(No Model.)

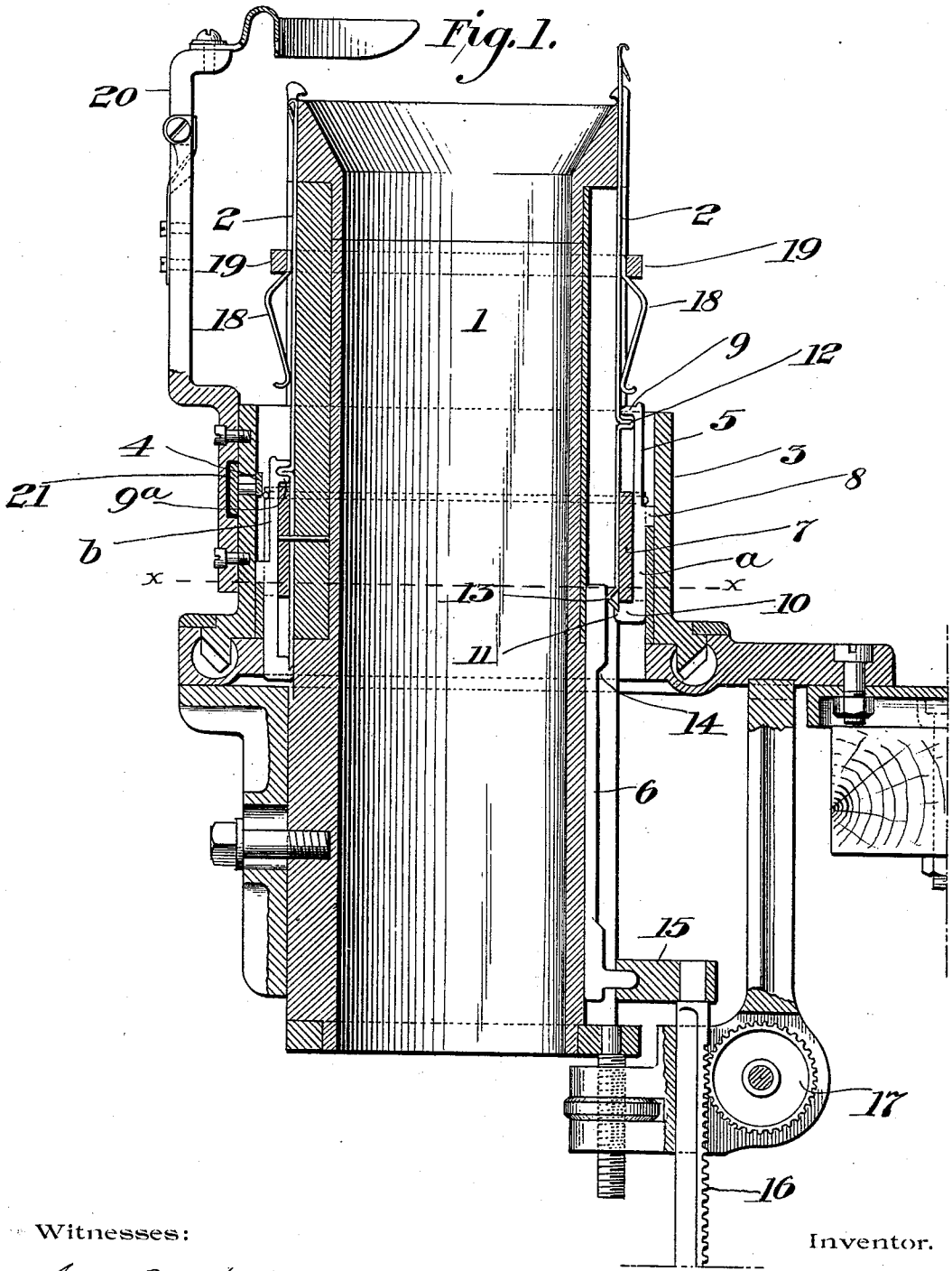
4 Sheets—Sheet 1.

W. H. ZELLERS.

KNITTING MACHINE.

No. 521,069. Patented June 5, 1894.

Fig. 1.



Witnesses:

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per John F. Nolan.

Attorney.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.)

4 Sheets—Sheet 2.

W. H. ZELLERS.

KNITTING MACHINE.

No. 521,069. Patented June 5, 1894.

Fig. 2.

