Oct. 27, 1931. W. A. INGALLS 1,829,094

KNITTING MACHINE

Filed June 16, 1930 3 Sheets-Sheet 1

Fig. 1.

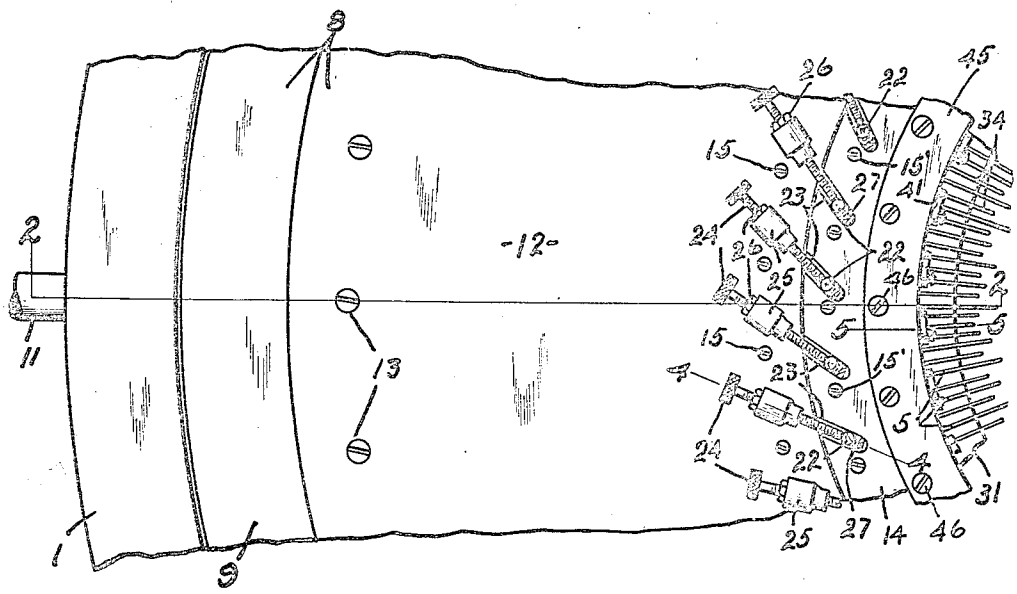
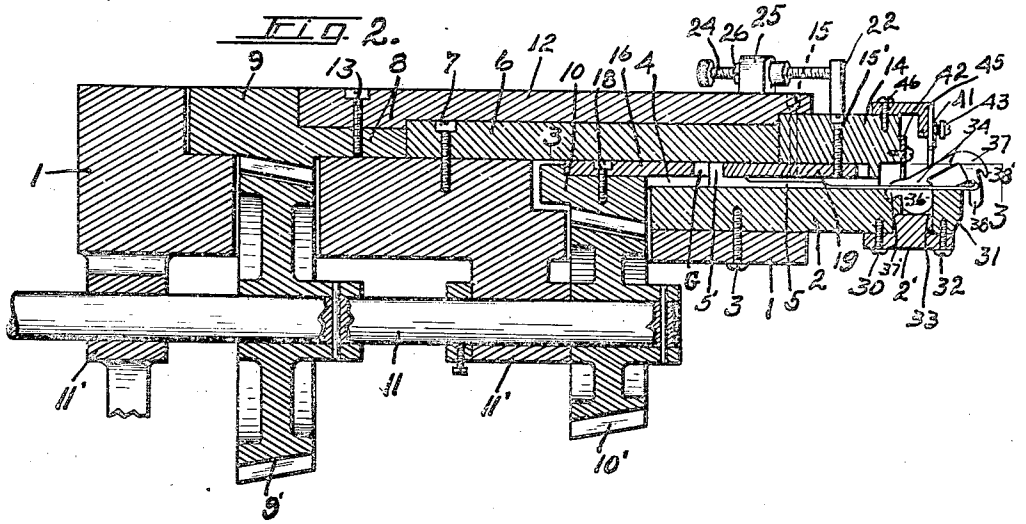


Fig. 2.



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FIG. 3.

