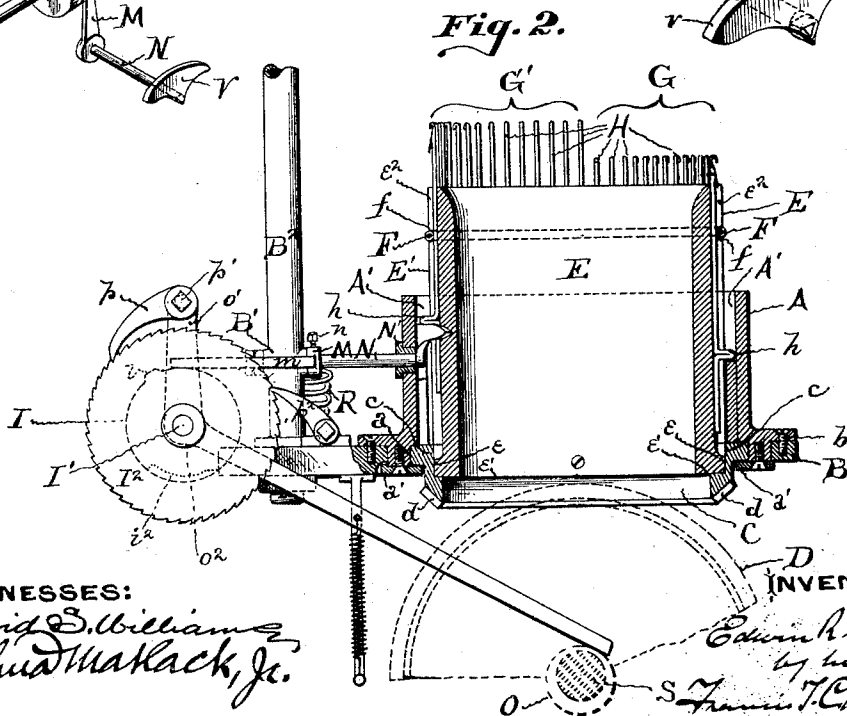
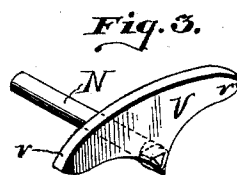
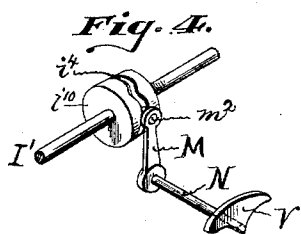
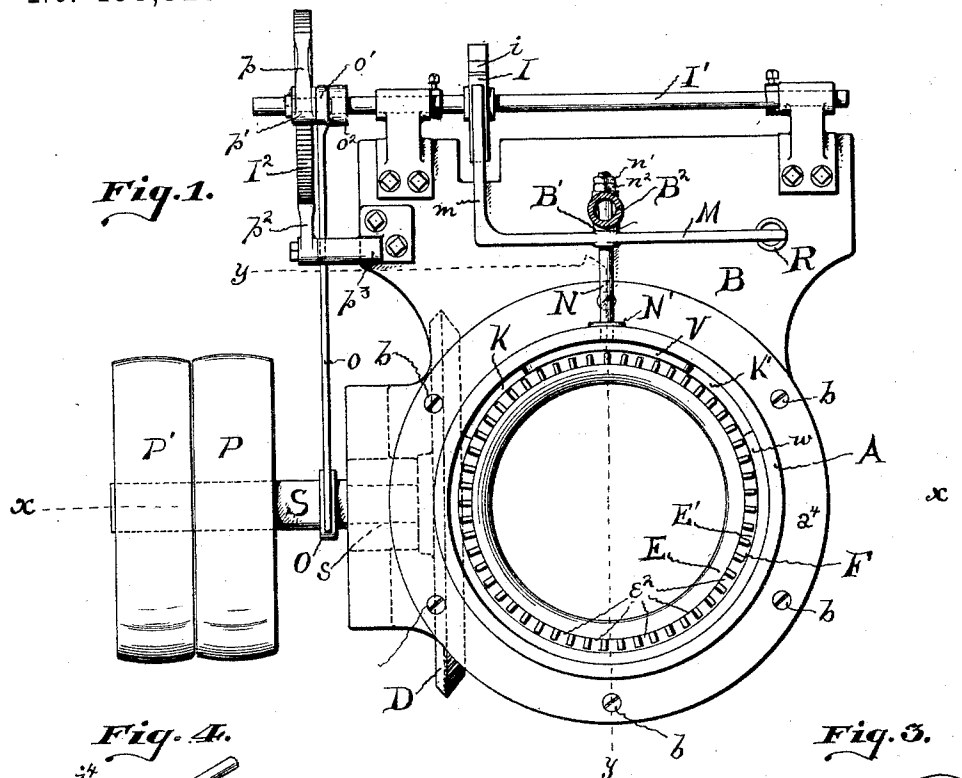


