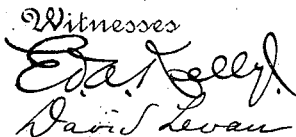


3 Sheets—Sheet 1.

No. 523,111.

Patented July 17, 1894.



James L. Eck
Inventor

By *his* Attorney

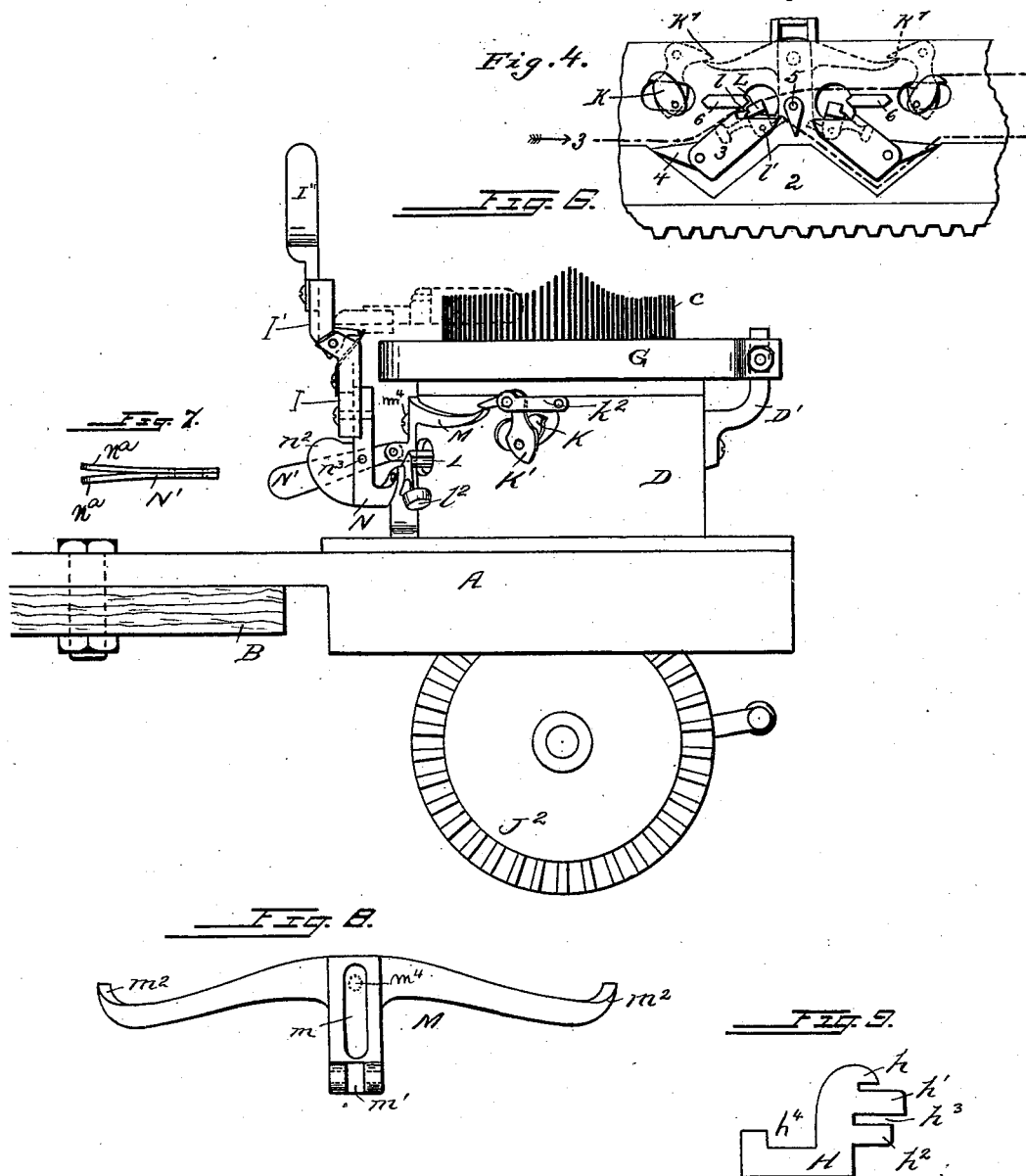
(No Model.)

3 Sheets—Sheet 2.

J. L. ECK.
CIRCULAR KNITTING MACHINE.

No. 523,111.

Patented July 17, 1894.