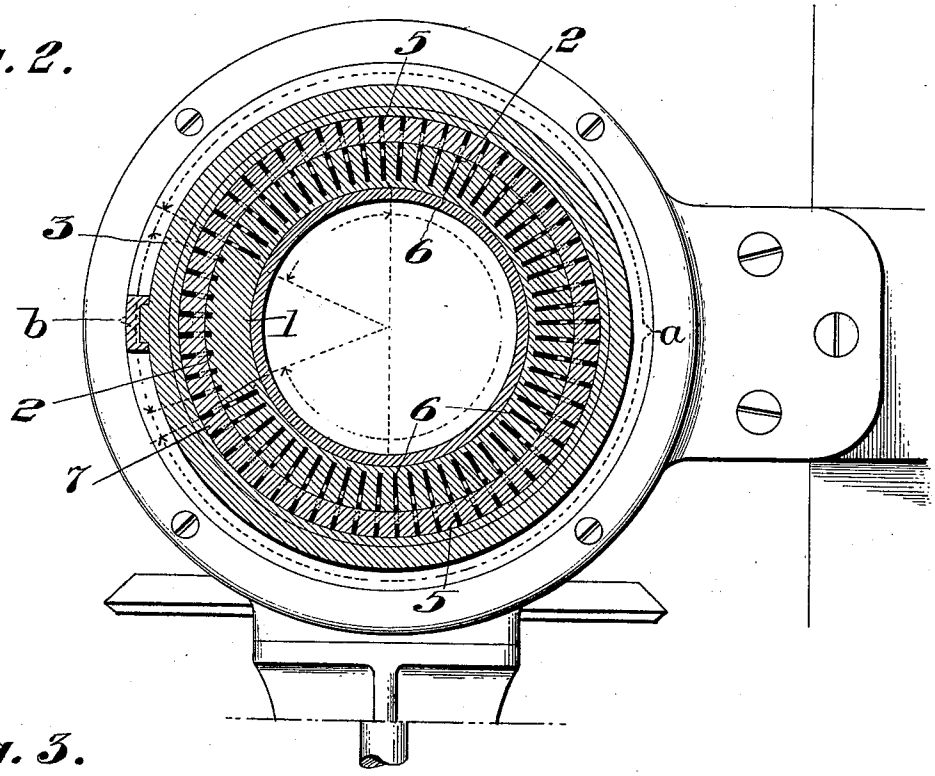
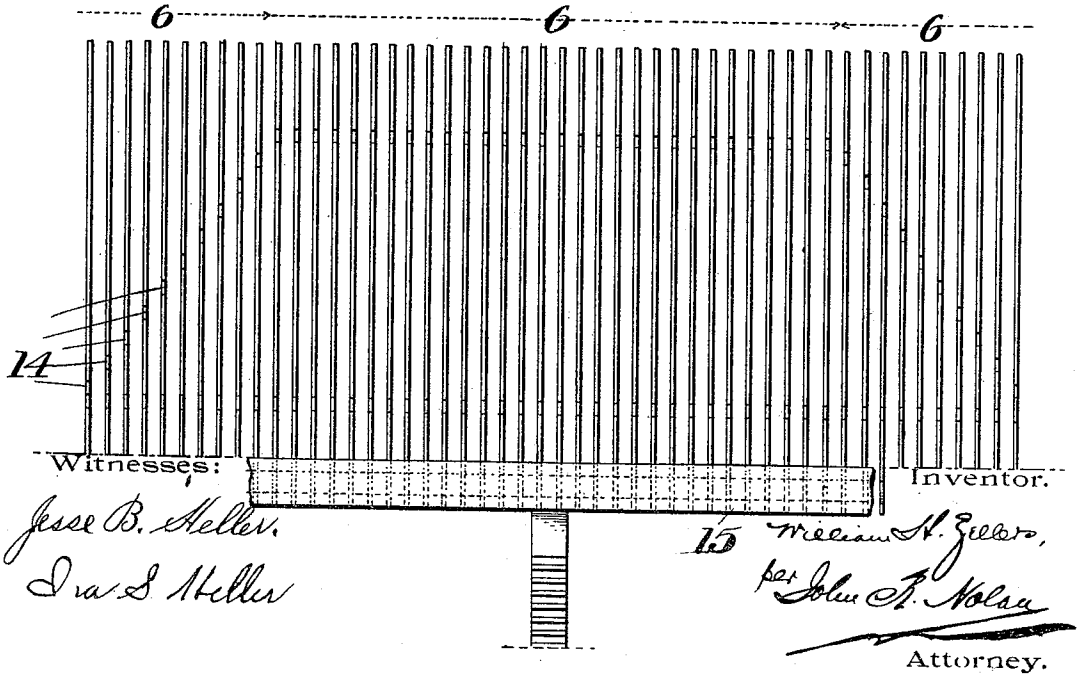


Fig. 3.