E. R. BRANSON.  
CIRCULAR KNITTING MACHINE.

No. 468,323.

Patented Feb. 9, 1892.



WITNESSES:  
David S. Williams  
Joshua M. Mack, Jr.

INVENTOR:  
E. R. Branson  
by his atty.  
S. Francis T. Chambers

(No Model.)

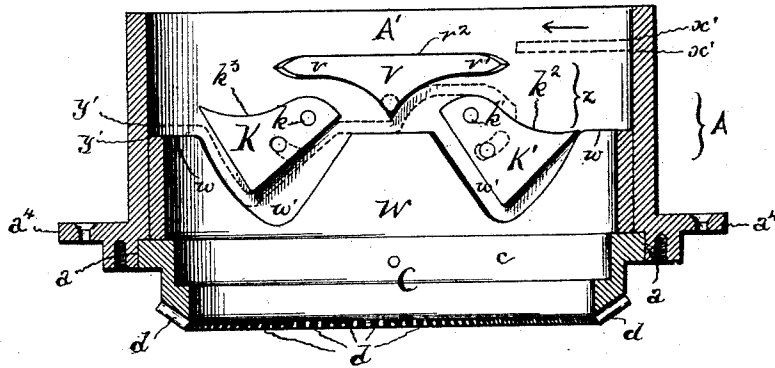
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E. R. BRANSON.  
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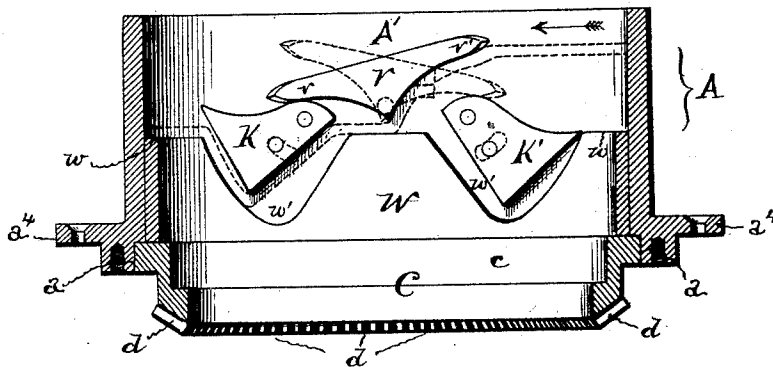
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*Fig. 5.*



*Fig. 6.*



**WITNESSES:**

David S. Williams  
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James T. Chambers

# UNITED STATES PATENT OFFICE.

EDWIN R. BRANSON, OF PHILADELPHIA, PENNSYLVANIA.

## CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 468,323, dated February 9, 1892.

Application filed July 15, 1890. Serial No. 358,784. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN R. BRANSON, of the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Circular-Knitting Machines, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My present invention relates to the needle-actuating cams of a knitting-machine; and its chief object is, without sacrifice of their common forms and functions, so to contrive, control, and operate them that they may upon occasion have the ancillary power of returning to their actuating range proper such needles as may have been temporarily removed therefrom and placed in certain adjacent non-active limits, further objects being, in carrying my said invention into practice, so to contrive and combine the chief cam employed as not only to render its actions automatic, but also to effect its movements and maintain it in proper positions, when assumed, by positively-connected controlling mechanism. Moreover, as economy of space and concentration of function are very desirable qualities in the ordinarily highly-restricted cam-belt of hosiery circular-knitting machines and as my said invention tends to secure both those qualities I have not only practically combined and embodied it in such a machine with great advantage, but I shall also, without thereby intending to limit its more general scope and nature, hereinafter make use of such a machine illustratively to describe the same.