Witnesses
E. A. Kelly
David Levan

James L. Eck, Inventor

By his Attorney *W. H. Sturck*

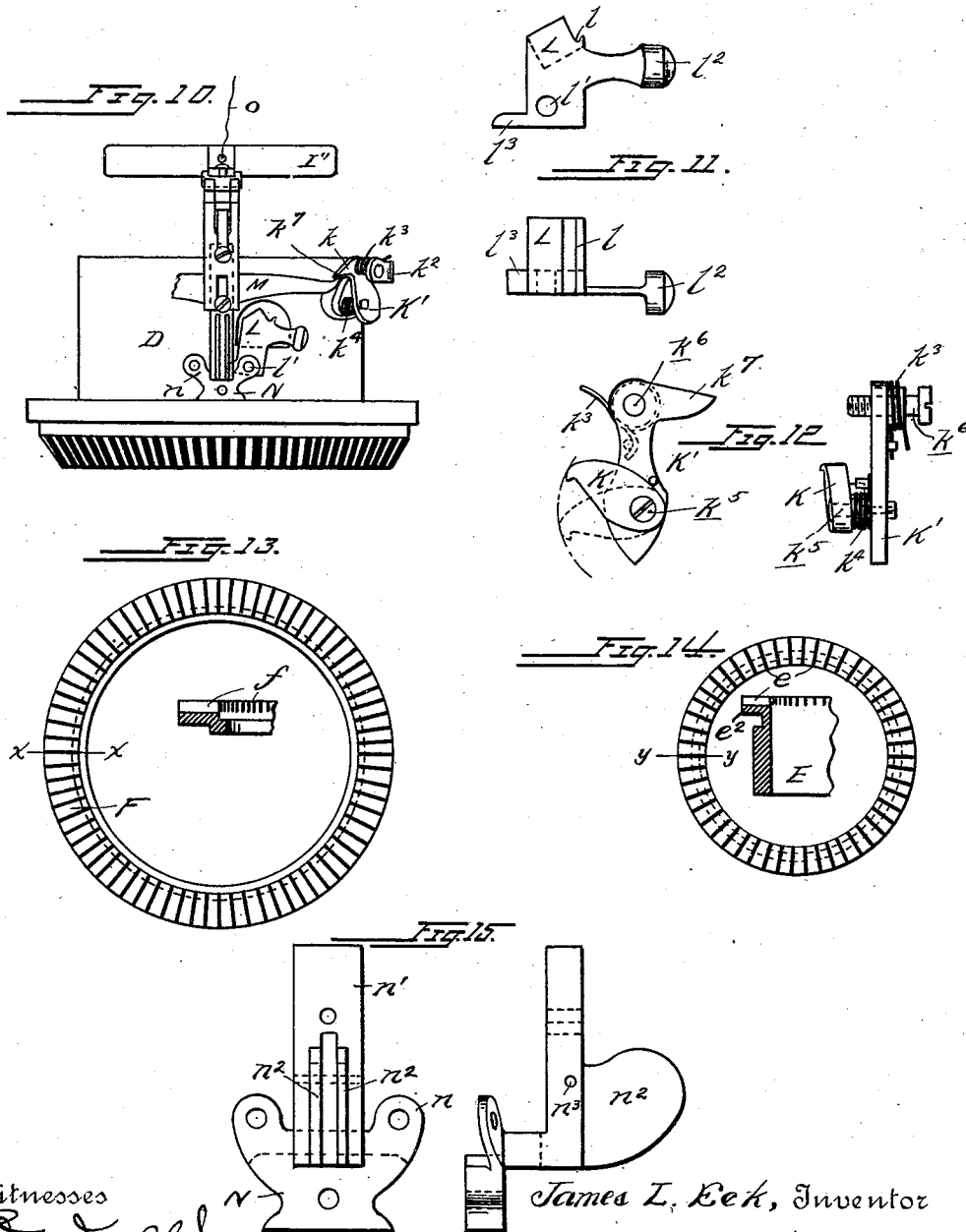
(No Model.)

3 Sheets—Sheet 3.

J. L. ECK.
CIRCULAR KNITTING MACHINE.

No. 523,111.

Patented July 17, 1894.



Witnesses
Edw. Kelly
David Lewis

James L. Eck, Inventor
By his Attorney *J. H. [Signature]*

UNITED STATES PATENT OFFICE.

JAMES L. ECK, OF READING, PENNSYLVANIA.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 523,111, dated July 17, 1894.

Application filed August 4, 1893. Serial No. 482,358. (No model.)

To all whom it may concern:

Be it known that I, JAMES L. ECK, a citizen of the United States, residing at Reading, in the county of Berks, State of Pennsylvania, have invented certain Improvements in Circular-Knitting Machines, of which the following is a specification.