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(No Model.)

4 Sheets—Sheet 3.

W. H. ZELLERS.

KNITTING MACHINE.

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Fig. 5.

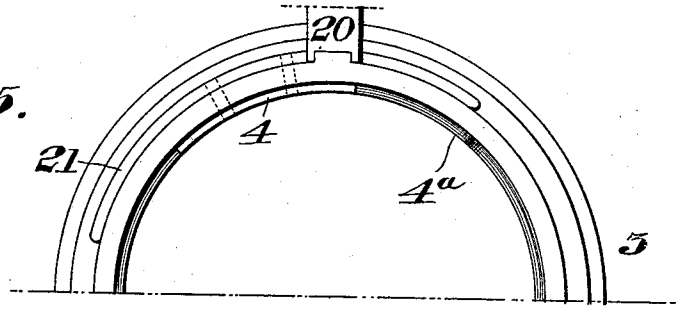


Fig. 4.

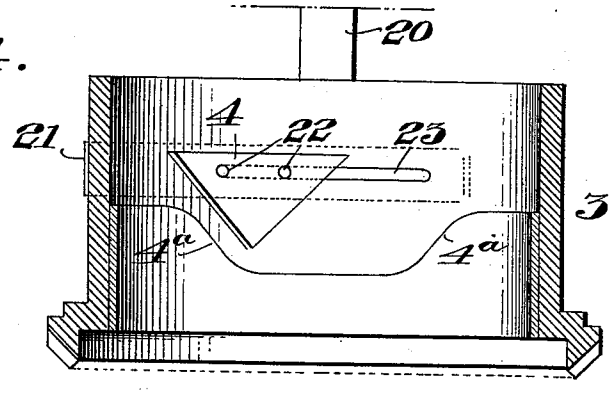


Fig. 6.

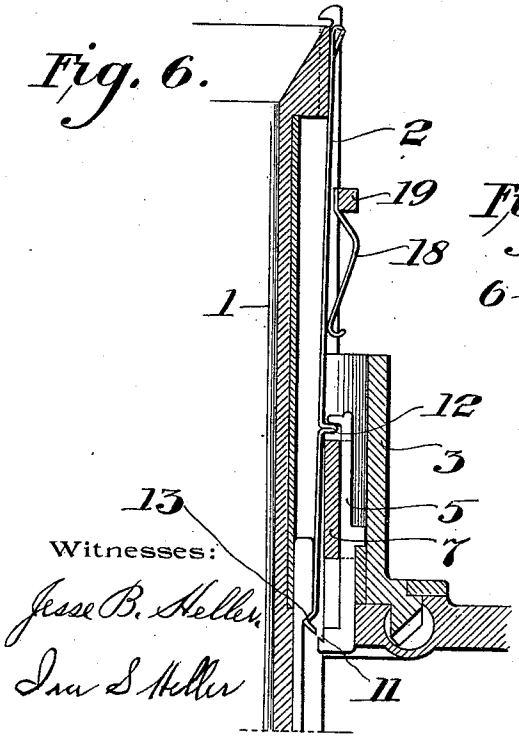


Fig. 9.

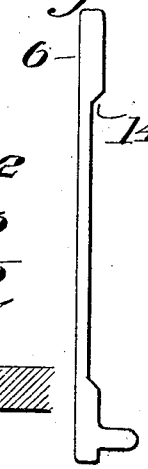


Fig. 8.

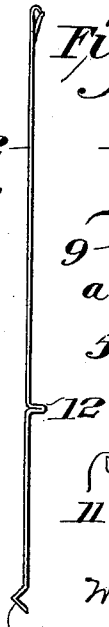
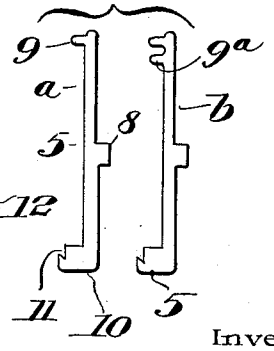


Fig. 7.



