gears which operate the needle-cylinder and dial. Fig. 7 is a perspective of one of the casting-off plates shown as detached. Fig. 8 is a perspective of the dial-needle presser shown as detached,
45 and also that part of the yoke with which it connects illustrated as broken out. Fig. 9 is a side elevation of the dial-needle-presser leg, with the horizontal rod to which it attaches adjustably shown in cross-section. Fig. 10 is

a side elevation of a slotted bracket projected
50 from the side of the yoke, into which bracket the horizontal rod of the dial-needle presser is made to tongue for adjustment at its inner end. Fig. 11 is a side elevation of the bracket
55 projected from the side of the yoke, on which bracket the horizontal rod of the dial-needle presser is supported. Fig. 12 is a perspective of the vertical-needle presser shown as detached. Fig. 13 is a perspective of a part of
60 the cam of the cam-ring which operates the vertical needles to draw downwardly. Fig. 14 shows in a diametrical section a modification of my invention in which the dial-wheel and dial-needles are stationary, as well as the
65 vertical-needle cylinder and vertical needles, with the cam-ring operating the vertical needles revolving, as well as the cam-plate of the dial-needles. Fig. 15 is a view of the top of the dial-wheel of the modification, showing
70 the recess for the gears, as well as the gears therein.

The several parts of the apparatus thus illustrated are designated by letter reference and the function of the parts is described as follows:

75 The letters S designate the driving-shaft, which is provided with a driving-pulley P and a shipper S².

The letter G' designates a gear-wheel on the inner end of the driving-shaft S, and this
80 gear-wheel meshes into a geared rack g' on the vertical-needle cylinder C, by which as said shaft is rotated the cylinder C is caused to turn on the machine-bed B. This vertical-needle cylinder C is vertically slotted to receive bearded or spring needles N', each of
85 which is provided with an outwardly-projected nib n^2 , and these needles are as arranged adapted to be moved upwardly and downwardly in the slots made in the cylinder.

90 The letters R' designate a stationary cam-ring which is arranged on the bed B to encircle the vertical-needle cylinder C, and this ring is provided with cams C², by which, as the cylinder C revolves, the projecting nibs
95 n^2 of its needles will engage with the cams on the cam-ring and be by the latter caused to rise on the inclines of said cams C², as shown

at Fig. 1, and to descend by having their nibs n^2 underrun the adjustable plate i^3 , as shown at Fig. 13.

The letter R^2 designates a pattern-ring which is arranged upon the bed B outside of the cam-ring R' , and this pattern-ring is provided with projections p on its upper surface for raising or lowering the dial-needle presser, and upon its side edge this pattern-ring is constructed with gears g^2 , which are adapted to engage with and to mesh into a pinion thrown into and out of connection with driving mechanism.

The letter D designates a rotating dial-wheel which is cut away on its upper surface at d^2 , and it is thereat radially slotted to receive the bearded or spring dial-needles N^2 , each of which is provided with an upwardly-projecting nib n^3 .

The letter K designates a stationary cam-plate which is by means of studs I connected to the yoke Y, the latter at its ends y^2 y^2 being connected to the stationary cam-ring R' .

The letters k^2 designate cams formed on the edge of the cam-plate K, by which as the dial-wheel D revolves and the cam-surfaces k^3 engage with the nibs of the dial-needles the latter are forced outwardly in their slotted seats to hook onto the yarn, and then when coming in contact with the cam-surfaces k^4 the needles are drawn inwardly and when hooking into the yarn they cooperate with the vertical needles, as will be hereinafter described.

The letter B^2 designates the sinker-bur, by which yarn as coming from the spools is by the sinker-bur carried under the beards of the vertical needles to form stitches when the needles are raised and in connection with the dial-needles, as will be hereinafter described.

The letters A designate a presser which is employed to force inwardly the barbs or beards of the vertical needles N' preparatory to casting off the stitches, and this presser A is shown as attached to the machine at Figs. 1, 2, and 5 and as detached therefrom at Fig. 12.