My invention relates particularly to circular knitting machines and the improvements consist mainly in the mechanism provided for automatically raising and lowering the end needles of a row to take from or add to the number of loops as is required in forming heels and toes of stockings, &c.; and in the improved sinker mechanism employed. The novel features are specifically pointed out in the claims.

Figure 1 is a sectional elevation of a machine embodying my improvements. Fig. 2 is a separate view of the sinker cam-ring. Figs. 3 and 4 (on Sheets 1 and 3 respectively) are interior views of a portion of the cam cylinder showing the relative arrangement of the cams and indicating the action of the throwing up and throwing-down cams or levers. For clearness the section of cylinder is developed into a flat surface in these views. Fig. 5 is a partial plan view of the cam cylinder. Fig. 6 is an elevation taken at right angles to Fig. 1. Fig. 7 is a separate view of the spring handle for operating the throwing up and throwing down levers. Figs. 8 to 15 are detail views of different parts of the mechanism.

The form and arrangement of the machine shown in the drawings is similar in the main to that illustrated and fully described in Patent No. 410,505, issued to me September 3, 1889.

The frame A of the machine is suitably clamped to the table B and is provided with a depending bracket A' in which is mounted a driving shaft, having a bevel wheel J² and a pulley J with hand crank, fixed thereto at opposite ends.

J' is a loose pulley to which the driving belt is shifted from the fast pulley J by a mechanism not shown.

The needle cylinder C provided with a circular series of needles c mounted in horizon-

tal grooves therein as usual, is secured to the frame A, preferably by means of a clamping mechanism similar to that shown in my prior patent referred to. Inclosing the needle cylinder and riding upon an annular flange on the frame A is the cam cylinder D, having teeth on its lower face arranged to gear with the bevel wheel J² so as to be rotated thereby. This cam cylinder is provided as usual on its inner periphery with a series of cams arranged to form a race in which the needle hubs c' travel. In my present construction I provide a novel construction of cams and levers by which to effect automatically and in the most rapid and satisfactory manner; all the movements of the needles required for not only the usual straight knitting but also for forming the heels and toes of stockings and similar work which ordinarily requires the raising or lowering of needles by hand to gradually reduce or increase the number of loops formed, thereby narrowing or widening the heel and toe. The central cam 2 and side cams 3, 3, form the usual depressed portion 1 of the race, into which the needles are lowered in forming the stitch. Pivoted cams 4, 4, guard the entrance to this portion of the race, said cams being preferably held down by springs to insure their proper action. A central cam 5, loosely pivoted between the cams 3, 3, is arranged to be swung freely into contact with one or the other of these as the case may be, by contact with the needles which are to be guided downward through the race 1; and fixed cams 6, 6, located above cams 3, 3, serve to prevent the throwing of the needles above the top of the latter farther than is necessary to permit their passage along the course indicated by arrow 1, Fig. 3 which course blends with 2^a as shown. This course indicates the raising and lowering of the needles required to form the stitches in the ordinary knitting.

The throwing-down cams or levers K, as shown in detail in Fig. 12, are pivoted on posts projecting inward from the lower ends of arms K' and are held normally in the relation shown to said arms by coiled springs k⁴ which encircle said posts k⁵ and are each secured at one end to an arm K' and at the

other end to a cam or lever K. The levers K are located inside of the cam cylinder in the path of the needles, while the arms K' are located outside, being pivoted to the cylinder wall by means of brackets k^2 and posts k^6 and provided with springs k^3 which normally hold them in the positions indicated in Fig. 3 and return them to said position when the cross arm is lowered, said springs encircling said posts and each engaging at one end a pin on the adjacent arm and at its other end the adjacent bracket k^2 .

The throwing up cams or levers L, shown in detail in Fig. 11, are pivoted at l' between the ears n of the bracket N and the outside of the cam-cylinder, and the cam portion projects through the wall of the cylinder and normally drops down into the upper path of the needles it being provided with a weighted arm l^2 for this purpose.