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WASHINGTON, D. C.

(No Model.)

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W. H. ZELLERS

KNITTING MACHINE.

No. 521,069. Patented June 5, 1894.

Fig. 10.

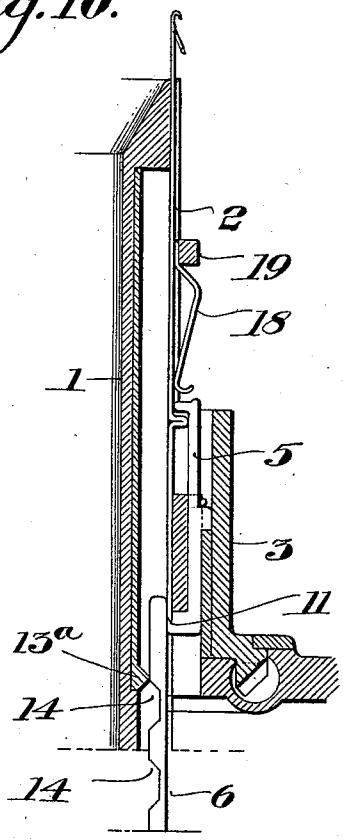


Fig. 11.

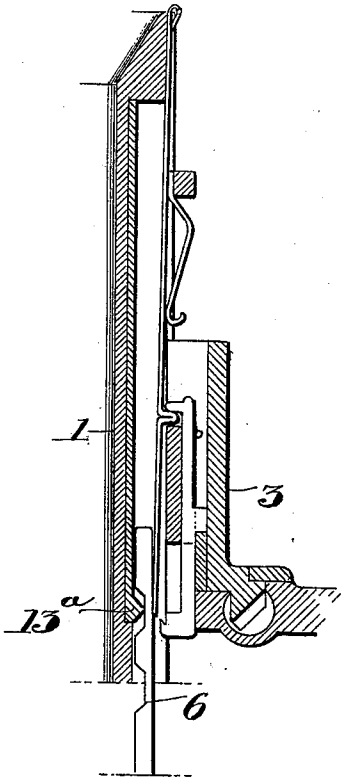


Fig. 12.

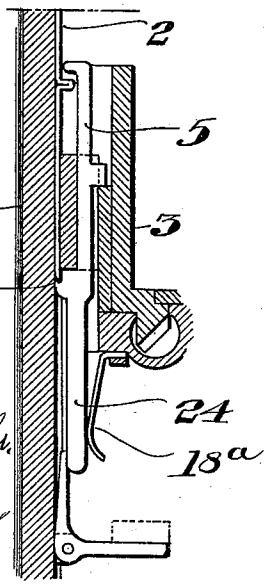
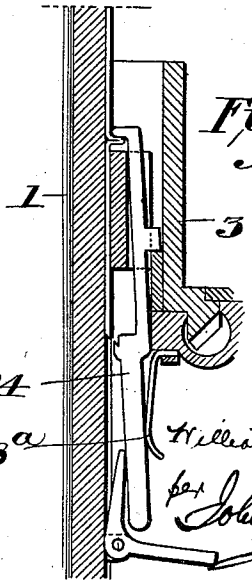


Fig. 13.



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per John B. Nolde

Attorney.

THE NATIONAL LITHOGRAPHING COMPANY.
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM H. ZELLERS, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 521,069, dated June 5, 1894.

Application filed December 5, 1893. Serial No. 492,842. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. ZELLERS, a citizen of the United States, residing in the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to that class of knitting machines in which are provisions for automatically moving certain needles into and out of action at predetermined intervals, as, for example, in the operation of forming the heel and toe parts of stockings. A machine of this type is set out in Letters Patent of the United States No. 476,110, granted me May 31, 1892, to which reference may be had.

The present invention consists, mainly, in a novel arrangement of jack devices with which the knitting cam is adapted to be positively engaged, and with which the needles are adapted to be intermittently or temporarily engaged, together with appropriate means for periodically operating the needles and jacks in respect to each other, to effect their engagement or disengagement, as desired.

The invention also embodies novel features of construction and organization that will be hereinafter pointed out.