The letters A^2 designate the presser employed to close up or force inwardly the beards or barbs of the dial-needles preparatory to casting off the stitches, and this presser A^2 is sleeved at its upper end onto a horizontal rod a^2 , and made adjustable thereat by means of set-screws a^3 a^4 . At its inner end this rod a^2 tongues into a bracket a^7 , projected from the yoke Y, and it is therein pivoted or hinged at a^5 .

The letter a^6 designates a rest for the rod a^2 , this rest being projected from the yoke Y, and on which rest the rod a^2 is supported.

The letter l^2 designates a depending leg which at its upper end adjustably connects with the horizontal rod a^2 at the outer end of the latter beyond the connection made between the presser A^2 and the rod a^2 . This depending leg l^2 at its lower end is imme-

diately over the projections or cams on the pattern-ring R^2 , (indicated at p .) When either of the projections p comes in contact with the lower end of the leg l^2 , the latter is raised thereby and the dial-needle presser is raised from off the needles, so that a double or tuck stitch is formed, and these projections p are operated to thus act by the rotation of the pattern-ring R^2 .

The letter n^4 designates a spring connecting at its upper end with the arm a^2 and at its lower end with the base B, and the function of this spring is to make the descent of the presser A^2 positive.

The letters E designate a ratchet-wheel which is arranged to turn with the shaft e^3 , on which it is mounted, and the letter E^2 designates a sprocket-wheel arranged on and secured to said shaft e^3 , so as to turn with the latter.

The letter b^3 designates a pawl-arm which is provided with a pivoted pawl p^3 , adapted to engage with the teeth of the ratchet-wheel.

The letter M designates a pattern-chain that is adapted to make a sprocket engagement with the wheel E^2 and be carried around thereon as it is rotated by the ratchet-wheel.

The letters t^2 designate tappets or projections arranged on the exterior face of the pattern-chain.

The letter e^5 designates a vertical shaft which journals at a^8 and is adapted to be moved upwardly and downwardly in its journals, and when moved upwardly to be so actuated against the force of the spring e^8 , encircling said shaft between the bed B and the spoke-wheel m^3 arranged thereon.

The letter P^3 designates a pinion arranged on the upper end of the shaft e^5 . This pinion will engage with and mesh into the peripheral teeth of the pattern-ring R^2 and actuate the latter to move on the machine-bed and operate the downwardly-depending leg l^2 of the dial-needle presser, as before described. To actuate the pawl p^3 , the shaft e^3 of the latter is extended inwardly and has secured thereon a crank-arm b^3 , which is provided with a cam-roller b^4 on its inner end.

The letters T^3 designate the downwardly-extended studs of the take-up-mechanism frame, which studs are supported by the needle-cylinder and revolve in a circle outside of the web W.

The letter T^2 designates an arm which is projected laterally from one of the studs of the take-up-mechanism frame, as shown at Fig. 1, and as this frame revolves and its arm T^2 and cam b^5 come into engagement with the roller b^4 on the crank-arm b^3 of the pawl-shaft it operates said crank-arm to rotate the pawl-shaft and thus actuate the pawl to move the ratchet-wheel one tooth.

The letter I^2 designates another arm which is projected laterally and outwardly from one of the take-up-frame studs T^3 , which may be the same stud that is provided with arm T^2 , as shown at Fig. 1, or another of the said

studs, as shown in Fig. 5, and as the take-up frame revolves this arm I^2 at each revolution will engage with one of the spokes m^4 of the spoke-wheel m^3 , and so as to move it, the shaft e^5 , and the pinion p^3 a quarter of a turn. As thus constructed, when one of the tappets on the pattern-chain has raised the shaft e^5 the spoke-wheel will be in line with the arm I^2 , and when the pattern-chain has been operated so that none of its tappets are in engagement with the shaft e^5 then by the action of the spring e^8 the shaft and spoke-wheel are drawn downwardly, so that the arm I^2 will not engage with the spoke-wheel with the parts in position as shown at Fig. 1.