The bracket N (Fig. 15) is fixed to the cam cylinder and carries the yarn carrier I, I', I'', which is adjustably secured to the vertical arm n' . A spring lever N' is pivoted to the bracket at n^3 , passing between the ears n^2 which serve as friction plates. The outer end of this lever is split or divided to form the two parts n^a , n^b which, when pressed together, allow the lever to be easily raised or lowered and when released spring apart into close frictional engagement with the ears n^2 . The inner end of this spring lever is connected at m' to a cross-arm M (Fig. 8) which it serves to move up and down guided by a pin m^4 which works in the slot m . The ends m^2 of this cross-arm engage the throwing down arms K' at k^2 , so that the raising of the cross-arm swings the throwing down cam K down to the position in which it is shown in Fig. 4, at the same time allowing the throwing up cams L to drop to their lower position. The lowering of the cross arm on the other hand allows the throwing down cams to assume the position shown in Fig. 3 while at the same time raising the throwing up cams L by bearing upon the toes l^3 which are arranged to extend under the bottom of the cross-arm; the movement of the latter thus places both sets of cams simultaneously in proper position for the automatic throwing up or throwing down of the needles, as the case may be. I will now describe how this, as well as the ordinary knitting operation is effected so far as the action of the cam mechanism is concerned.

In Fig. 3 the arrow marked 1 indicates the ordinary course of the needle hubs, over cams 4 and 3, under cams 6 and L and then, swinging cam 5 ahead, under cams 3 and 4 on the other side up to the original level. In forming the toe of a stocking however, as is well known, about half of the needles are raised from the level of arrow 1 to that of 2 the number of loops formed is first gradually reduced and then increased to narrow and widen, respectively and the cylinder is reciprocated instead of rotated. To accomplish this in my

improved device, the operator (after one half of the needles have been raised to the idle level 2, Fig. 3) presses the lever, N', down, thereby raising the cross arm M, which forces the throwing down cams K down to a position where they will be out of alignment with the needles at the idle level and allows the throwing up cams L simultaneously to drop into operative position, as heretofore stated. In Fig. 4 is shown the relative position of the cams for throwing up the end needles automatically to cause them to take the course indicated by the dotted line 3. The first needle of the row riding upward on cams 4 and 3 comes into contact with cam L, which it pushes ahead by causing it to swing upward around the center l' , the hub of the needle catching in the groove l and rising with it and finally over it and over the cam K shown at the right hand side of Fig. 4 into the upper course, during which operation the remaining needles of the row pass under the cam L and follow the usual lower course. This operation is repeated at each end until the desired number of needles have been thus raised to reduce the number of loops formed and correspondingly narrow the stocking at the heel and toe thereof. After this is done, the lever N' is again raised, thereby lowering the cross arm, which allows the throwing down cams K to assume operative position and simultaneously forces the throwing up cams L to their inoperative position. This position of the parts is indicated in Fig. 3.

The operation is as follows: As the raised needles travel in the course marked 2, the first needle of the row comes in contact with the throwing down cam K, engaging under the hook at the top of the same; the push of the needle against the cam causes the arm K' to swing on the center k^6 , thus carrying the cam K and the first needle which is in contact with it down sufficiently to permit the passage over it of the remaining needles of the row, which latter hold said cam down by the engagement of their hubs with the top surface thereof and follow the straight course indicated, the second cam K being readily pressed down on its own pivot out of the path of the needles without affecting them, they being already at their extreme elevation. Meanwhile, the first needle of the row, which has been carried down by the first cam K, falls into course 1, as shown, thus joining the lower row of needles. This operation is repeated at each end until as many needles have been thus thrown down as is desired.

The yarn carrier which is mounted on the cam cylinder as usual, consists of a portion I which is adjustably secured to the bracket arm n' ; an intermediate portion I' which is hinged to the portion I; and the main portion I'' which is adjustably secured to the hinged portion I' and is formed with the needle guard extension i . This needle guard when swung

down to the position indicated in dotted lines extends sufficiently around the needles to include those which are acted on by the throwing down cams and is of such height and so located that it will be directly opposite and close to the latches of the raised needles and just above the top of the lowered needles, whereby it will prevent the latches of the needles from being thrown outward from their proper position by the rapid downward movement in forming heels and toes and keep them from closing while the needles are being raised during ordinary knitting. The yarn *O* is carried through an opening in the carrier and thence to the needles as usual.