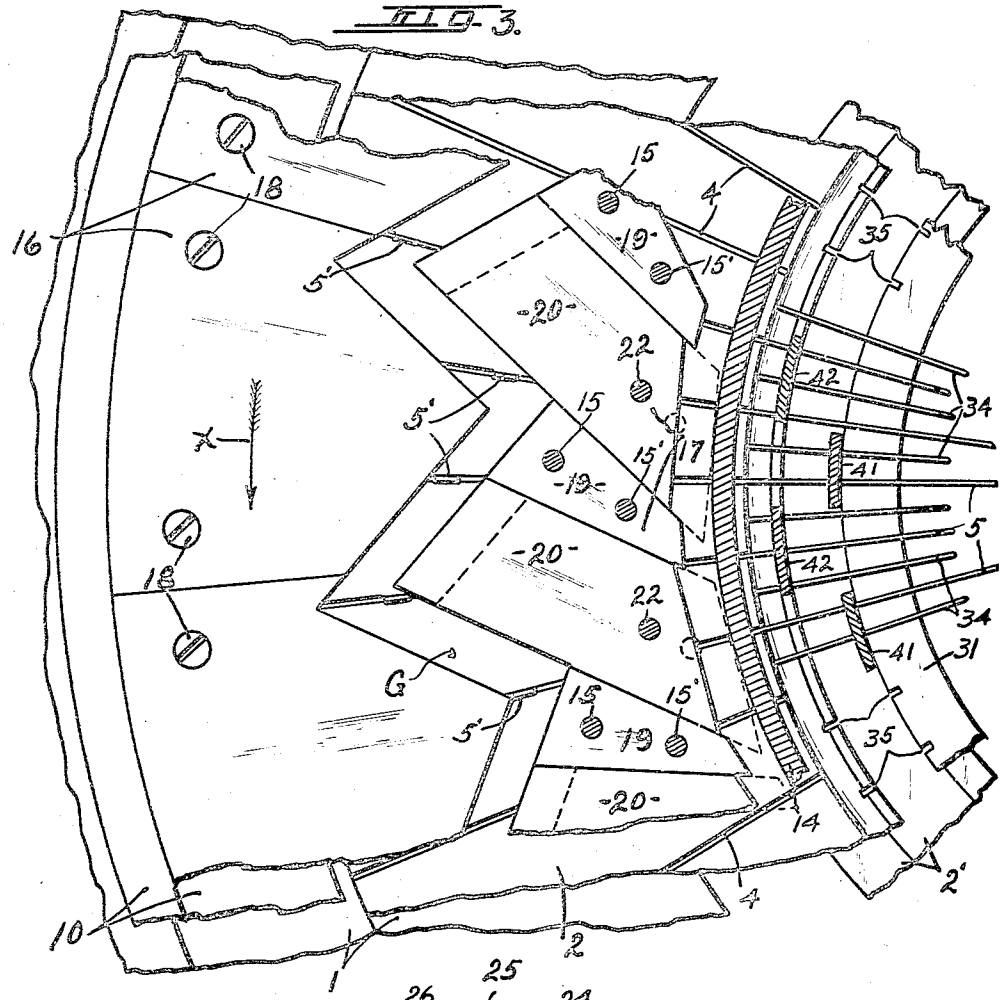
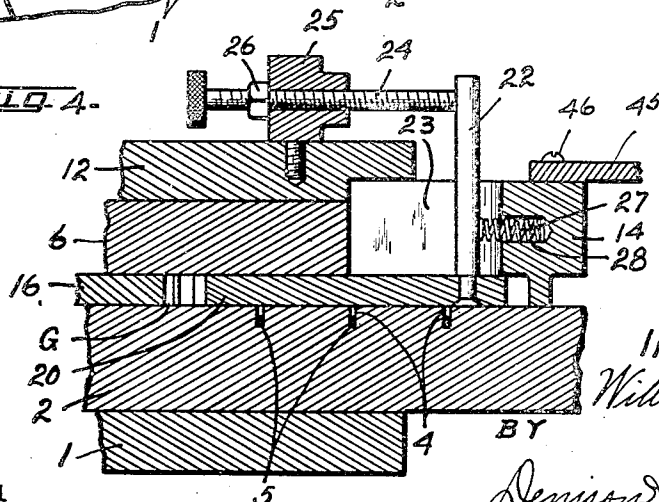


FIG. 4.