The stationary cam-plate K is constructed with studs $y^3 y^3$, by which it is connected to the stationary yoke Y, and this cam-plate is made with a hub H^3 for the passage of the stud U, on which the dial-wheel revolves. This dial-wheel is made with a hub H^4 , that is downwardly projected from its under surface. This hub has arranged on and secured to it a gear-wheel G^2 , which meshes into a gear-wheel G^3 , arranged on a vertical shaft g^5 , having its bearings in an offset formed on the collar C^5 , which latter is secured to the vertical stud U, on which the dial-wheel D and its hub turn. This vertical shaft g^5 at its lower end has mounted thereon the gear-wheel G^4 , which meshes into another gear-wheel G^5 , turning upon the vertical stud U.

The letter O designates a plate which is attached to the under side of the gear-wheel G^5 , and the letters $O^2 O^2$ designate arms which are laterally and downwardly extended from said plate.

The letter O^6 designates a nut which is threaded onto the lower end of the stud or shaft U, and O^7 a washer thereon.

The letters $L^4 L^4$ designate arms inwardly extended from the studs T^3 of the take-up frame, and as thus constructed when the take-up frame is revolving and the arms L^4 engage with the arm O^2 of the plate O the latter is rotated on the stud U and the gear G^5 , connected to this plate O, communicates motion to the gear-wheel G^4 on the lower end of the shaft g^5 , thereby causing the gear-wheel G^3 to turn the gear-wheel G^2 and the dial-wheel D, the latter rotating in the same direction with the vertical-needle cylinder C. The object of driving the dial-wheel from the plate O through these gears G^5 , G^4 , G^3 , and G^2 , instead of directly from plate O to the dial-wheel, is that the latter combination and arrangement would be impracticable with the construction shown. The problem is to drive the dial-wheel from the cylinder, while leaving the casting-off plates J stationary between them and not impeding the fabric. The only feasible way of effecting this is by gearing around the said casting-off plates and supporting the latter from a fixed central shaft on which the gears $G^2 G^5$ are free to turn, the fabric passing down, as shown, between the said casting-off plates and the cylinder. The

gears $G^5 G^4 G^3 G^2$ afford a satisfactory means of transferring motion around the said casting-off plates without touching them, and the support of said casting-off plates by the fixed central shaft avoids all interference with the fabric, which would be a fatal objection to any attempt to support said plates from the outside of the machine.

The letters J J designate the casting-off plates, each of which at its lower end is connected to the plate O^3 , and is therefrom extended upwardly on an incline outwardly to pass up between the dial-wheel and the vertical-needle cylinder, said plate O^3 being integral with projections from the stationary collar C^5 . Each of these plates J is provided upon its upper edge with a casting-off lip or edge l^4 , and its operation in casting off the stitches will be described more fully in connection with the operation of the needles, the bur-sinker, and the pressers hereinafter.

In the modification shown at Figs. 14 and 15 the needle-cylinder C and the dial-wheel D and its needles do not revolve, but the cam-ring R' and the cam-plate K and the casting-off plates revolve.

In the modification shown at Figs. 14 and 15 the gear-wheel G' meshes into a rack g^8 , formed on the cam-ring R' , instead of on the vertical-needle cylinder, as in the other drawings, and the yoke Y^2 connects with the revolving cam-ring R' to turn with the latter. In the modification the center stud or shaft U^2 connects with the yoke Y to turn with it, and the dial-wheel D^2 is made with a recess V, through which the stud U^2 passes and where within said recess the stud U^2 has mounted thereon the gear-wheel W^2 , which meshes into a gear-wheel W^3 , also arranged within said recess, said wheel W^3 having a shaft w^4 , which is projected downwardly through the dial-wheel D^2 , and a vertical bearing w^5 on the under side of the latter, and on the lower end of this shaft w^5 there is a gear-wheel W^6 , arranged to mesh into a gear mounted on a sleeve w^7 , arranged to turn on the downwardly-extended hub h^5 of the dial-wheel.