Reference now being had to the accompanying drawings, forming part of this specification, in which corresponding parts are represented by similar letters in all figures, they will be found to illustrate my present invention as follows:

Figure 1 is a plan of sufficient of the parts of a hosiery circular-knitting machine embodying my present invention to illustrate the same, the needles being removed and the yarn-bobbin support shown in transverse section for the sake of unrestricted view of associate parts. Fig. 2 is an elevation, partially in cross-section, upon the off-set broken line *yy* of Fig. 1 of the chief parts of the mech-

anism shown in the latter figure. The needles, however, are here shown in place and indicate by their different altitudes two groups, the lower of "active" stitch-wave cam-path pursuing sort and the other or higher lot a "non-active" thrown-out series; also, although it lies within the plane of said section the cam and its immediate actuating shaft, on which I rely for returning such non-active group, is left entire. Fig. 3 is a perspective view of said cam and actuating part shown separately. Fig. 4 is a similar view of the same upon a slightly-smaller scale and in combination with a modified controlling mechanism, the latter shown fragmentarily. Figs. 5 and 6 are each elevations in median vertical section of the cam cylinder and socket shown in Figs. 1 and 2, the broken line *xx* of Fig. 1 denoting that upon which said sections were passed and the point of view of each being diametrically opposite to the duplex stitch-wave-forming cam-belt which they show.

In general in these figures the table, cam, and needle-cylinders, with the actuating mechanism of the latter, are of the ordinary sort of the class of machine referred to, and in brief may be said to consist of a fixed girdling cam-cylinder A, secured by screws *b* passing through its laterally-flanged foot *a* and engaging with the table B. Said cylinder having fashioned in its lower inner wall A' an enlarged bore or chamber *a* affords, with removably-secured retaining-clips *a'*, a bearing with proper freedom for concentric rotation to a combined needle-cylinder socket and miter-shaped actuating-gear C. The teeth *d* of this gear, as indicated in Figs. 1 and 2, are adapted to mesh with those of a transversely-disposed fellow miter-pinion D, fixed to the inner end of a drive-shaft S, and the latter, equipped with the ordinary device for the application and removal of rotary driving force—viz., with the fast and loose drive-pulleys P P'—is in turn rotatably mounted in a bearing *s*, fashioned in the main frame of the machine, of which the table B aforesaid forms the general lower part. The needle-cylinder E, having its lower outside wall and base *e e'*, respectively, snugly fitted and secured to the inner chamber or socket-seat *c* of the annular socket-gear C, is thereby concentrically carried and freely rotat-

