

No. 643,997.

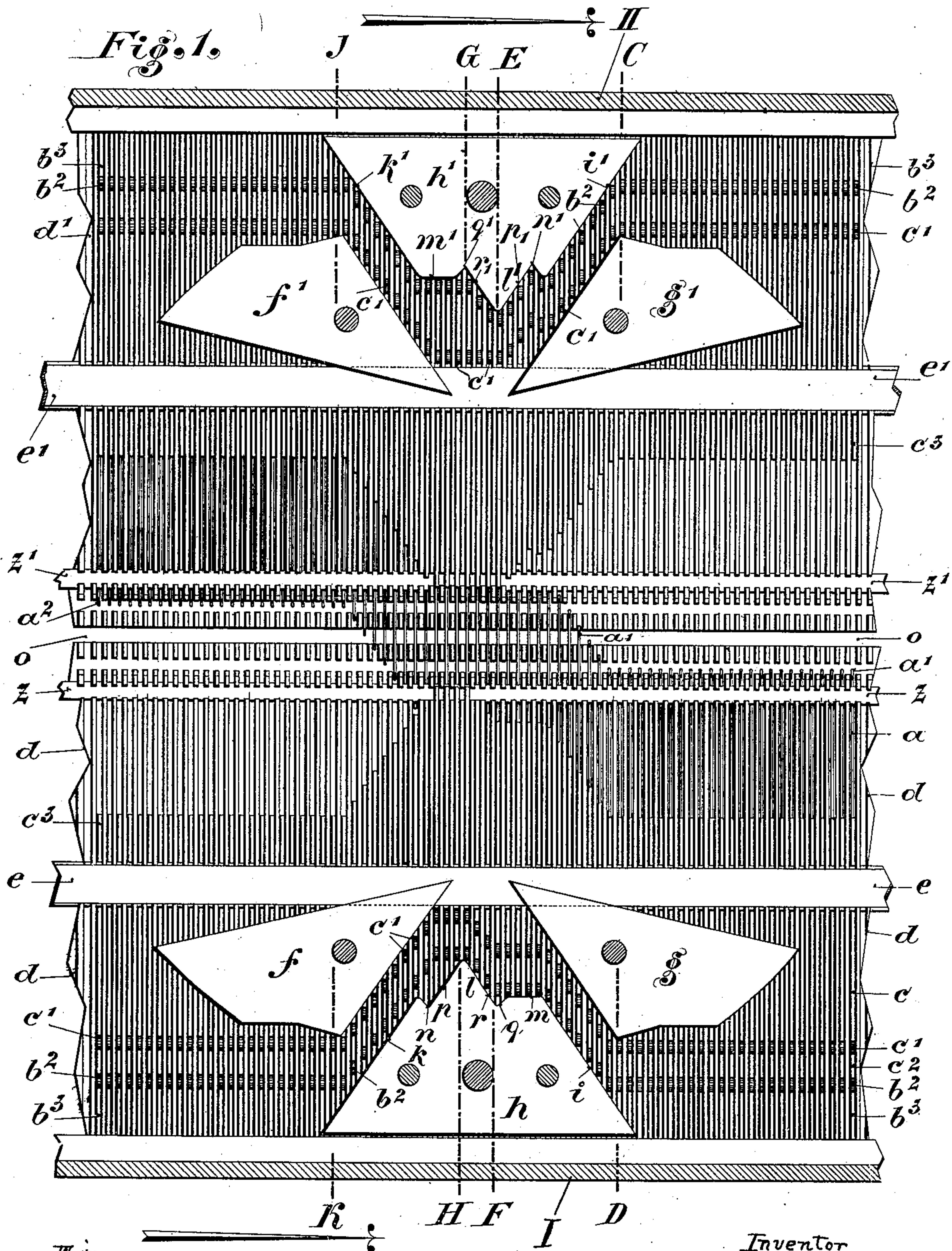
Patented Feb. 20, 1900.

W. BACH.  
KNITTING MACHINE.

(Application filed Oct. 1, 1897.)

(No Model.)

6 Sheets—Sheet 1.



Witnesses

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Inventor

*Wilhelm Bach*

By

*James L. Norris*

*Att'y*





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Fig. 6.

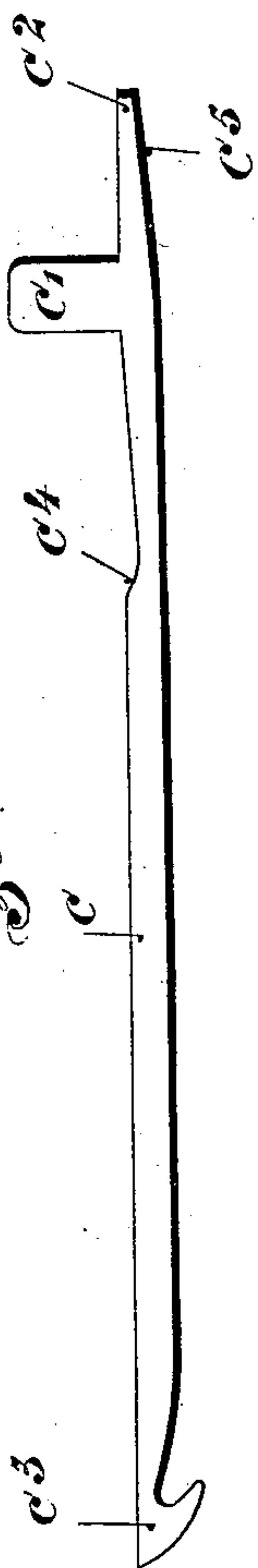


Fig. 8.

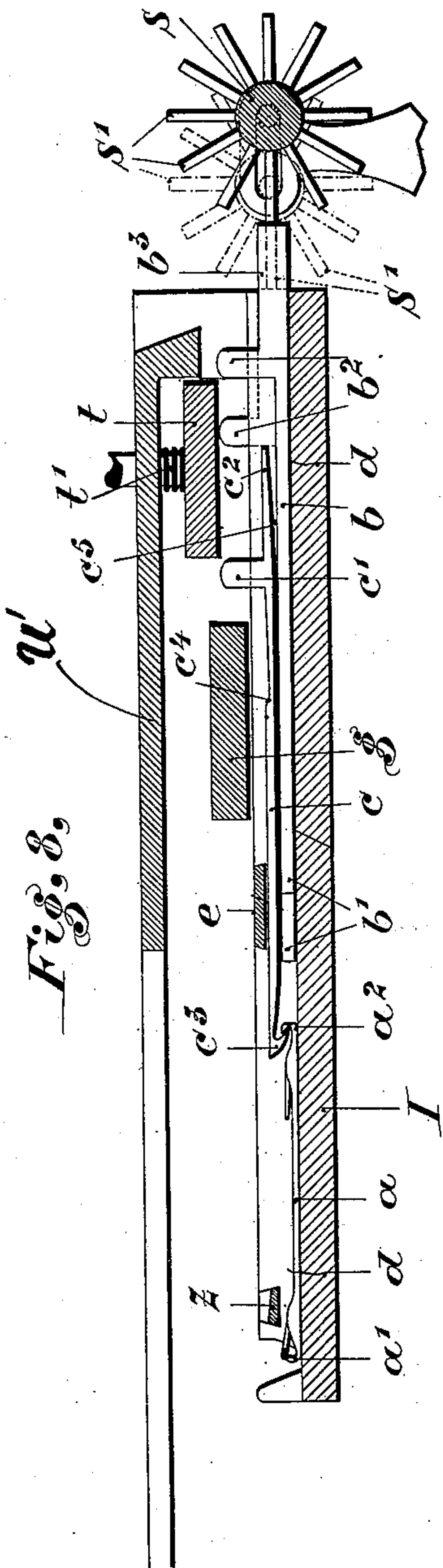


Fig. 10.