In the annexed drawings,—Figure 1 is a vertical section of a knitting machine constructed according to my invention. Fig. 2 is a transverse section, as on the line x—x of Fig. 1. Fig. 3 is a developed view of the series of vertical slide cams for controlling the positions of certain needles relative to the jack devices. Fig. 4 is a vertical section of the cam cylinder, detached. Fig. 5 is a partial plan thereof. Fig. 6 is a vertical section through one side of the needle and cam cylinders, with their immediate connections, showing the needle as disengaged from the jack device, and the parts in the respective positions which they occupy at this stage of the operation. Fig. 7 is a view of the jack devices; Fig. 8 one of the needles, and Fig. 9 one of the slide cams. Figs. 10 and 11 are vertical sections of a modification, showing the needle in the active and inactive positions respectively, and Figs. 12 and 13 are corresponding views of another modified construction in which oscillatory jacks are employed.

The numeral 1 represents the needle cylinder and 2 the needles therein.

3 is the rotatable cam cylinder, and 4 the knitting cam.

5 is one of a series of vertically-disposed jacks detachably connected with the needles and in operative position relative to the knitting cam, and 6 is one of a series of similarly-disposed slide cams arranged rearward of the needles and adapted at predetermined intervals to affect the disengagement of certain needles from, and their re-engagement with, said jacks.

In previous constructions, the needle heels (or the butts of jacks with which the needles were connected) were moved directly into and out of action with the knitting cam by means of suitable co-acting devices. An objection to those constructions is that the heels of the needles (or the butts of the jacks) when moved out of action, are apt to drop below the top of the needle rest, in which case they are forced against said rest and broken, or otherwise injured, while being returned to their active position. To obviate this objection, I have devised the plan of jack mechanism above referred to, the same being more particularly described as follows: Those grooves in the needle cylinder in which the fashioning needles are contained are of sufficient depth to receive the needles and a corresponding series of rearwardly-disposed slide cams, 6. Surrounding the needle-cylinder, is a suitably-located supplemental cylinder or bed, 7, which is grooved exteriorly coincidently with the needle cylinder. Fitted to these grooves are the longitudinally-movable jacks 5 that are provided with butts 8 which extend into the track of the knitting cam in the cam-carrier. Hence during the rotation of the said carrier, the jacks are successively reciprocated by the knitting cam. This being the case, it will be obvious that the needles, if engaged with the jacks, will be correspondingly actuated by and with the latter. Those jacks (marked a) which co-act with the series of fashioning needles are so constructed that the needles may be readily

disengaged therefrom, and re-engaged therewith, while those (marked *b*) which engage the remaining series of needles are constructed to remain in engagement with the needles.

The jacks of the series *a* each comprise a metallic plate provided at top and bottom with inwardly-projecting portions 9, 10, respectively, the distance between which is equal to or greater than the height of the supplemental cylinder plus the throw of the knitting cam, whereby the requisite reciprocation of the jack may be had. The inner edge of the portion 10 is notched or hooked as at 11 to receive the lower pointed or beveled end of the proximate knitting needle, while the upper portion, 9, is a simple finger that is adapted to engage the usual outwardly-projecting heel, 12, of the needle. The lower portion of the needle is provided on its inner edge with a V-shaped bend, 13, the apex of which bears against the opposed edge of the rearward slide cam 6, which latter thus maintains the needle parallel with the jack to permit the needle to be engaged and reciprocated by said jack. The distance between the heel and the lower extremity of the needle is somewhat less than that between the co-acting portions 9, 10, of the jack to the end that the notched or hooked portion will be disengaged from the point of the needle during the descent of the jack, but which portion, during the ascent of the jack will be re-engaged with the needle point. By this construction it will be seen that when the jack and, perforce, the needle are depressed, if the back support be removed from the needle, the lower end of the latter may be moved rearward from the path of the hooked portion of the jack. This being done the needle will remain quiescent until it is returned to its previous position. In the present instance the slide cams 6 comprise a series of thin metallic plates of uniform length, provided with off-set portions 14 and connected at their lower ends by a plate 15. The upper portion of the outer edge of each slide is the part against which the bend 13 of the needle bears when the latter is in action, while the offset portion is the part engaged by said bend when the needle is out of action. Those slide cams that are fitted to the grooves in which the back half of needles are contained, are offset uniformly or in the same horizontal plane, while the remaining slide cams, on each side of this set, are offset successively at descending intervals, which latter slides are fitted to the grooves in which are supported the needles that are manipulated during the narrowing and widening process, as in the formation of the heel or toe part of the stocking.