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FIG 5.

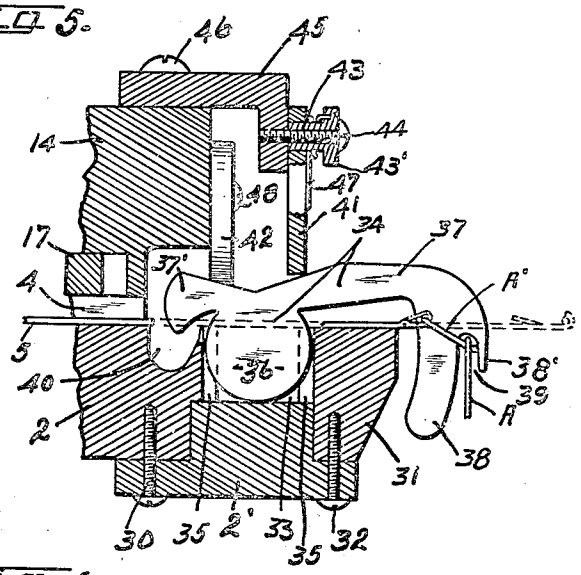
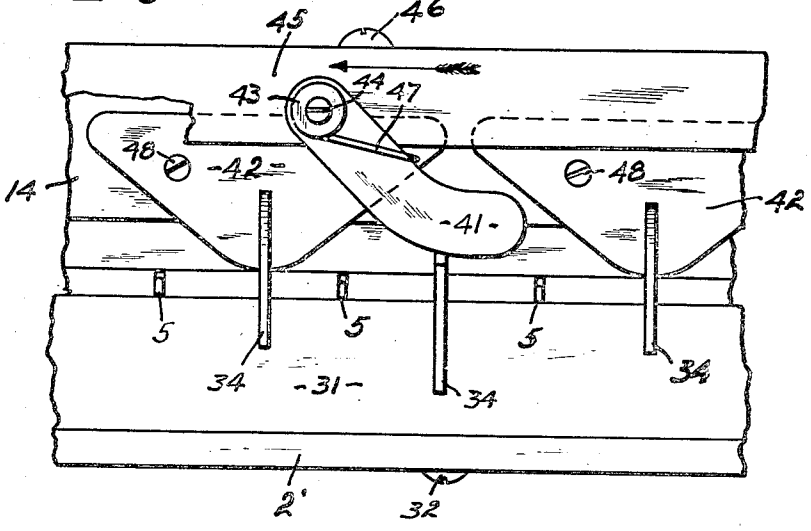


FIG 6.



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UNITED STATES PATENT OFFICE

WILLIS ADOLPHUS INGALLS, OF SYRACUSE, NEW YORK

KNITTING MACHINE

Application filed June 16, 1930. Serial No. 461,563.

This invention relates to improvements in knitting machines in which certain of the needle actuating cams are adjustably mounted for governing the length of the stitch, and which operate in conjunction with web-holding detents mounted in juxtaposition to each needle for preventing the misplacement of the loops on the needles as the needles are reciprocated through said loops in the act of knitting and thereby reducing the liability of dropping the loops or stitches during this operation.

The main objects of this invention are to provide a simple and economically constructed mechanism which may be easily and quickly manipulated for the purpose of controlling or varying the length of the travel of the needles and, therefore, the length of the stitches at will.

In carrying out these objects, I have adjustably mounted certain portions of the needle actuating cams upon the needle carrier, have provided simple and efficient means connected with the adjustable cams which may be easily manipulated from the exterior of the needle carrier for moving said adjustable cams relative to the remaining portion of the cams for governing the length of the travel of the needles, and have provided the needle carrier with a series of oscillatory detents, one for each needle reciprocally movable into and out of engagement with the edge of the knit fabric in synchronism with the movements of the corresponding needles for holding the loops in proper relation to said needles as the latter are reciprocated for engaging and drawing the yarn therethrough and thereby to reduce the liability of dropping the stitches during the knitting operation.

Another object is to support the oscillatory detents upon the needle carrier without the use of extra pivotal pins and in such manner that any one or more detents may be removed and replaced without disturbing the remaining detents.