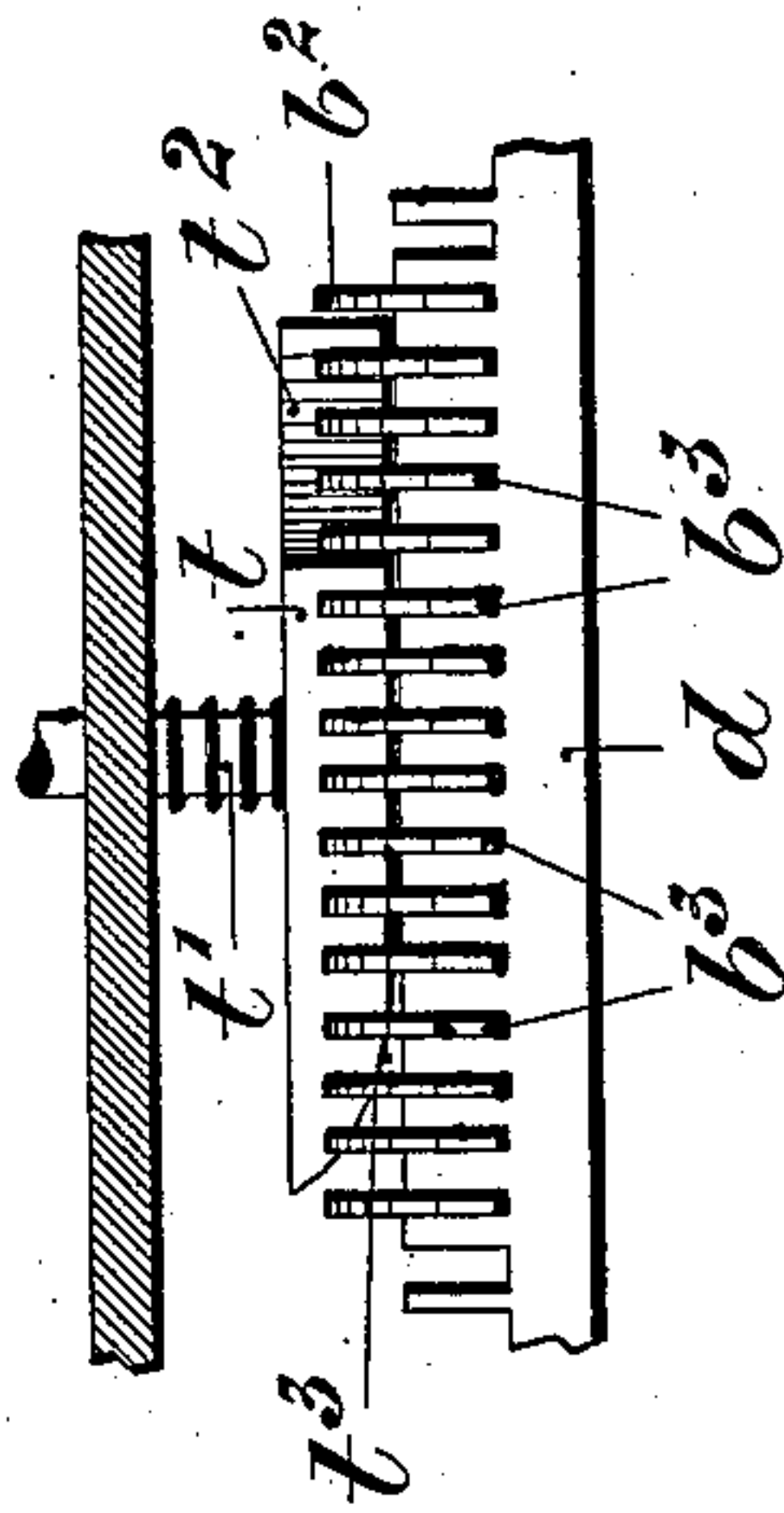
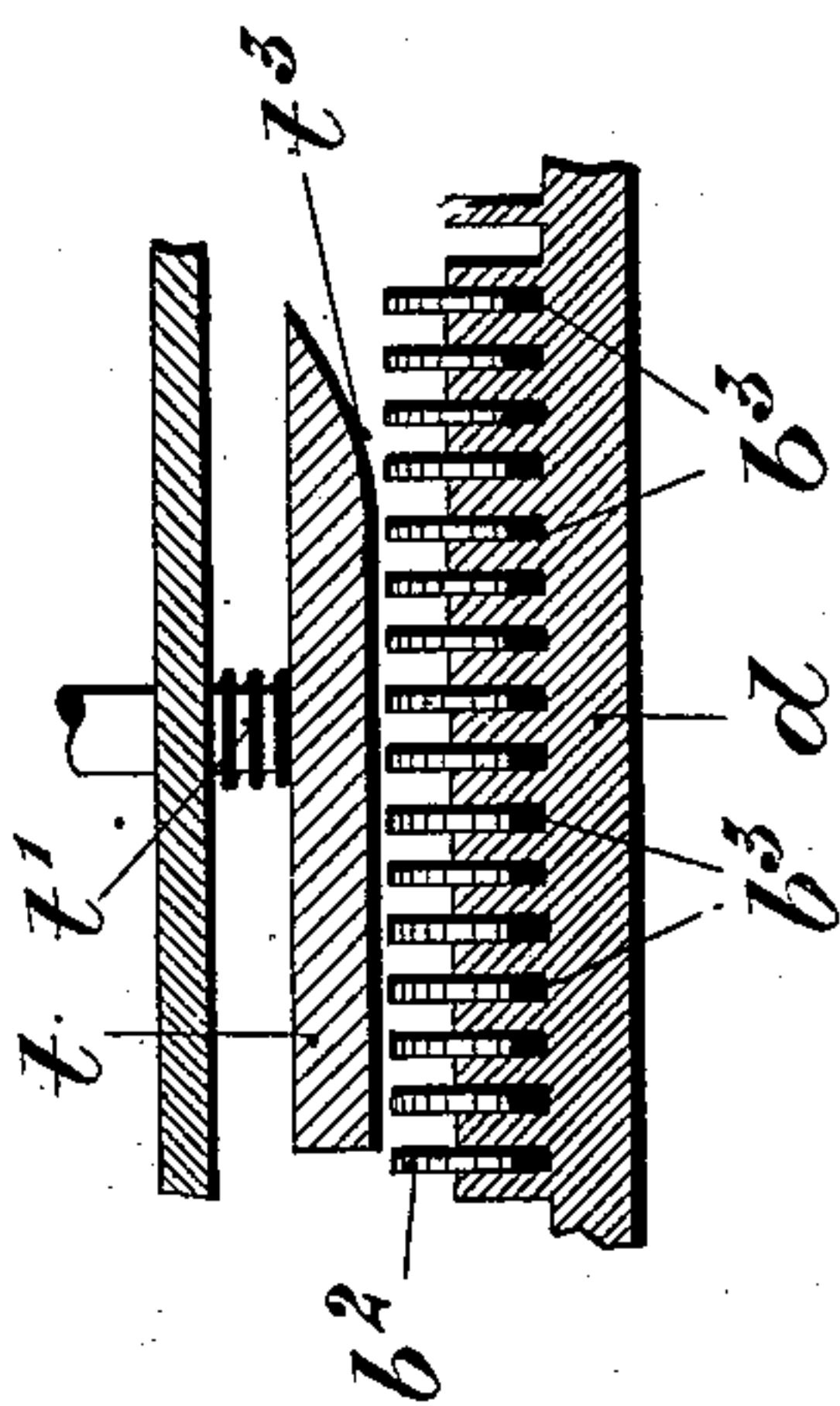