During the knitting of tubular work, the upper portions of all the slide cams are rearward of the needles, so as to maintain the latter in action, the needles being pressed yieldingly against said slide cams by suitable spring devices such as those hereinafter described. Preparatory to the fashioning operation, all the slides are raised one step, thereby advancing the uniform series of offsets below the bends, 13, of the contiguous needles, and permitting the latter to be thrown rearward by the springs. The one-half series of needles are thus disengaged, at their lower ends, from the jacks. During the succeeding strokes of the cam cylinder the slides are raised step-by-step so as to advance the offset portions of the slides at the ends of the strokes alternately, and in that way insure the release of the needles individually from their jacks. Hence a gradual narrowing of the web is effected. Upon the completion of the narrowing, the slides are lowered step-by-step, thereby returning the inactive needles to their active positions relative to the jacks in inverse order to the narrowing operation, thereby accomplishing the gradual widening of the web. The result is the formation of the heel or toe pouch of the stocking. In the present instance the slide supporting plate 15 is provided with a depending rack, 16, with which engages a pinion 17, by the movement of which said plate and therewith the slide cams may be actuated. Any appropriate means may be employed for supporting and actuating the slide cams, without departing from my invention.

The spring devices shown in the drawings, for pressing the needles against their respective slide cams comprise a circular series of spring fingers, 18, secured to and depending from a ring or support 19 surrounding the needle cylinder, although, of course, any other suitable means to the same end may be employed. As it is not requisite that the needles contained in the front space of the needle cylinder be thrown out of active position, the needle grooves in that part of the cylinder are of usual depth to receive the needles. The jacks of the latter differ from those previously described only in that they are each provided near their upper end with an additional finger, 9^a, which takes against the under portion of the needle heel and assists the lower portion of the jack in the elevation of the needle. This additional finger may, however, be omitted, if desired. The V-shaped stitch-cam 4 is constructed to slide to and fro during the reciprocation of the cam cylinder so as to lie rearward of the thread-guide, 20, during each stroke of the cylinder, and thus insure the proper delivery of the thread to the needles. There is, of course, a sufficient space between the raising cams 4^a to permit the sliding of the stitch cam. In the present instance the latter is secured to a horizontally disposed plate 21 on the exterior of the cam cylinder, by means of pins 22 that extend through a horizontal guide slot 23 in the cylinder. This plate not only steadies the cam in its movement but also covers and conceals the slot 23. It will be obvious that the supplemental cylinder or bed in which the jacks are supported and guided, not only reinforces

the needle cylinder, but affords a support and guide for the lower extremities of the needles during their reciprocations.

In Figs. 10 and 11 I have illustrated a modified construction in which the offset or cam portion, 14, is on the inner edge of the vertical slide, while the outer or straight edge is presented to the shank of the needle. In this construction the inner edge of the slide bears against a V-shaped projection 13ª at the base of the groove. When the upper edge of the slide is in contact with this projection the lower end of the needle is held in the path of the lower hooked end of the jack (Fig. 10), but when the slide is moved upward to bring the offset portion of the slide in contact with said projection, the rearward support of the needle is removed, and hence the spring presses the needle backward out of active position (Fig. 11). In this construction I have represented the slide as provided with a series of offsets, at intervals apart, whereby the needle may be thrown into and out of action during alternate upward movements of the slide, and in that way, during tubular knitting, effect well-known variations in the appearance of the web.

In Figs. 12 and 13 I have shown another modification in which the jack, and not the needle, is operated to engage or disengage the parts. In this construction provision is made for the requisite outward movement of the jack to disengage its lower notched or hooked portion from the end of the needle. In this instance, the jack is shown as provided with a depending portion 24 which is held normally inward by means of a suitably-disposed spring 18ª. The vertical arm of a bell-crank lever extends rearward of this depending portion, whereby the act of depressing the horizontal arm of the lever will move the lower end of the jack outwardly from the needle. I have not shown any special mechanism for operating the crank lever, as any well-known means for that purpose may be employed.

I claim—

1. The combination with a needle bed, a needle, a cam carrier and its cam, of a jack disposed lengthwise of the needle and provided with needle-engaging and cam-engaging portions, devices adapted to maintain the jack and needle in operative engagement, and means whereby said devices may be operated to effect the disengagement of the jack and needle, to the end that the needle will be idle during the operation of the jack by the knitting cam, substantially as described.

