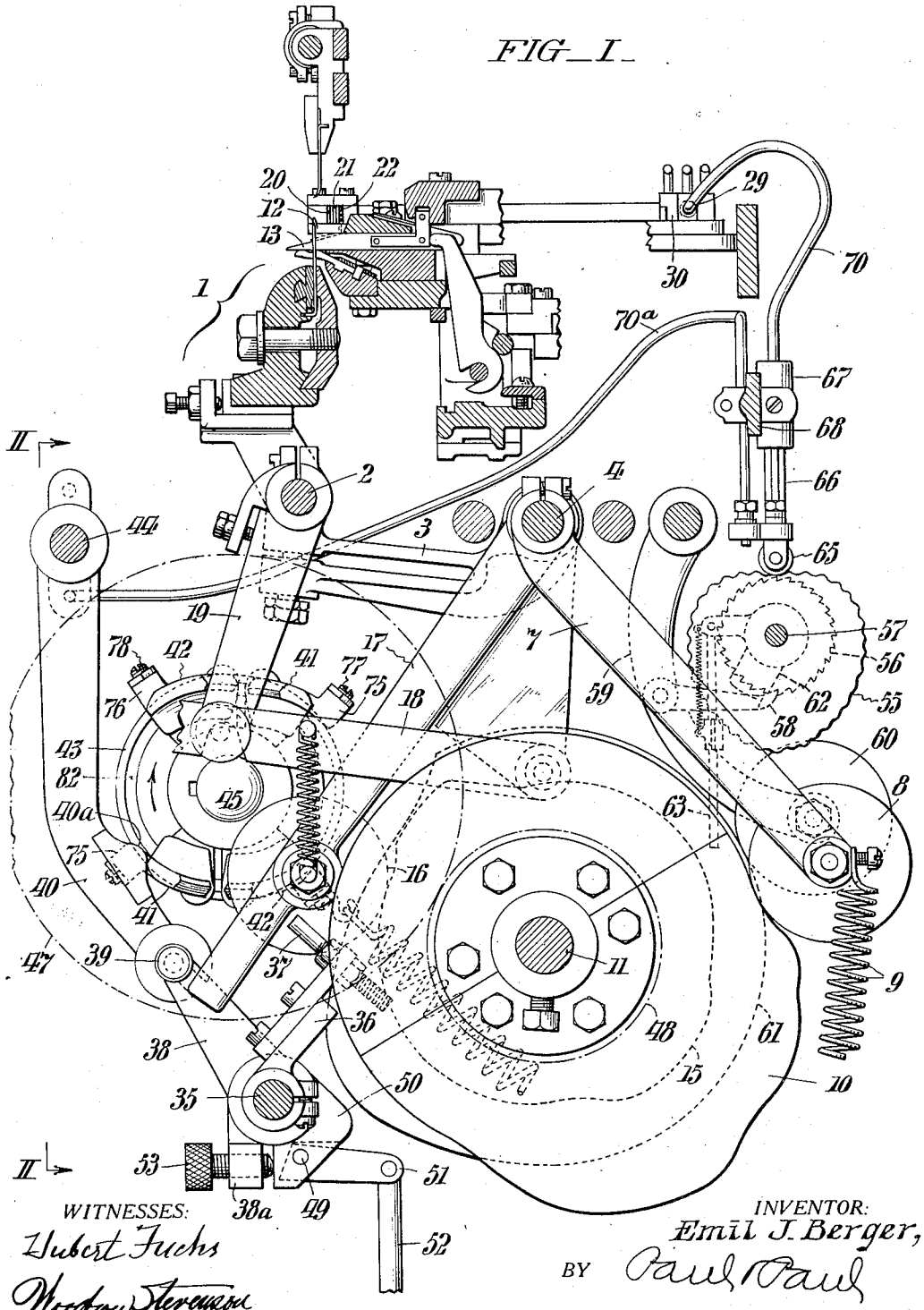
July 9, 1940. E. J. BERGER 2,207,606

KNITTING MACHINE

Filed July 8, 1939 3 Sheets-Sheet 1

FIG_I_



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KNITTING MACHINE

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FIG. II.