able under the control of the shaft S within the girdle of the aforesaid cam-cylinder A, and thus normally presents to the cams thereof the radially-projecting heads or "butts" *h* of the series of needles H, which needles it carries, as shown in Fig. 2, in ordinary fashion—viz., with one needle between each adjoining two of the leaves *e*<sup>2</sup> of its longitudinally-channeled outer wall E'. In these channels the endless distended spiral spring or garter F, that passes outside the said needle-shanks in the circumferential groove *f* of the needle-cylinder's outer upper body, serves to keep them at any desired adjustment unless they are in some wise externally acted upon, as by the stitch-waves or knitting-cams proper. These cams W K K' V of the cam-cylinder A are also shown in substantially their normal shape, number, and arrangement in Fig. 5, wherein they are shown as of a symmetrical "duplex" or right and left path-crossing sort, and as adapted to produce, when engaged from either direction, as controlled by the movements of the drive-shaft S, either a continuous progressive or a to-and-fro reciprocal stitch-wave in the crown-like general arrangement of the latch-bearing hooked upper extremities of the knitting-needles to the hooks of which yarn is presumably fed in the ordinary manner well understood by hosiers. These cams will also, upon inspection of Figs. 1, 2, and 5, be seen to each consist of a metallic plate or other substantially rigid material curved to correspond to the adjoining cylinder-walls, and, as to general shape and disposition, to be formed and located as follows: First, they are all comprised within a certain belt or zone, which is in width proportionate to the range of stitch-wave depths and of a length considerably short of a semi-circumference of the cylinder within which they are carried; second, they are individually and upon the lower part formed of (a) a somewhat truncated W-shaped "up-cast" cam W, which cam is rigidly fixed to or formed integral with the said cam-cylinder wall, and merges at each extremity of its actuating-faces into the general ledge *w*, which serves to support in an approximately parallel level the butts of such of the active needles as are not at any given time actually within this cam-belt proper, and (b) above this cam and in part filling the bays or re-entrant angles *w'* thereof of a pair of similar vibrative pivotally-connected stitch-wave "depth" cams K K', which cams, in combination with a third (and from them central and equidistant) overlying downcast cam V, form not only the common cam-belt proper when disposed in normal position, as shown in Fig. 5, but also with said V-shaped central cam form, as it were, jaws which lead on either side to the throats or entrances of the cam-paths which they help constitute. For by this means these parts serve not only to give the necessary successive reciprocations to the needles as their butts are traversed through

them, but also to fetch within the cam-path entrances, whether moving to the right or left, any needle-butt which may have been displaced therefrom, as, say, displaced within the horizontal limits of the bracket *z* of Fig. 5—that is to say, the backs *k*<sup>2</sup> *k*<sup>3</sup> of the stitch-wave cams K K' are fashioned as "ogee" curves and adapted for leading the active needle-butts when either of said cams is in the non-active position, as K' is depicted to be in Fig. 5, from the ledge *w* to a position under the overlying extremity or jaw of the above-mentioned central V-shaped downcast cam, which downcast cam, for this purpose sloping upward and outward from its lower central portion, extends on either side above said cam-backs into wings *v v'*, which wings, reaching out laterally with ample clearance, usually extend beyond the pivoted connections *k k'* of the cams K K', and are united above by a normally-horizontal top *v*<sup>2</sup>, above but adjoining the level of which top when in said horizontal position the butts of the group of needles at any time non-active, as G', are by the garter F purposely maintained. Now the path of such group is denoted by the rectangular parallelogram comprised between the broken lines *x' x'*, Fig. 5, and its presumed present direction indicated by the adjoining arrow, which also indicates the direction of the associated needle-cylinder's movement at the same instant; also, just below and at the slight advance or interval of an interspace between said group's leading needle and the last of the remaining active ones the broken lines *y' y'* indicate in said Fig. 5 the path concurrently pursued by the said latter active needle's butts—that is, they now presumably occupy a path of position which commences within the right-hand jaws of the cam-belt or within and between *k*<sup>2</sup> and *v*'s adjoining faces, and thence extend through the normal stitch-wave cam-path, and, emerging upon the ledge W, pursue the same until the aforesaid non-active group is again overtaken. Now suppose at this instant the proper time has arrived in the knitting operation in hand to fetch said non-active needle-group back within this very active path *y' y'*—that is, within the cam-path jaws. Ordinarily, the moving cylinder for this purpose is arrested, and the non-active group of needles is either manually forced down to a proper butt-level upon *w* or auxiliary switches (separate from the stitch-wave cams W K K' V) are then brought into action and the change effected; but by me, as I have illustrated in Figs. 1, 2, 5, and 6, the above is effected by simply pivoting the said central downcast V-shaped cam V, and then, without substantially impairing its downcasting capacity, controllably tilting or swinging said cam away from or across the line or direction of the on-coming non-active group of needles' butts, the tilting being to such extent or angle as serves to bring said cam's adjoining wing-extremity, as *v'*, Figs. 5 and 6, above the said group's path, then the smallest fur-