2. The combination with a needle bed, its needles, a cam carrier and its cam, of a series of jacks disposed lengthwise of the needles in operative position relative to the knitting cams, and provided with needle-engaging and cam-engaging portions a series of longitudinally movable slide cams adapted to maintain a predetermined number of said needles and jacks in engagement, and means for operating said slide cams, to effect the disengagement and re-engagement of said needles and jacks substantially as described.

3. The combination with a needle bed, its needles, a cam carrier and its cam, of jacks longitudinally disposed in operative position relative to the knitting cam, and provided with needle engaging and cam-engaging portions devices adapted to act upon a predetermined number of needles to maintain them engaged with said jacks, and means for operating said devices, to effect the disengagement and re-engagement of said needles and jacks whereby when the parts are disengaged the needles will be idle during the operation of the jacks by the knitting cam substantially as described.

4. The combination with a needle bed, its needles, a cam carrier and its cam, of longitudinally-disposed jacks provided with cam-engaging and needle-engaging portions, and devices rearward of and in contact with the needles adapted to effect the disengagement of the latter from the engaging portions of the jacks at predetermined intervals, substantially as described.

5. The combination with a needle bed, its needles, a cam carrier and its cam, of a jack supporting bed intermediate said needle bed and the cam carrier, longitudinally-arranged jacks in said bed in operative position relative to the knitting cam, devices adapted to maintain a predetermined number of needles and jacks engaged, and means for operating said devices, to effect the disengagement and re-engagement of said needles and jacks, substantially as described.

6. The combination with a needle bed, its needles, a cam carrier and its cam, of a jack-supporting bed between said needle bed and the cam carrier, jacks disposed in said jack supporting bed and provided each with two needle engaging portions that inwardly project beyond the respective edges of said latter bed, and provided also with a cam-engaging portion, and devices adapted to effect the disengagement of the jacks and needles at predetermined intervals, substantially as described.

7. The combination with a needle bed, a needle therein provided with two jack-engaging portions, the lower one of which is beveled or pointed, the cam carrier and its cam, of a jack arranged lengthwise of the needle and provided with two needle engaging portions and a cam engaging portion, the lower of which needle engaging portions is notched or hooked and adapted to interlock with the beveled or pointed portion of the needle, and means whereby these interlocking parts may be engaged or disengaged to effect the action or inaction of the needle, substantially as described.

8. The combination with the needle bed, a needle provided with a jack-engaging portion, a cam carrier and its cam, of a longitudinally disposed jack provided with needle engaging and cam engaging portions, a spring

tending normally to move the needle out of operative engagement with the jack, and a slide cam rearward of the needle adapted to maintain the latter in operation with said jack against the action of the spring, substantially as described.

9. The combination with the needle bed, its needles, the cam carrier and its cam, of a series of slides of uniform length disposed rearward of, and in contact with, the needles, and provided with cam faces at varying heights, means whereby the needles are held yieldingly against said slides, and means whereby the latter are operated to release the needles and permit the inward movement thereof by the springs, together with the jacks interposed between the needles and the cam carrier, and provided with cam-engaging and needle-engaging portions, substantially as described.

10. The combination with a needle bed, a needle provided with a jack-engaging heel and with a depending jack-engaging portion, a cam carrier and its cam, of a jack provided with a cam-engaging portion and with two needle-engaging portions, the upper of which is adapted to engage the heel and the lower of which is notched or hooked to engage the lower end of the needle, substantially as described.

11. The combination of a longitudinally-grooved needle bed, a needle therein provided with a jack-engaging portion, a longitudinally-grooved jack bed exteriorly of said needle bed, and a jack in said jack bed provided with a needle engaging portion, the said jack-bed being so disposed as to support the lower extremities of the needle substantially as described.

12. A jack provided with a needle-engaging portion at each end thereof, and with an intermediate cam-engaging portion, substantially as described.

13. The combination with a cam cylinder and the yarn carrier connected therewith, of the horizontally movable V-shaped stitch cam having a horizontal sliding connection with said cylinder, whereby the said cam will have an independent sliding movement to and fro during the reciprocation of the cam cylinder substantially as described.

14. The combination with the horizontally-slotted cam cylinder and the yarn carrier connected therewith, of the V-shaped stitch cam in said cylinder and the exteriorly disposed freely movable slide plate to which it is connected, whereby the said cam will have an independent sliding movement to and fro during the reciprocation of the cam cylinder, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

WILLIAM H. ZELLERS.

Witnesses:
JOHN R. NOLAN,
JESSE B. HELLER.