The letters $w^2 w^2$ designate arms laterally extended from the sleeve w^7 , on which are placed the casting-off plates $J^2 J^2$, each having the same construction as in the other figures and as revolving to have relatively the same position to the needles, the pressers, and their sinker-bur during the production of and casting off of the stitches as in the other illustrations.

The letter n^5 designates a nut which is threaded onto the upper end of the vertical shaft or stud U^2 , and C^6 a collar formed integrally with the lower end of said shaft or stud, and the function of this nut and collar is to keep the shaft U^2 in position to be turned by and with the yoke Y^2 .

The letter F designates a collar which encircles the lower end of the hub h^5 below the sleeve w^7 . The hub h^5 is made with a shoul-

der, against which the upper end of the said sleeve bears, with the lower end of the latter resting on the stationary collar F. The arms of the cast-off plates are projected up
5 and outwardly from the sleeve w^7 , and the latter is rotated by the gears W^2 , W^3 , and W^6 , as before described.

The letter z designates a collar which is secured to the lower end of the hub h^5 and
10 is provided with arms z^2 z^2 , which engage with arms L^5 L^5 , projected inwardly from the legs l^2 of the machine, by which engagement the hub h^5 of the dial-wheel is prevented from turning.

15 The operation of the mechanism thus illustrated and described is as follows: When the vertical needles are raised by their cams, as before described, yarn coming from a spool is by the sinker-bur B^2 carried under their
20 beards. The dial-needles are at the same time forced outwardly by their cam to pass between the vertical needles, so that the beards of the dial-needles are carried outwardly beyond the vertical needles, the latter having
25 the yarn already under their beards, and when the vertical needles commence to draw downwardly by the action of their cam they draw the yarn over the dial-needle just back of the beards of the latter, and the vertical
30 needles as drawing downwardly pass under the presser A, which presses inwardly their beards, so that the stitch passes over the latter as the vertical needles descend, carrying the yarn for a succeeding stitch through the
35 loop on the vertical needles and casting off the old stitch over the verge of the cylinder, while the dial-needles having, as before described, had the yarn passed over them by the drawing down of the vertical needles are ac-
40 tuated by their cam to draw inwardly, carrying their beards over the yarn resting on their shanks, in which condition they pass under the presser A^2 , which closes their beards, so that the stitch thereon is carried
45 outwardly over their beards as the dial-needles draw inwardly, with the stitch resting on the needles back of the outer end and in front of the beard, and while in this position as it comes in contact with the casting-off
50 plate J its lip l^4 moves the stitch laterally from off the needles, and this operation is the same in the modification as in the other illustrations. By retaining the stitches on the
55 dial-needles a short distance from their ends before being cast off the stitches are made shorter as to vertical length and have more length of loop laterally, by which the web has but little elasticity longitudinally, but is very elastic laterally, which cannot be produced
60 when latch-needles are used to produce like kinds of web.

I am aware that spring or bearded needles have been used in connected vertical and dial arrangement, and I make no broad claim
65 thereto, my improvement consisting in the manner that I arrange them to be operated connectedly to shorten up the stitches verti-

cally and elongate them laterally by the employment of a cast-off mechanism operating upon the under side of the needles.

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

1. In a rotary knitting-machine the combination of a cylinder provided with vertically-
75 arranged needles; cams whereby said cylinder-needles are caused to rise and descend; means by which the yarn is carried beneath the beards of said vertical needles when the latter are raised; a presser whereby the beards
80 of said cylinder-needles will be closed when descending to cast off their stitches; a dial-wheel having radially-arranged needles and provided with cams whereby said dial-needles are forced outwardly and drawn in-
85 wardly; a presser whereby the beards of the dial-needles are closed when being drawn inwardly; and a casting-off plate adapted to engage with the under side of the dial-needles when the latter are being drawn inwardly and
90 force the stitches therefrom, substantially as shown and described.