Fig. 9.



Witnesses

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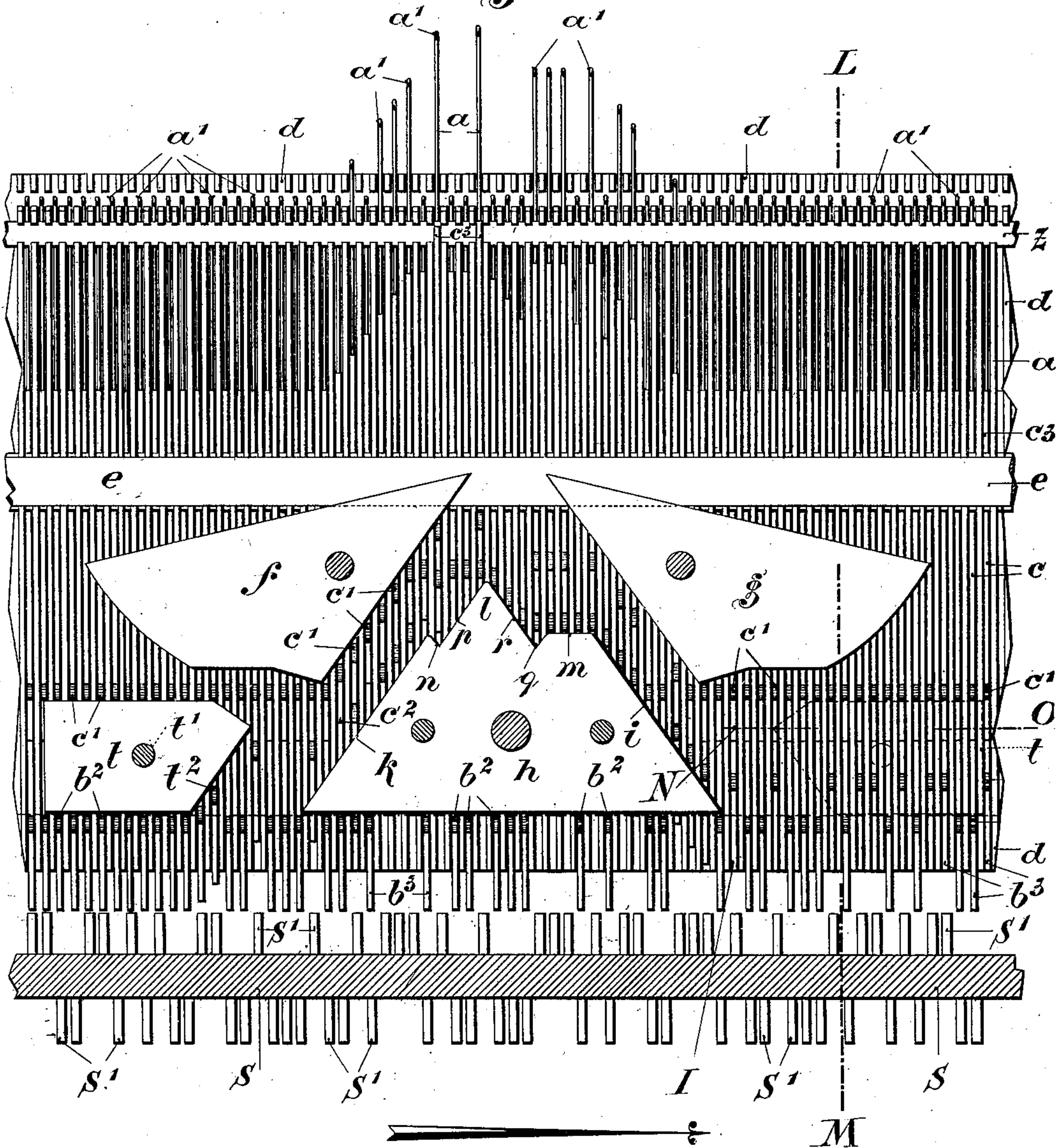
W. BACH.  
KNITTING MACHINE.

(Application filed Oct. 1, 1897.)

(No Model.)

6 Sheets—Sheet 4.

Fig. 7.



Witnesses

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**No. 643,997.**

**Patented Feb. 20, 1900.**

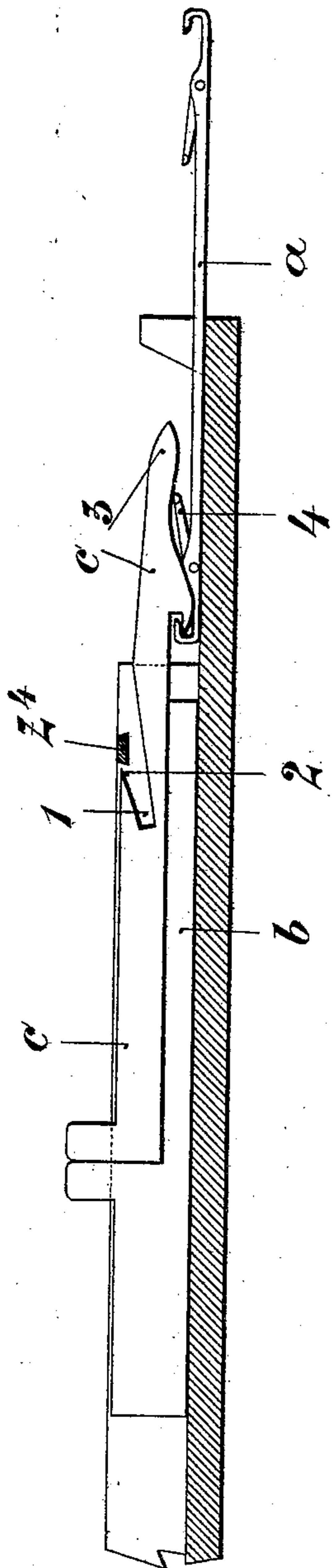
**W. BACH.**  
**KNITTING MACHINE.**

(No. Model.)