F represents the sinker ring which is provided with radial grooves *f* as usual in which the sinker plates *H* are moved in and out by the cams *g g' g'* upon the sinker cam-ring *G*, so that the hook portion *h* of the sinker plates may overhang the material and prevent it from being raised by the rising needles. A serious difficulty with these sinker plates has heretofore been that the hook portions *h* upon which the strain is brought are so far from the points of support in the sinker rings *F* and *G* that they very soon become so loose as to seriously interfere with the proper action. I entirely obviate this difficulty by providing an inside sinker ring *E* designed to provide positive support to the sinker plates directly below the hook *h* and in the line of strains, and also to permit of ready adjustment in case of wear. This ring *E* fits inside of the needle cylinder and is adjustably secured by means of set screws *e'*. A circular flange *e²* is provided around the top of the ring the upper face of which is grooved radially to somewhat less than the depth of this flange. The sinker plates *H* are formed with fingers *h'* which fit in these radial grooves, and *h²* which pass below the flange *e²*, leaving a slot *h³* in the plates to admit the solid portion of the flange *e²*. The central cam *g* of the sinker cam ring *G* is fixed while the cams *g' g'* on either side of it are pivoted at their far ends and have their near ends free so that they may be adjusted to provide for wear of the cams said cams being held in adjusted position by set screws, *g²*, having their lower ends normally engaged with said cams and their upper ends extended through slots, not shown, in which slots said set screws are adjustable with the cams. These cams ride in the grooves *h⁴* of the sinker plates and serve to move them in and out in accord with the vertical movement of the needles. It will be noticed that the sinker plates are thus firmly held by the ring *E* against vertical or side movement though perfectly free to move in and out.

To move the sinker cam ring *G*, I provide a separate arm *D'* upon the periphery of the cam cylinder which engages ears or lugs *g'* upon the cam ring, allowing a limited lost motion between them as required. This arm

is readily made sufficiently strong to withstand the frequent blows upon either side resulting from the rapid reversal of the motion of the cam cylinder in knitting the heels and toes of stockings.

Having thus fully revealed my invention, I do not limit myself to the exact construction shown, but

What I claim is—

1. In a knitting machine, the combination with the cam cylinder, provided with a race for the needle hubs, of the throwing up cams, having weighted arms, the throwing down cams, pivoted arms with which said throwing down cams are connected, and a vertically movable cross arm, engaging the arms of said cams and serving to place one set of the cams in operative position and the other set in inoperative position, simultaneously, substantially as described.

2. In a knitting machine, the combination with the cam cylinder, provided with a race for the needle hubs, of the throwing down cams or levers, pivoted arms, with which said cams are connected, a cross-arm engaging said pivoted arms, and a lever for operating said cross arm to throw said cams into and out of operative position.

3. In a knitting machine, the combination with the cam cylinder, provided with a race for the needle hubs, of pivoted arms, throwing down spring-pressed cams or levers, movable with said pivoted arms and also having separate movement thereon, and a lever for throwing said cams into and out of operative position.

4. In a knitting machine, the combination with the cam cylinder, provided with a race for the needle hubs, of pivoted arms, a cross-arm engaging the same, a lever for operating said cross arm and spring-pressed throwing down cams or levers pivotally connected with said pivoted arms.

5. In a knitting machine, the combination with the cam cylinder, provided with a race for the needle hubs, of spring-pressed pivoted arms, a vertically movable cross arm engaging the same, and cams pivotally connected with said pivoted arms and being movable therewith and also having a spring-controlled movement thereon, substantially as described and for the purposes specified.

6. In a knitting machine, the combination with the cam cylinder, and the vertically-movable cross arm, of the throwing up and throwing down cams, having means projecting from them into the path of movement of said cross arm, said projecting means being operated on by said cross arm for the purposes specified.

7. In a knitting machine, the combination with the cam cylinder, the vertically-movable cross arm, having a depending slotted part, a guide pin in the slot of said depending part, and an operating lever engaging said depending part, of the throwing up and throwing down cams, provided with means projecting

into the path of movement of and operated on by said cross arm in adjusting the cams, as specified.

8. In a knitting machine, the combination with the cam cylinder, having a race for the needle hubs, and the throwing up and throwing down cams therein, of a bracket having ears, a divided spring lever pivoted between said ears, and means connecting the inner end of said lever with said cams, for the purposes specified.

9. In a knitting machine, the combination with the cam cylinder, having a race for the needle hubs, of the weighted throwing up cams having toes, pivoted arms, throwing down cams connected with said arms, and a vertically movable arm engaging the toes of the throwing up cams and the arms of the throwing down cams, substantially as shown and described.

10. In a knitting machine the combination with the needle cylinder and outside sinker ring F, of inside sinker ring E provided with grooved flange e^2 and sinker plates H formed with fingers h' and h^2 engaging said grooved flange, substantially as set forth.

11. In a knitting machine the combination with the needle cylinder and outside sinker ring F, of inside sinker ring E provided with grooved flange e^2 , sinker plates H engaging said grooved flange, and sinker cam ring G for moving said plates in and out between the needles, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES L. ECK.

Witnesses:

ED. A. KELLY,
CAMERON E. STRAUSS.