Other objects and advantages relating to the construction of the cams and detents and to the manner of mounting the same upon the needle carrier will be brought out in the following description, taken in connection with the accompanying drawings wherein:

Figure 1 is a top plan of a segment of a needle carrier plate for knitting machines embodying the various features of my invention.

Figure 2 is a vertical sectional view taken on line 2—2, Figure 1, showing the needles and web-supporting detents, together with the rotary cams for operating the needles and detents showing one of the needles in its loop-forming position and the detent in its elevated position.

Figure 3 is an enlarged horizontal sectional view taken on line 3—3, Figure 2, showing a top plan of the cams for operating the needles and the adjustable cam members for governing the travel of the needles.

Figure 4 is an enlarged detail vertical section taken on line 4—4, Figure 1, illustrating the manner in which the adjustable cam members are manipulated.

Figure 5 is an enlarged sectional view taken on line 5—5, Figure 1, showing the inner portion of the carrier plate for the needles and detents and adjacent portion of the cam members for operating the detents, the detent being shown in its web-engaging position and the needle as about to pass through the previously formed loop to the dotted position for engaging the yarn preparatory to drawing the latter through the loop.

Figure 6 is an inner face view of the carrier plate showing the ends of the needles and detents and a plan view of the cams for actuating the detents.

In order that this invention may be clearly understood, I have shown a part of a knitting machine comprising a relatively stationary frame —1— having a needle-supporting

plate —2— removably secured thereto by bolts —3—.

The plate —2— is provided with a multiplicity of guide grooves —4— in which are reciprocally movable a corresponding number of conventional knitting needles —5—. The frame —1— is also provided with a guide ring —6— removably secured by screws —7— to the upper face thereof to overhang the needle supporting plate —2— in spaced relation thereto as shown in Figure 2.

A cam supporting frame —8— is rotatably mounted upon the frame —1— and comprises a pair of concentric gear rings —9— and —10— in radial spaced relation and having their gear teeth projecting into respective concentric annular grooves provided in the adjacent portions of the frame —1—, said teeth being adapted to engage with axially spaced coaxial gears —9'— and —10'— which extend into openings provided in the frame —1— in alignment with the respective gear-receiving grooves and which are secured to a rotary driving shaft —11—, said shaft being journaled in suitable bearings —11'— on the underside of the stationary frame —1— as shown in Figure 2.

The gear ring —9— is rotatably mounted in a recess in the top of the frame —1— around the outer periphery of the guide ring —6— and is provided with a cap plate or ring —12— removably secured thereto by screws —13— and extended across the upper face of said guide ring for receiving and supporting a cam supporting ring —14— which extends around the inner periphery of the guide ring —6— and is removably secured by screws —15— to the inner edge of the cap plate —12— to rotate therewith.

The needles —5— are adapted to be reciprocated in the conventional manner along their respective guides —4— by a pair of complementary cam rings or plates —16— and —17—. The cam rings —16— may be of any well-known conventional construction and is removably secured by screws —18— to the upper face of the gear ring —10— to rotate therewith, while the cam ring —17— comprising a portion of my invention, is composed of a plurality of fixed plates —19— and a like number of movable cam plates —20—.

The fixed plates —19— are secured in circumferential spaced relation by screws —15— and —15'— to the underside of the cam-supporting ring —14— and each of the plates —20— are positioned between the adjacent fixed plates —19— so as to be rotated by said fixed plates which, in turn, are rotated by the cam ring —14— so that the cam rings —17— and —16— are rotated in unison and in radial spaced relation so as to form a cam groove —G— between them for receiving the usual projections —5'— of the needles —5— as shown in Figures 2 and 3.

The cam groove —G— may be of any suitable contour to obtain the desired movement of the needles —5— and, in this instance, extends in a zig-zag course in a general direction concentric with the center of the machine.