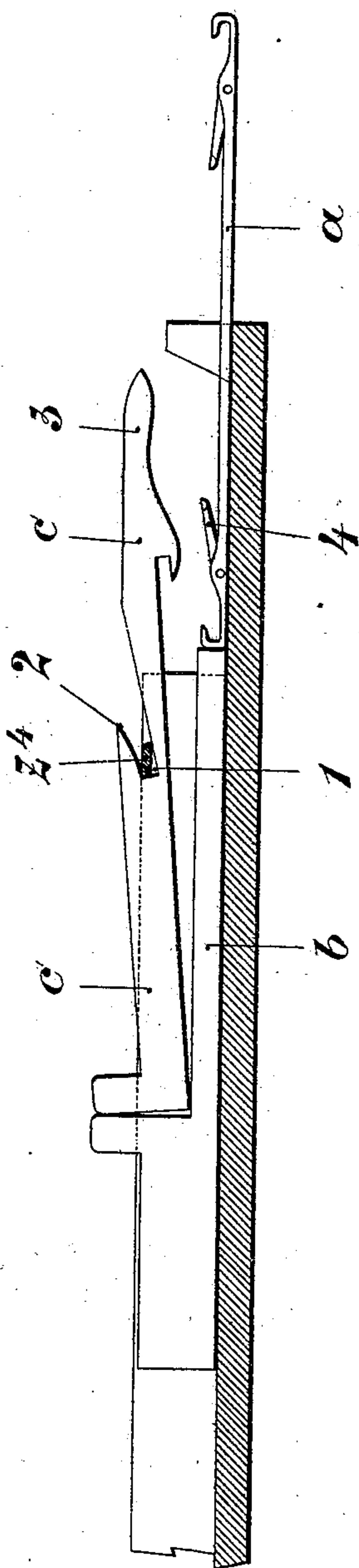
(Application filed Oct. 1, 1897.)

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Fig. 11.



**Fig. 12.**



Witnesses

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No. 643,997.