2. The combination with the vertical spring-needles N' , constructed to be operated substantially as described; of the sinker-bur B^2 ,
95 operated to deliver yarn to said vertical spring-needles; the presser A' , operated to press in the beards of said vertical spring-needles; the horizontally-arranged and radially-placed spring-needles N^2 , operated to be
100 moved outwardly and inwardly substantially as described; the presser A^2 , and the casting-off plates J, J, each made with the edge or lip l^4 , constructed to engage with the under side of said horizontally-arranged needles when
105 the latter are drawn inwardly, substantially in the manner as and for the purposes set forth.

3. The combination with the dial-wheel D, having the downcast hub H^4 , of the vertical shaft or stud U, on which said dial-wheel
110 journals; the gear-wheel G^5 , mounted to turn on the lower end of said shaft U, and provided with a plate O, having downwardly and outwardly extended arms O^2 , O^2 , adapted to engage with and be turned by the depending
115 legs T^3 , of a revolving take-up mechanism; the shaft g^5 , having mounted upon its lower end the gear-wheel G^4 , adapted to mesh into the gear-wheel G^5 , and on its upper end the gear-wheel G^3 ; and the gear-wheel G^2 , mounted
120 on the dial-wheel hub, and adapted to mesh into the gear-wheel G^3 , substantially in the manner as and for the purposes set forth.

4. The combination with the dial-wheel D, having the downcast hub H^4 carrying a gear-wheel, of the stationary stud or shaft U; the
125 gear-wheel G^5 , mounted to turn on the lower end of said shaft or stud; the plate O having the laterally-extended arms O^2 , O^2 , and secured to the lower side of said gear-wheel G^5 ; gears connecting said gear-wheel G^5 , with the gear-wheel on the dial-wheel hub; a revolving
130 take-up mechanism provided with inwardly-projecting arms L^4 , L^4 ; a collar C^5 , secured to

said stud or shaft U; and the cast-off plates J, J, upwardly projected from said collar substantially in the manner as and for the purposes set forth.

5 5. The combination with the cylinder C, provided with a geared rack g^7 and a driving-wheel G^7 , of the shaft U, the dial-wheel D, having the downcast hub H^4 , operated to be rotated substantially as described, of the collar C^5 , connected to said shaft U, and the
10 cast-off plates J, J, upwardly projected from said collar, constructed and arranged to be operated substantially in the manner as and for the purposes set forth.

15 6. The combination of the yoke with the presser A^2 , having a sleeved passage-way in its upper end of the rod a^2 , provided with the depending leg l^2 , at its outer end, and at its inner end pivoted to the yoke; of the pattern-
20 ring R^2 , having the projection p , on its upper surface; the vertical shaft e^5 , provided with the pinion P^3 at its upper end, and having the encircling spring e^8 ; the ratchet-wheel E; sprocket-wheel E^2 ; pattern-chain M, having
25 tappets t^2 ; the pawl p^3 , having the crank-arm b^3 ; and cam-roller b^4 ; a revolving take-up mechanism having the depending legs T^3 , T^3 ,

provided with the arm T^2 , and the arm I^2 , and the spoke-wheel m^3 , arranged on the shaft e^5 , constructed and arranged to operate
30 substantially in the manner as and for the purposes set forth.

7. The combination with the stationary shaft or stud U; of the dial-wheel D, having the hub H^4 , downwardly projected from its
35 under side, and provided with the gear-wheel G^2 , the gear-wheel G^5 , arranged to turn on said shaft U, at its lower end; the plate O connected to said gear-wheel G^5 , and provided with arms O^3 , O^2 , adapted to engage
40 with and be turned by the sides of a revolving take-up mechanism; and the gear-wheels G^4 , and G^3 , communicating motion from said gear-wheel G^5 , to said gear-wheel G^2 , substantially
45 in the manner as and for the purposes set forth.

Signed at Troy, New York, this 11th day of May, 1895, and in the presence of the two witnesses whose names are hereto written.

EUGENE VERMILYEA.

Witnesses:

W. E. HAGAN,

CHARLES S. BRINTNALL.