The cam ring —17— is positioned adjacent the interior of the cam groove —G— with the fixed plates —19— thereof so positioned at the inner apexes of the groove that the back longitudinal edges thereof, as considered from the direction of movement, will lie in the vertical plane of the back wall of that portion of the cam groove adapted to move the needles outwardly and, therefore, cause the front longitudinal edges of the movable plate members —20— positioned between the fixed plates to form said back wall of the outwardly operating portions of the groove and in parallel spaced relation with the front wall thereof, while the outer ends of the plates —19— and —20— form the front wall of that portion of the cam groove adapted to move the needles inwardly and are arranged in parallel spaced relation with the opposite side or back wall of said groove portions, as clearly illustrated in Figure 3, where the cam rings are arranged to travel in the direction indicated by the arrow —X—.

The opposed edges of adjacent fixed plate members —19— are arranged in parallel spaced relation so as to permit the free longitudinal movement of the movable plates —20— therebetween during the adjustment of said movable plates for governing the length of travel of the needles and, therefore, the length of the stitch.

It is now evident by referring to Figure 3 that when the movable plates —20— are in the position indicated by full lines, the needles will be caused to travel a greater distance during the reciprocal movement thereof than when said plates are moved to the position indicated by the dotted lines due to the different relative positioning of the end walls of the plates with the adjacent or companion walls of the groove formed by the plate —16—.

This adjustment of the plates —20— may be accomplished in any suitable manner and for this purpose, I have shown a simple and easily operated and constructed device for accomplishing this result which is comprised of vertically disposed cam-actuating pins or posts —22— secured at their lower ends to the inner ends of respective movable cam plates —20— (see Figure 4) and which extend upwardly therefrom through respective elongated slots —23— provided in the cam-supporting ring —14—, said slots extending inwardly from the outer periphery of the plate —14— in a plane parallel with the respective outwardly extending portions of the cam groove —G—.

The upper ends of the posts —22— terminate in a plane a short distance above the upper face of the cap plate —12— and are engaged at one side thereof by respective adjusting screws —24— which are screw-threaded in suitable upwardly extending lugs —25— secured to or made integral with the cap plate —12—.

The screws —24— are arranged to extend from the posts —22— in a plane in line with the direction of movement of said posts for moving the posts and cam plates connected therewith in one direction only and may be secured in the adjusted position by a lock nut —26— screw-threaded thereon and adapted to engage the adjacent face of the post —25—.

The posts —22— and plats —20— are yieldingly moved in the opposite or outward direction by respective springs —27— positioned in horizontally disposed holes —28— provided in the cam-supporting plate —14— at the inner ends of each slot —23— so that when it is desired to change the length of the stitch, it is only necessary for the operator to loosen the lock nut —26— and rotate the adjusting screw —24— in one direction to move the posts —22— and, therefore, the respective cam plates —20— inwardly against the action of the springs —27— toward the center of the machine to shorten the distance of travel of the respective needles —5— or to rotate the screw —24— in the opposite direction to permit the springs —27— to move the cam plates —20— outwardly to the desired degree for lengthening the distance of travel of the needles after which the respective plates may be yieldingly maintained in the adjusted position by securing the screws —24— against rotation by the manipulation of the lock nuts —26—.

It has been found necessary in a device of this nature, where the length of travel of the needles is varied, as required to produce different lengths of stitches to provide some means for holding the loops in proper relation to the needles during the knitting operation and, therefore, I have provided a simply constructed and operated means for this purpose, which is constructed as follows:

The needle-supporting plate —2— is provided with an extension —2'— removably secured to the inner marginal edge thereof by screws —30— for receiving and supporting a supplemental guide ring —31— which is removably secured by screws —32— to said extension in radial spaced relation to the inner periphery of the plate —2— to form an intervening annular groove —33— for the reception of portions of a multiplicity of web-holding detents —34— one for each of the needles, in a manner presently described.

The opposite walls of the groove —33— are provided with a multiplicity of pairs of vertical grooves —35— corresponding to the number of detents —34—, those of each pair being arranged in radial alignment between and adjacent the needles for receiving the adjacent edges of circular portions —36— of the detents for holding the latter edgewise vertically and in uniformly spaced relation circumferentially with the lower edges of the portions —36— resting upon the upper face of the extension —2'—.