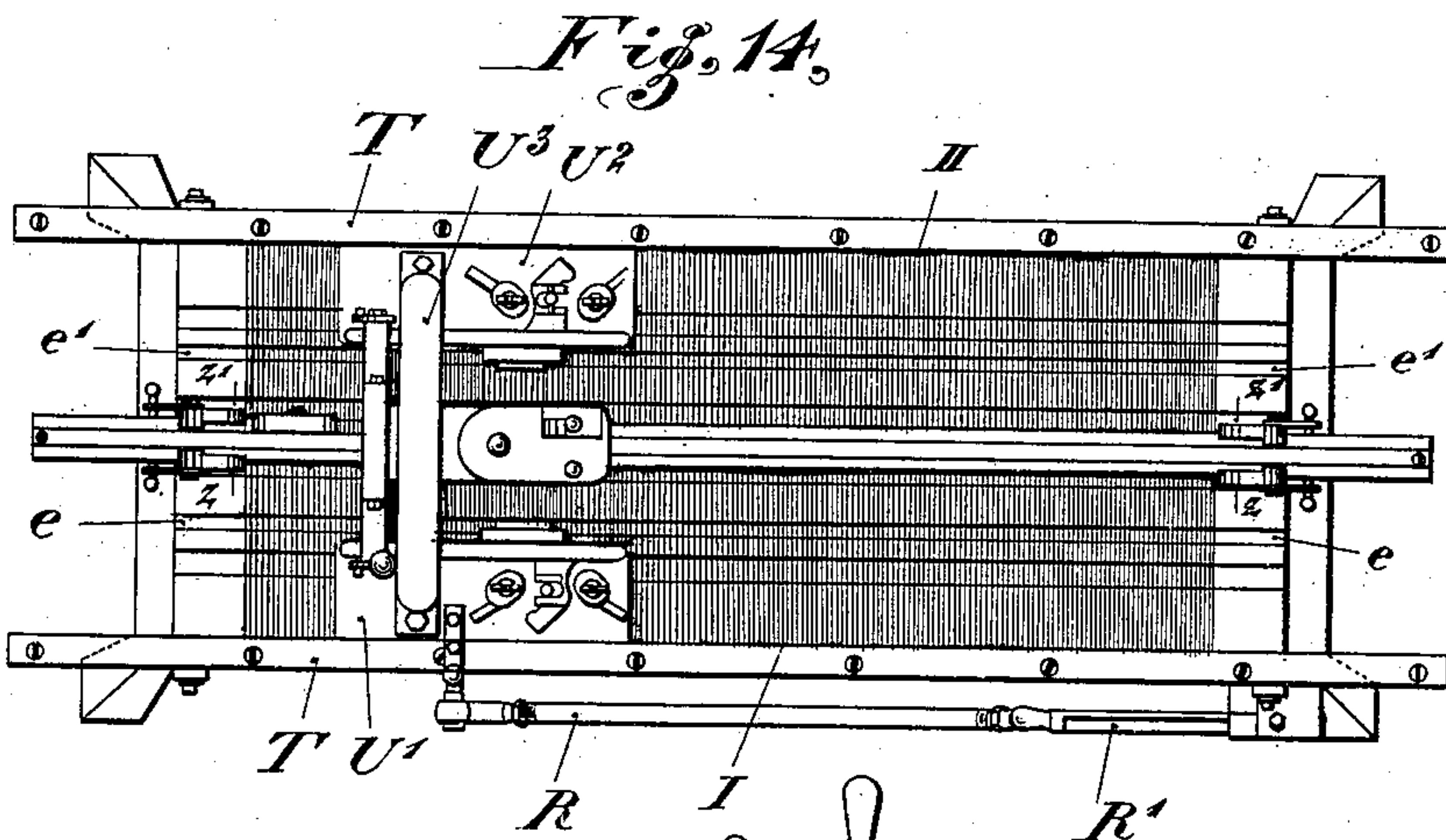
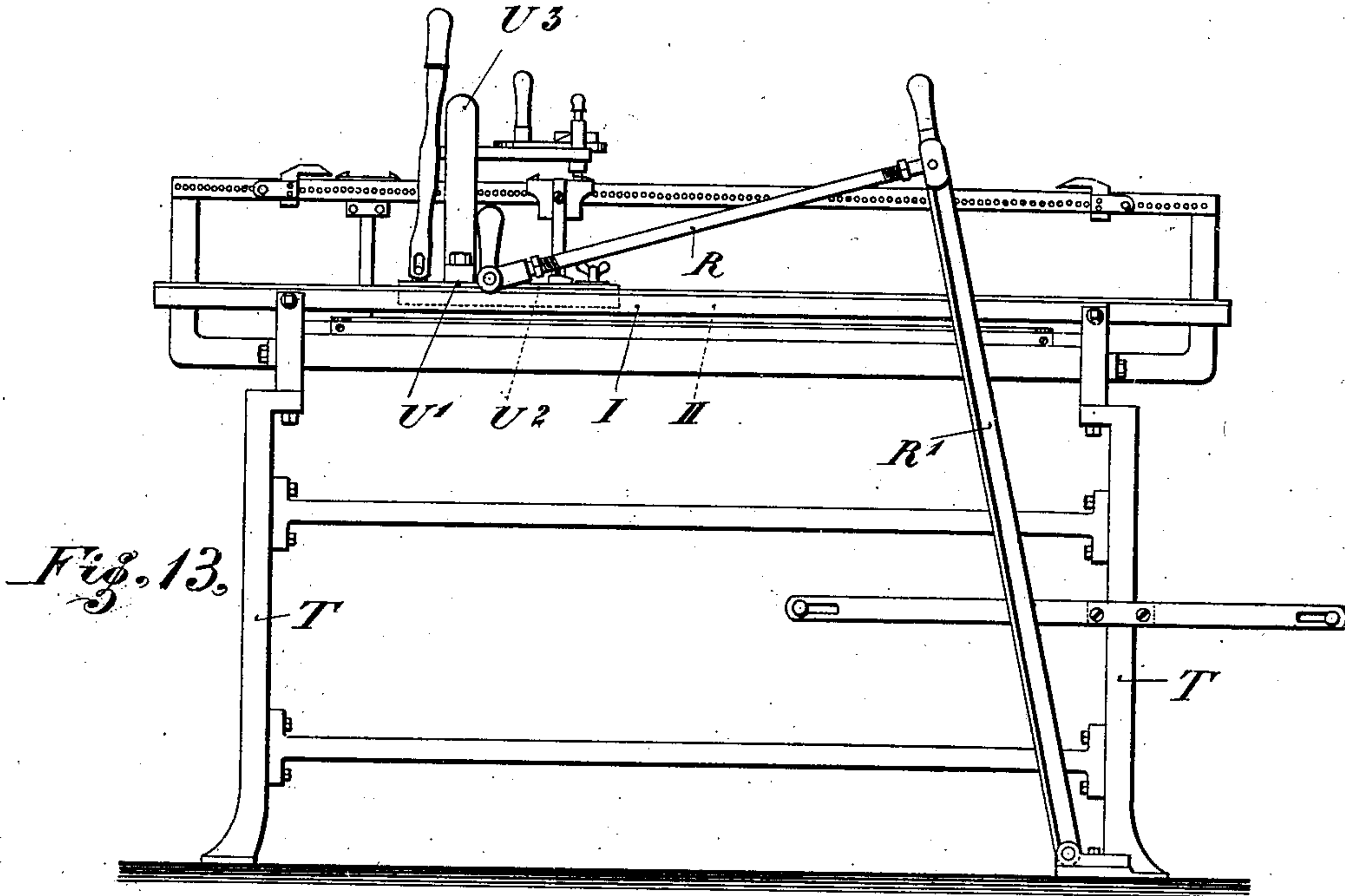
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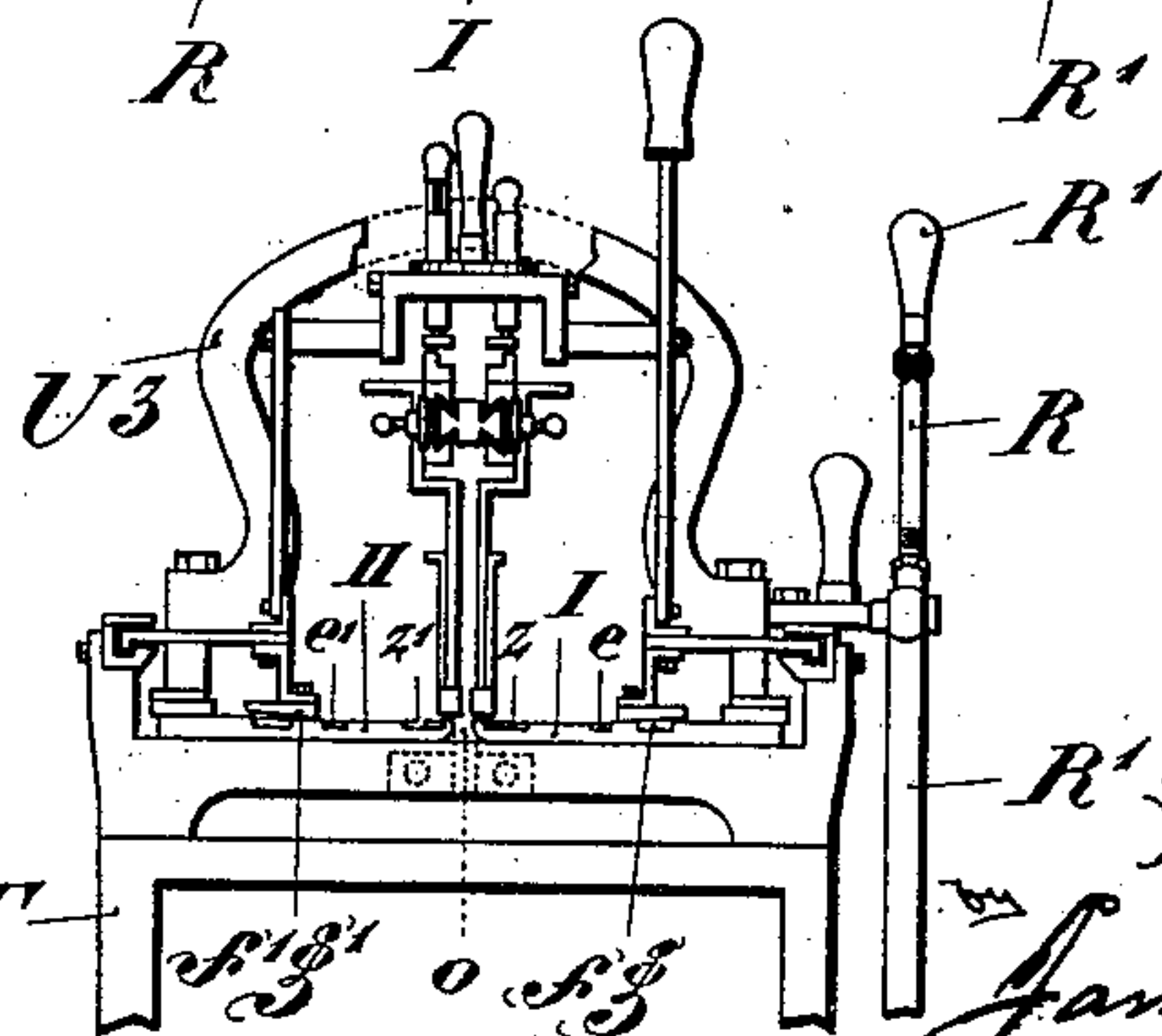
(No Model.)