ther rotation of the needle-cylinder fetches the non-active needle-butts under it, and it immediately overrides them, and by reason of its easy slope switches or shunts them below the central lower point or apex of its converging under sides. Now, in order to accomplish this shunting act whether the group becoming from the right or left, (for which change of conditions a corresponding right or left swing must be made of the cam V, as indicated in full and broken-line outline, respectively, in Fig. 6,) I not only preferably chamfer the extreme wing-tip of said cam, as shown in Figs. 2, 3, 5, and 6, but I also preferably contrive to pivot it as close to its lower central point or apex as is compatible with the strength requisite to support and actuate it. For this purpose I therefore either form the cam of steel, and integral with it form a pivot-shaft N, as shown in Fig. 4, or else I fashion it by forming the cam of a properly-curved plate pierced, preferably, as near as possible to its said lower apex by a triangular orifice transverse to the cam's general body, and rivet the shaft N to it by a registering neck and shoulder. Such modification is shown in broken lines in Fig. 3. Further, as the groups of non-active needles in all cases require some force to overcome the pressure of the garter F and as this is enhanced by giving them a "flying shunt," as I may presume to call the cam's above-described action upon tilting its wings across their 'butts' coming path, I have found in practice that it is not only essential to tilt said cam in order to invoke its ancillary powers, but also to retain it in a properly-tilted position until the desired number of needles, whether it be the non-active group or any less number, (which latter sort of partial return is also within the purview of my present invention,) be returned. This I also conveniently effect by means of the central cam's pivot-shaft N, which for this purpose I make of sufficient size to bear the strain and of circular cross-section suitable for a journal-bearing in a corresponding orifice, which orifice I also fashion on the cam-cylinder wall, and preferably equip with a bushing, as N', Figs. 1 and 2, and thence through it I extend the said shaft to some convenient operating position and equip it with a controlling device. This controlling device may consist of any suitable mechanism—say simply of a cross-head, as the lever M, which may be grasped by the operator's hand and so assist him to keep the cam V to any desired position, which, if the cross-lever M be aligned with the cam, it will itself indicate; or else, and preferably, the shaft N may be further provided with an automatic tilting device and be self-acting. Such modification is illustrated in Figs. 1 and 2, wherein the cam-pivot shaft N has a rocking bearing not only in the bushing N' of the cam-cylinder, but also a second bearing B' in the body of the bobbin-support B<sup>2</sup>, which for this purpose is fash-

ioned as a T-shaped tube, to which bearing's ends it (the rock-shaft N') is collared against end motions by means of its screw-threaded outer tail, the jam-nuts  $n'$   $n^2$  mounted thereon, and the adjoining face of the lever cross-head eye, which lever is also preferably adjustably secured to said shaft, as by the set-screw  $n$ , (shown in Fig. 2,) the whole allowing for not only proper freedom for the rocking motion, but also for the nice alignment of the associated parts. The necessary motions are in this case, Figs. 1 and 2, automatically imparted to the cam V by passing the arm  $m$  of said lever M over a cam-wheel I, which is mounted upon and fixed to a rotatably-mounted shaft I', which is parallel with the drive-shaft S, and receives intermittent motion therefrom by means of, first, the ratchet-wheel I<sup>2</sup>, also fixed to said shaft I'; second, the cam O, secured to shaft S, and, third, the cam-actuated rock-lever arms  $o$   $o'$ , which are by a suitable transverse eye located at their junction, freely mounted and adapted to vibrate about the ratchet-wheel's shaft and fetch the pawl  $p$ , which the shorter arm  $o'$  carries, upon a suitably-projecting pivot-pin  $p'$  in play over the teeth of said ratchet. A retaining-pawl  $p^2$  being secured by a suitable gudgeon-block and pivot  $p^3$  to the table B, as shown in Figs. 1 and 2, prevents backsliding of the actuating-cam I, whose projection  $i$ , being by this means forced under the extension  $m$  of lever M, causes the cam-pivot shaft N to rock and tilt the cam V carried thereby from its normally horizontal position to, say, that indicated by dotted outline in Fig. 6. Upon the passage of the cam or projection  $i$  of the cam-wheel I the recoil of a spring R between the opposed cross-head arm's extremity and the top of the table B serves to force the cross-head's arm  $m$  down upon the general circular periphery of the tilting cam-wheel I, and so forces the central V-cam back to its normal horizontal position; also, if it be desired to tilt the cam so as to interrupt a non-active needle or needles' butts when coming in the opposite direction or toward the cam-belt from right to left in Fig. 5 it is within the purview of the device shown in Figs. 1 and 2 to fashion the periphery of the tilting cam at a proper part with a depression, as indicated by the dotted depression  $i^2$ , Fig. 2, which, coming below the arm under the intermittent feeding of the pawl-and-ratchet device, (or their equivalent,) affords the spring B opportunity to extend farther and cause a corresponding tilting of the cross-head, and force the cam V to the position in which it is actually illustrated in Fig. 6. Further, should it be desired to tilt the cam V at any part of the operation of the machine not provided for by the timing of the cam's driving parts when thus constituted it is within the operator's power to lay hold of the ratchet-wheel I<sup>2</sup> as if a hand-wheel, and lifting off the pawls  $p$   $p^2$  to tilt cam V at will; also, if it be desirable to hold cam V positively to its several