The object in making the parts —2'— and —31— separate from the plate —2— is to facilitate the formation of the grooves —35— by any suitable cutter such, for example, as a broaching tool, it being understood that these grooves —35— are quite narrow transversely and correspond approximately to the thickness of the corresponding detents. These detents —34— are identical in construction and each consists of a thin plate of sheet metal or equivalent material, having the intermediate pendant boss —36— and oppositely extending arms —37— and —37'— of unequal lengths, the longer arm —37— being extended across the upper face and some distance beyond the inner edge of the guide ring —31—, while the shorter arm —37'— is adapted to overhang the upper face of the inner edge of the plate —2— and may be termed the heel of the detent.

The circular boss —36— is of greater diameter than the vertical depth of the groove —33— and of greater circumferential length than a half circle, so that when seated on the upper face of the extension —2'—, as a bearing with its inner and outer edges in the grooves —35—, the arms —37— and —37'— will be mainly above the upper face of the ring —31— and plate —2— respectively.

The upper face of the extension —2'— and the walls of each pair of the slots —35— constitute a journal bearing in which the circular boss —36— of the detent —34— is journaled to permit vertical rocking or oscillating movement of said detent.

The inner arm —37— of each detent —34— is provided with a forked pendant extension forming outer and inner tines —38— and —38'— of which the outer tine —38— is considerably longer than the inner tine —38'— to afford an abutment against which the fabric as —A— is drawn by the needles —5— when the latter are moved to the position shown by full lines in Figure 5 in the act of drawing the yarn through the previously formed loop —A'— of the fabric.

The shorter tine —38'— forms, with the tine —38—, an intervening slot —39— which is open at the bottom to receive the adjacent edge of the fabric —A— when the detent —34— is moved to its web-holding position, as shown in Figure 5, the inner tine —38'— serving to hold the edge of the fabric against inward movement when the needle is ad-

vanced to the position shown by dotted lines in Figure 5 preparatory to engaging and drawing the yarn through the previously formed loop —A'—.

The heel —37'— of each detent —34— is extended across the horizontal plane of movement of the needles —5— into a groove —40— provided in the upper face of the inner edge of the needle-supporting plate —2— to assist in holding the detent in an edgewise vertical position as it is rocked about the axis of the circular boss —36— into and out of holding engagement with the fabric —A—.

This rocking movement of the several detents is effected automatically through the medium of two sets of cam members —41— and —42— which are mounted upon the cam-supporting ring —14— in radial spaced relation at opposite sides of but rather close to the vertical plane of the axis of each of the detents —34—, as shown more clearly in Figure 5.

The cam members —41— are each pivotally mounted at one end upon a bushing —43— which is secured by a bolt —44— to brackets —45— which, in turn, are secured by bolts —46— to the cam ring —14— to rotate therewith.

The inner end of each of the bushings —43—, in this instance, is provided with an enlarged annular flange portion —43'— positioned in spaced relation with the respective cam member —41— for maintaining a spring —47— coiled thereon between the cam —41— and said flange, one end of the spring —47— being secured to the bushing and the other end resting upon the upper face of the cam —41— and tensioned to yieldingly maintain the respective cam member —41— in operative relation with the detents —34—.

The cam members —41—, in this instance, are substantially flat elongated metal pieces having an opening provided, at one end thereof, for receiving the respective bushings —43— and which extend downwardly and rearwardly therefrom in the direction of rotation to engage the detents —34— and then are bent to extend rearwardly in a substantially horizontal plane for a short distance, as more clearly illustrated in Fig. 6.

The cam members —42— are secured by screws —48— to the inner vertical edge of the cam-supporting ring —14— so that both sets of cam members —41— and —42— may rotate in unison with the cam plate —14—.

The lower edges of the cam members —42— are formed V-shaped for engaging the detents —34— and are arranged one cam in radial alignment with each outer apex of the cam groove —G—, while the cam members —41— are arranged in radial alignment with the inner apex of the groove —G—. In other words, the cam members —41— and —42— are arranged complementary to each other to successively and alternately engage the upper edges of the detents —34— during the rotary movement thereof for effecting the rocking movement of said detents about the axis of their respective bosses —36—.