(Application filed Oct. 1, 1897.)

6 Sheets—Sheet 6.



*Fig. 15.*



Witnesses

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# UNITED STATES PATENT OFFICE.

WILHELM BACH, OF APOLDA, GERMANY.

## KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 643,997, dated February 20, 1900.

Application filed October 1, 1897. Serial No. 653,740. (No model.)

*To all whom it may concern:*

Be it known that I, WILHELM BACH, manufacturer, a subject of the Grand Duke of Saxe-Weimar, residing at Apolda, in the Grand Duchy of Saxe-Weimar and German Empire, have invented new and useful Improvements in or Relating to Knitting-Machines, of which the following is a specification.

This invention relates to that class of knitting-machines described in Letters Patent No. 55,241, issued June 5, 1866, to W. W. Clay, wherein double-end hook-needles move in grooves at one or both sides of a central opening, the selection of the needles to be used from time to time being effected by the jac-

quard. The chief objects of my present invention are to generally improve the character or type of knitting-machines referred to, to provide new and improved means for operating the double-end tumbler-needles, and to avoid rapid wearing and uneven working, bending, jamming, and breaking of the needles when operated by cam-actuated slides. These objects are accomplished in the manner and by the mechanism hereinafter described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 is a detail sectional plan view showing the front and rear needle-beds, the plane of section being on the line A B, Fig. 3. Fig. 2 is a sectional view on the line C D, Fig. 1, showing the needle-drivers in the position to which they are uniformly moved by the advancing-cams to coact with each double-end tumbler-needle. Fig. 3 is a section through the needle-beds on the line E F, Fig. 1, the needles being shown in the position in which the drivers on the rear needle-bed have been moved forward. Fig. 4 is a section through the needle-bed on line G H of Fig. 1, the position of the needles being the one they occupy when the advancing-cam of the front needle-bed has moved its drivers, and consequently the tumbler-needles, to their forward position into the rear needle-bed. Fig. 5 is a detail section on the line J K, Fig. 1, when the needle-hooks are moved back by the retracting-cams, and consequently the double-end tumbler-needles are also drawn over. Fig. 6 is a detail view of one of the needle-hooks on an enlarged scale. Fig. 7 is detail plan view showing one of the beds of the knit-

ting-machine in proper relation to part of a well-known jacquard mechanism. Fig. 8 is a cross-section on the line L M of Fig. 7. Fig. 9 is a cross-section on the line N O, Fig. 7. Fig. 10 is a detail sectional view showing the cam of the jacquard mechanism, which is operative in the withdrawal of the advanced drivers. Figs. 11 and 12 are detail longitudinal sectional views showing a modified construction of the needle-hooks. Fig. 13 is a side elevation of a knitting-machine embodying my invention. Fig. 14 is a top plan view of the same, and Fig. 15 is an end elevation of the same.

The machine-frame T is provided at the top with a front needle-bed I and a rear needle-bed II, and over and in engagement with the two beds travel the cam-carrying slides U' and U<sup>2</sup>. The slide U' is connected by a link or rod R with a hand-lever R', Figs. 13, 14, and 15, pivoted at its lower end to the base of the machine-frame, whereby the slides can be simultaneously moved back and forth by the lever.

The double-end tumbler-needles *a* are moved or pushed forward by the drivers *b*, on which are mounted the needle-hooks *c*. The needle-hooks are movably mounted at their lower edges *c*<sup>5</sup> on the drivers *b* and in their reciprocating movement oscillate on the said edges, and they are, on one hand, held by the covering-bars *e e'* and, on the other hand, elevated or raised by the cross-bars *z z'*.

The needle-hooks *c* are caused to move forward by their tail ends *c*<sup>2</sup> resting against the heels *b*<sup>2</sup> of the drivers *b*.

The hook parts *c*<sup>3</sup> of the needle-hooks *c* can engage with the hooks *a'* *a*<sup>2</sup> of the tumbler-needles *a*.

The double-end tumbler-needles are pushed forward by the front driving ends *b'* of the drivers *b*. The drivers *b* are arranged in the needle-grooves *d d'* of the needle-beds behind the tumbler-needles *a*, and the bars *e e'* extend across the needle-hooks *c*, Figs. 2, 3, 4, and 5.

The advancing-cams *h h'*, as indicated in Fig. 1, serve to effect the movement of the drivers *b* and needle-hooks *c*. The driver and needle-hook retracting cams *f g f' g'* are arranged exactly opposite each other. The advancing-cams *h h'* are also arranged opposite each other as regards their cooperating edges



$i i' k k'$ ; but the middle triangular portions  $l l'$  of the cams  $h h'$  are arranged one in advance of the other and cause the complete advance movement of the drivers to effect the movement of the double-ended tumbler-needles, one a little in advance of the other.

The double-end tumbler-needles  $a$  lie under cross-bars  $z z'$ , which have chamfered edges for the purpose of simultaneously raising and holding the needle-hooks  $c$  raised. From the foregoing it will be seen that the parts coöperate as follows: When the slides  $U^1 U^2$  move from left to the right, the double-end tumbler-needles  $a$  are at first on the front needle-bed. The edges  $i i'$  of the cams  $h h'$  push simultaneously and uniformly the heels  $b^2$  of the drivers  $b$  forward, as indicated in Fig. 2, until the drivers reach the straight edge  $m$  of the front cam  $h$  or the edge  $n'$  of the rear cam  $h'$ . In consequence of this the tumbler-needles  $a$  are moved forward by the drivers  $b$  of the front needle-bed, so that they cross the longitudinal slot  $o$  and partly enter the needle-grooves of the rear needle-bed. Then the edge  $p'$  of the central triangular point of the rear cam  $h'$  is first alone operative and pushes the heels  $b^2$  of the drivers  $b$  of the rear needle-bed only and causes the drivers  $b$  to advance with their driving-ends  $b'$ . The heels or projections of the drivers on the front needle-bed move during this time along the straight planes  $m$  of the middle cam  $h$ , as indicated in Fig. 3. When the projections  $b^2$  of the drivers of the rear needle-bed have passed the outer point of the central triangular part of the cam  $h'$ , they have been moved forward so far that they push with their driving-ends  $b'$  against the tumbler-heads of the double-end tumbler-needles  $a$ . In consequence of the movement of the drivers on the rear needle-bed their corresponding needle-hooks are also moved forward in such manner that their hook parts  $c^3$  pass over the needle-bar  $z'$ . Now the triangular part  $l$  of the cam  $h$  of the front bed begins to act, the operative edge  $r$  of said part  $l$  pushing forward the projections  $b^2$  of the drivers  $b$  of the front bed. The side  $r$  of the part  $l$  of the cam  $h$  corresponds to the side  $r'$  of the part  $l'$  of the rear cam  $h'$ . Both have the same angle of inclination, and the result is that as the side  $r$  of the cam  $h$  pushes forward the heels or projections  $b^2$  on the drivers of the front needle-bed the side  $r'$  of the cam  $h'$  enables the heels or projections on the drivers of the rear needle-bed to be pushed back and the tumbler-needles  $a$  to be pushed over to the rear bed. Each tumbler-needle is thus guided at both ends and is pushed into the rear bed, Fig. 4, until its open end  $a'$  nearest to the rear bed is behind the hook part  $c^3$  on a needle-hook of the rear bed, the other end  $a^2$  being under the needle-bar  $z$  on the front bed, so that it cannot be seized by the hook part  $c^3$  of the needle-hook on this latter side. The needles remain for a moment in this position, while the projections  $b^2$