positions and to dispense with the spring R this is preferably done by such a modification as is shown in Fig. 4, where instead of a cross-head the cam's pivot-shaft is fitted with a fixed crank M', whose wrist-pin  $m^2$  is positively engaged by projecting snugly into the groove  $i^4$  of a scroll-cam I<sup>10</sup>, yet with a fit not incompatible with the rotation of said cam, which rotation is, as indicated in this figure, provided for by mounting it upon a suitable drive-shaft, as the shaft I', in which event there is coupled with the said more positive connection a simplicity and reduction in the number of parts which for many reasons I much prefer.

After the above description it is almost unnecessary to proceed; but for further clearness I may state that with the mechanism thus fully illustrated the mode of operation when knitting a stocking is preferably as follows: During the knitting of the tubular web forming the leg of the fabric the pawl  $p$  is lifted out of engagement with the ratchet-wheel I<sup>2</sup>, and the V-shaped cam is in its normal or untilted position. When, however, the leg is done and the time for turning or fashioning the heel of the stocking has arrived, then concurrently with putting, say, half of the needle-butts into the non-active zone of the cylinder, as above described, I preferably put into engagement with said ratchet-wheel I<sup>2</sup> the said pawl  $p$ , and thereupon the wheel I<sup>2</sup> is intermittently rotated. This rotation being continued and the parts appropriately timed the moment for returning the ultimate group of non-active needles is reached at the same instant that the wheel I<sup>2</sup> fetches the elevation of cam  $i$  into operation upon the crank-provided shaft N, and by rocking said shaft tilts the cam V, and thereby shunts said ultimate non-active group back into the cam-path and activity.

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

1. The combination, with a knitting-machine's upcast and stitch-wave depth-cams, of a tiltable downcast cam operative when in its normal position to coact with the above and form a stitch-wave cam-path for reciprocating the butts or equivalent cam-engaging portions of a passing series of knitting-needles and upon occasion adapted to be tilted and held as a switch leading non-active needles' butts back into said path, substantially as and for the purposes hereinbefore described.

2. In combination with a knitting-machine's upcast and stitch-wave depth cam or cams, a tiltable downcast cam, a rock-shaft connected to said downcast cam on the one hand and operatively to the driving parts of the machine on the other, and said driving parts, substantially as and for the purposes hereinbefore described.

3. The combination, with a W-shaped upcast cam and right and left stitch-wave depth-cams, of a winged central downcast cam pivoted at or near its apex, as described, and operative on being vibrated to extend its wing or wings across a non-active needle-butt path, substantially as and for the purposes hereinbefore described.

4. The combination, with the downcast cam V and relatively fixed rock-shaft N, of a scroll-cam, mechanism, as the crank M' and wrist  $m^2$ , positively connecting said scroll-cam and rock-shaft, and mechanism operative to move said scroll-cam, substantially as and for the purposes hereinbefore described.

EDWIN R. BRANSON.

Witnesses:

LEWIS R. DICK,  
JOSHUA MATLACK, Jr.