It will be observed that the vertical grooves —35— of each pair are open at the top so that by removing one or more of the cam members —42— any one or more of the detents —34— may be removed or replaced without disturbing any of the other detents, due to the resilient manner in which the cam members —41— are mounted, all of which adds materially to the economic assembly and operation of the web-holding devices.

The detent-operating cam members —41— and —42— and the cam rings —16— and —17— and, therefore, the cam groove —G— are arranged and timed in such manner that when each needle with the yarn therein is drawn backwardly for drawing the yarn through the previously formed loop carried by that needle, the outer arm —37'— of the detent will be engaged by the respective cam —42— to raise the forked end of the detent out of engagement with the fabric to the extent of withdrawing the tine —38'— from said fabric leaving the other tine —38— in engagement with the outer face of the fabric. Then immediately upon the beginning of the inward movement of the needle, the respective cam member —42— will release the arm —37'— of the detent, while the next succeeding cam member —41— will engage the arm —37— to force the forked end of the detent into holding engagement with the edge of the fabric until the needle has reached its innermost position and engaged the yarn preparatory to drawing said yarn through the previously formed loop or to the position shown by dotted lines in Figure 5.

Immediately following the engagement of the needle with the yarn and the beginning of the drawing of the yarn toward the previously formed loop, the next positioned cam member —42— will then engage the heel —37'— of the detent to elevate the forked end of the detent at about the time the detent is released by the cam member —41— by said cam passing beyond the respective detent whereupon the inner arm —37— is free to be moved upward out of the path of the yarn as the latter is drawn through the previously formed loop of the fabric by the continued action of the respective cam member —42—.

It will be observed from the foregoing description that the essential features of this invention lie in the peculiar construction and operation of the cam plates for varying the cam groove to effect the desired length of travel of the needles and also in the detents for engaging the fabric to permit the variation in the travel of the needle and insure the

proper stitching operation and, therefore, I do not wish to limit myself to any particular mechanism for operating the needles of the detents.

I claim:

1. In a knitting machine, a web-holding detent comprising a circular bearing member journaled on the machine, an arm extending from one side of the bearing member having a pendent fork member adapted to engage the fabric, and means alternately engaging the detent at opposite sides of the axis of the bearing member to rotate said arm into and out of holding engagement with the knitted fabric.

2. In a knitting machine, a web-holding detent comprising a circular bearing member journaled on the machine, a pair of arms extending in opposite directions from one side of said bearing member, one of said arms being provided with a pendent fork member adapted to engage the fabric, and means alternately engaging said arms at opposite sides of the axis of said bearing member to rock the detent into and out of holding engagement with the knitted fabric.

3. In a knitting machine, a web-holding detent comprising a circular bearing member journaled on the machine, an arm extending from one side of the bearing member having a pendent fork member adapted to engage the fabric, a plurality of actuating means adapted to successively and alternately engage the detent at opposite sides of the axis of the bearing member to yieldingly rock the arm into holding engagement with the knitted fabric and to positively rock said arm out of holding engagement with the fabric.

4. In a knitting machine, a needle-supporting plate having a groove in one face thereof extending transversely of the direction of movement of the needles, said groove having opposed vertical slots in opposite walls thereof and positioned intermediate the needles, a web-holding detent mounted in said groove, each detent comprising a circular bearing member journaled in opposed slots and upon the bottom of the groove, an arm extending from one side of the bearing member having a pendent forked member adapted to engage the fabric, and means alternately engaging the detent at opposite sides of the axis of the bearing member to rock said arm into and out of holding engagement with the knitted fabric.

5. In a knitting machine, a needle-supporting plate having a groove in one face thereof extending transversely of the direction of movement of the needles, said groove having opposed vertical slots in opposite walls thereof and positioned intermediate the needles, a web-holding detent mounted in said groove, each detent comprising a circular bearing member journaled in opposed slots and upon the bottom of the groove, an arm extending from one side of the bearing member having a pendent forked member adapted to engage the fabric, and a plurality of actuating means adapted to successively and alternately engage the detents at opposite sides of the axis of the bearing members to yieldingly rock the arms into holding engagement with the knitted fabric and to positively rock said arm out of holding engagement with the fabric.

In witness whereof I have hereunto set my hand this 12th day of June, 1930.

WILLIS ADOLPHUS INGALLS.