on the drivers of the rear needle-bed slide along the edge  $m'$  of the cam  $h'$ , so that in this manner time is obtained for a thread  $x$  to be introduced into the open tumbler end  $a^2$  of the tumbler-needle, Fig. 4. Then the retracting-cams  $f f'$ , at opposite sides, begin simultaneously and uniformly to act—not on the needle-drivers  $b$ , however, but on the projections  $c'$  of the needle-hooks  $c$  of the needle-beds. The needle-hooks will thus be simultaneously and uniformly pulled back, the action of this movement being as follows: The hook parts  $c^3$  of the needle-hooks slide on the front bed from the cross or needle bar  $z$  without being able to engage with the ends  $a^2$  of the double-end tumbler-needles, as these latter are under the cross or needle bar  $z$ , Fig. 4, so that on the front bed the tumbler-needle  $a$  is released. The open end  $a'$ , however, is on the rear bed so far behind the hook part  $c^3$  of the corresponding needle-hook that it engages with the hook part  $c^3$ , and it is pulled upon the retraction of the hook part  $c^3$  into the rear bed. The needle end  $a'$  of the tumbler-needle  $a$  remains open during this time, Figs. 1 and 5. The loop  $y$ , suspended on the shank of the needle  $a$ , is pushed in the well-known manner over the closing tumbler of the end  $a^2$  of the tumbler-needle and completed, while the thread  $x$ , Fig. 4, introduced into the end  $a^2$  is formed into a loop by the end  $a^2$  of the needle, Fig. 5, which is now closed. In the return movement of the needle-hooks  $c$  their driving ends  $c^2$  act on the heels or projections  $b^2$  of the drivers and push the latter back into their original position. When the slides are moved in the opposite direction, an opposite action takes place—that is to say, the sides  $k k'$  of the cams  $h h'$  cause the drivers  $b$ , and thus also the tumbler-needles  $a$ , to move forward. Then the surface  $p$  of the cam  $h$  becomes operative first. Then follows the side  $r'$  of the cam  $h'$ , whereby the tumbler-needle is pushed into the front bed so far that its end  $a'$  comes under the needle-bar  $z$ , whereas the end  $a^2$  comes far behind the hook part  $c^3$  of the needle-hook on the front bed, so that finally when the needle-hooks are pulled back by the retracting-cams  $g g'$  the double-end tumbler-needles  $a$  again pass into the front needle-bed, Fig. 2.

In order to properly guide the needle-hooks in their movements, they are provided with notches  $c^4$ , coöperating with the cross-bars  $e e'$ , Fig. 4. In this manner it is made possible for the needle-hooks to ride up on the needle-bars  $z z'$  and to be guided as they are retracted by the retracting-cams  $f g f' g'$ , said needle-hooks turning upon their lower edges  $c^5$  on the drivers  $b$ .

In order to facilitate the raising of the needle-hooks  $c$  and at the same time to protect the tumblers 4 against premature closing, the construction shown in Figs. 11 and 12 may be used, in which case the cross or needle bars  $z z'$ , before described, are replaced by the



cross-bars  $z^4$ , and the needle-hooks are provided with beaks 3. The cross or needle bars  $z$  and  $z'$ , previously described, afforded protection against the rising of the double-end tumbler-needle, but in the arrangement shown in Figs. 11 and 12 is effected by the beaks 3 of the needle-hooks  $c$ .

The needle-hook  $c$  is provided on its upper side with a wedge-shaped recess 1 to produce a wedge-point 2. The driver  $b$  is advanced and retracted in the same manner as previously described and actuates the needle-hook  $c$ , the wedge-point 2 of the latter riding upon the cross-bar  $z^4$ , thus raising the needle-hook.

As the cross-bars  $z^4$  in the present arrangement are not placed at the heads of the needle-hooks, as in the arrangement previously described, but about in the center of their length, the extent to which the needle-hooks can be raised is twice as great as in the previous arrangement. In the form shown in Figs. 12 and 13 the beaks 3 of the needle-hooks  $c$  may be made comparatively long and extend directly over the open tumblers 4 of the double-end tumbler-needle and prevent the tumblers from closing.

The machine according to the present invention enables the number and the position of the knitting-needles to be very easily varied whenever occasion demands. A knitting-machine for manufacturing pearl work can therefore be connected in a very simple manner with a jacquard mechanism, as shown in Figs. 7 to 10. The jacquard-roller  $s$ , which is driven toward the needle-bed, drives forward, by means of its studs  $s'$ , (before the movement of the slide begins,) the rear ends  $b^3$  of the drivers  $b$  of those needles which are to be used, the drivers and needles which are not to be used remaining in their retracted position. The operated drivers advance or push forward the corresponding needle-hooks  $c$ , which come against the sides of the advancing-cam, as hereinbefore explained. The remaining drivers pass along the back edge of the advancing-cam  $h$  and do not become operative, so that the corresponding needle-hooks and double-end tumbler-needles are not affected.

In order to properly guide the drivers which have been advanced or moved forward and to retract them afterward, I provide jacquard-cams, as at  $t$ , Fig. 7, which shows the arrangement for the front needle-bed. The jacquard-cams are each provided on the outer side, where the heels  $b^2$  of the drivers which have been operated strike, with a beveled edge  $t^3$ , Figs. 9 and 10. Springs  $t'$  are arranged to act on the cams in such manner that they may be raised by the heels  $b^2$  of the advanced drivers and depress them when not so raised, the result of which is that, during the forward movement of the slides which carry the cams, these drivers remain in position until moved by the advancing-cams. For this purpose the cams  $t$  are arranged under the cams  $f g f' g'$ . When, however, all the needle-hooks

are withdrawn by the cams  $f f' g g'$ , the inclined edge  $t^2$  of the jacquard-cam  $t$  meets the heels  $b^2$  of the drivers, which have been advanced, and the latter are retracted and become again operative only when they are again pushed forward by the studs  $s'$  of the jacquard-roller. Fig. 8 shows such a jacquard-cam  $t$  as it presses on the heels  $b^2$  of the operated drivers. Fig. 10 shows the edge  $t^2$  of the jacquard-cam in operative position when the needles which had been pushed forward are to be retracted or withdrawn.

To avoid confusion and to enable the drawings to more clearly show my invention, I do not illustrate the devices for opening the tumblers of the needles and for introducing thread; but these parts will be of ordinary or well-known construction.

It will be understood that the advancing and retracting cams, and the jacquard-cams, hereinbefore described, are suspended from the slides  $U'$  and  $U^3$ , which are actuated by the hand-lever before referred to.

The needle-hooks of the two needle-beds do not exercise any influence on each other, as is the case in similar devices hitherto known. Neither are the tumbler-needles caused to advance by the needle-hooks, and the latter do not engage the heads of the double-ended tumbler-needles, the consequence of which heretofore was rapid wearing of the parts in contact, uneven working, and bending and jamming of the pulling-wires and tumbler-needles, so that very often the cam-operating slide could be moved forward only after a number of needles had been bent, broken, or rendered useless.

It will be seen that the double-ended tumbler-needles in the machine according to the present invention are caused to move not only by the needle-hooks, but by the drivers.

It will be seen from the foregoing that the drivers  $b$  are practically independent of the needles and needle-hooks  $c$ , and that, therefore, it is possible to produce any pattern desired by simply pulling the drivers of the needles that are not to knit so far out of the needle-channels that such drivers cannot be operated. Also that by the arrangement of the drivers independent of the needles and needle-hooks it is possible to produce so-called "pearl work" of any desired pattern by arranging at the heels of the drivers a jacquard mechanism, as before explained, which operates only those drivers of needle-hooks and needles that are required to knit, leaving all other drivers, needle-hooks, and needles motionless or inoperative. Further, the needles, needle-hooks, and drivers being practically independent of one another, as the needle-hooks are retracted by the proper cams all the needles return to position of rest and in the next half-course can again be brought into knitting position.

Having thus described my invention, what I claim is—

1. The combination with the front and rear



needle-beds, and the double-end tumbler-needles thereupon, of needle-drivers arranged on each bed, needle-hooks mounted on the drivers and those of one bed serving to move  
 5 the needles from one bed to the other, advancing-cams for each bed, constructed to advance or push the drivers forward and thereby advance or push forward the corresponding needle-hooks and needles, retracting-cams for  
 10 each bed, constructed to engage and retract the needle-hooks and thereby retract the corresponding drivers and pull over the corresponding needles, and means for actuating said cams, substantially as described.

15 2. The combination of two horizontal needle-beds separated by a longitudinal slot and each provided with double-end tumbler-needles, needle-drivers on each bed, needle-hooks engaged with and oscillatory upon the  
 20 upper sides of the drivers and those of one needle-bed serving to pull across said slot the needles of the other bed, advancing and retracting cams for the drivers and needle-hooks, arranged over each needle-bed, and  
 25 two connected slides which carry said cams, substantially as described.

3. The combination of two horizontal needle-beds separated by a longitudinal slot and each provided with double-end tumbler-needles, needle-drivers on each bed, needle-hooks engaged with and oscillatory upon the  
 30 drivers and those of one bed serving to pull across said slot the needles of the other bed, advancing-cams over each bed for advancing the drivers thereof and thereby advancing  
 35 the corresponding needle-hooks and needles, devices for lifting the needle-hooks from engagement with the needles when advanced, retracting-cams located at opposite sides of  
 40 each advancing-cam and constructed to operate against a part of the needle-hooks to retract the same with the corresponding drivers and thus pull over corresponding needles, and means for simultaneously moving the advancing and retracting cams of the two needle-beds back and forth, substantially as described.

4. The combination of two horizontal needle-beds separated by a horizontal slot and  
 50 each provided with double-end tumbler-needles, needle-drivers arranged on each bed and provided with heel-pieces, needle-hooks engaged with and oscillatory upon the upper sides of the drivers and provided with projections, cross-bars extending over the needle-hooks for lifting the latter from engagement with the needles when advanced, advancing-cams arranged over the two beds and acting on the heel-pieces of the drivers to advance the latter with corresponding needle-hooks and needle-retracting cams arranged over the two beds and acting on the projections of the needle-hooks to retract the same and their drivers and pull over corresponding  
 65 needles, and slides for moving said cams back and forth, substantially as described.

5. The combination of two horizontal, separated

needle-beds, each provided with double-end tumbler-needles, needle-drivers arranged on each bed, needle-hooks engaged  
 70 with and oscillatory upon the drivers and provided with projections, advancing-cams arranged opposite each other and having central triangular points located one in advance of the other, cross-bars extending over the  
 75 needle-hooks for raising them when advanced with the needle-drivers, retracting-cams arranged over each bed and acting against the projections of the needle-hooks to retract the same and thereby retract the drivers, and  
 80 means for simultaneously moving the advancing and retracting cams of the two beds, substantially as described.

6. The combination of two horizontal needle-beds separated by a longitudinal slot and  
 85 each provided with double-end tumbler-needles, needle-drivers on each bed, needle-hooks engaged with and oscillatory upon the needle-drivers of each bed and advanced thereby, the needle-hooks of one bed serving to pull  
 90 over thereupon the needles of the other bed, devices for lifting the needle-hooks of each bed from engagement with the needles when the needle-hooks are advanced, devices for advancing the needle-drivers, and devices  
 95 acting upon the needle-hooks to retract them with the drivers and thereby pull over corresponding needles from one bed to the other, substantially as described.

7. The combination of two separated needle-beds each having double-end tumbler-needles, needle-drivers on each bed, needle-hooks engaged with and oscillatory upon the  
 100 drivers of each bed and advanced thereby, cross-bars extending over the needle-hooks to lift them when advanced, and the main advancing and retracting cams with jacquard mechanism for advancing certain drivers and thereby advancing corresponding needle-hooks and needles, and cams *t* having beveled  
 105 edges *t*<sup>3</sup> for acting on said advanced drivers, substantially as and for the purpose described.

8. The combination of two needle-beds separated by a longitudinal slot and each having double-end tumbler-needles, needle-drivers  
 115 on each bed, needle-hooks mounted on the drivers of each bed and advanced thereby, cross-bars for lifting the needle-hooks when advanced, and advancing and retracting cams over each bed, with a jacquard mechanism  
 120 for advancing certain drivers and corresponding needle-hooks and needles, cams *t* having beveled edges *t*<sup>3</sup> and arranged under the said retracting-cams, and means for actuating said cams, substantially as and for the purpose described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILH. BACH.

Witnesses:

P. TEIDMANN,  
 WILH. BÄETZ.