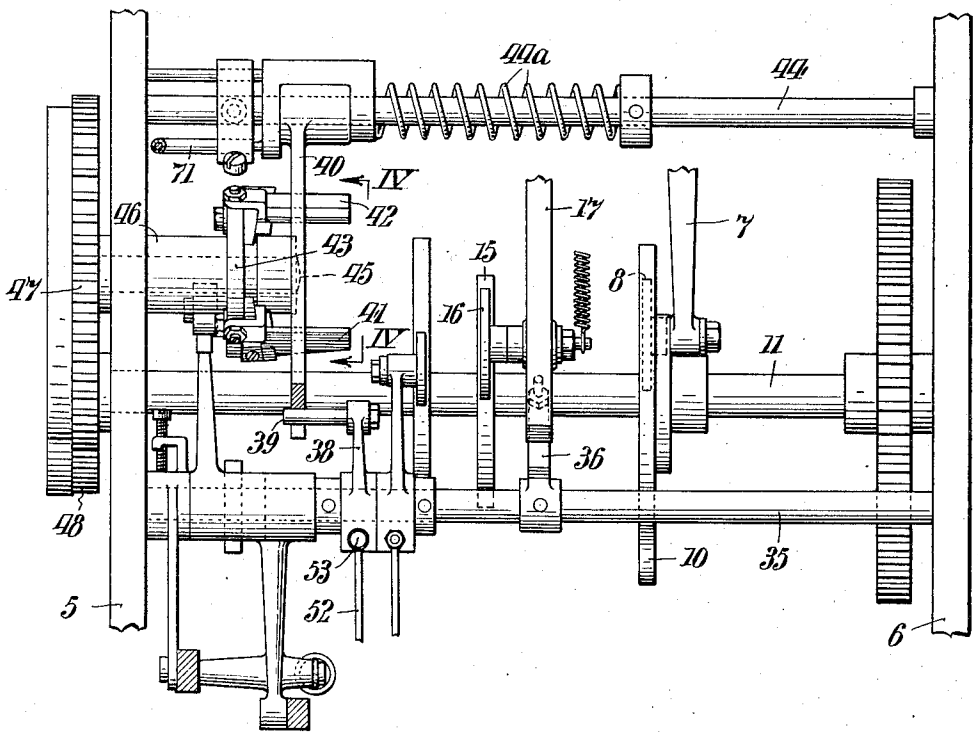


FIG. IV.

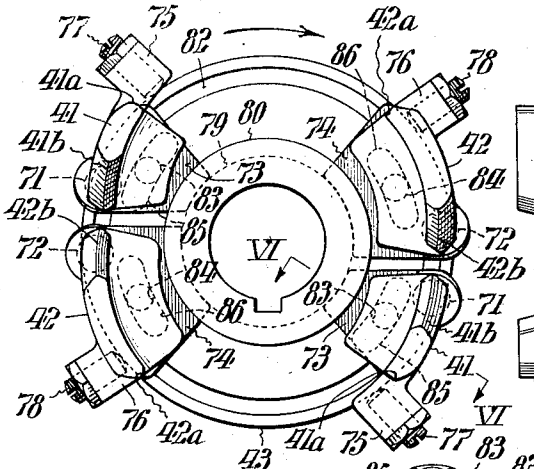


FIG. V.

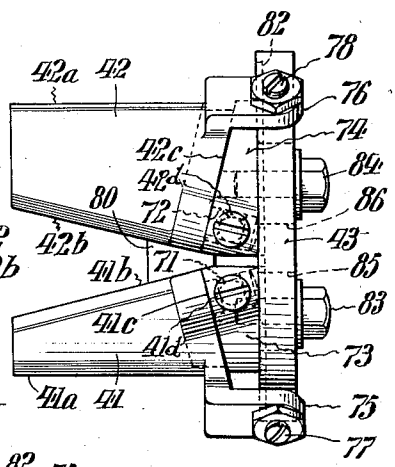
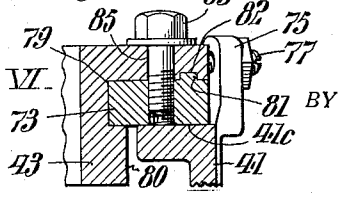


FIG. VI.



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KNITTING MACHINE

Filed July 8, 1939 3 Sheets-Sheet 3

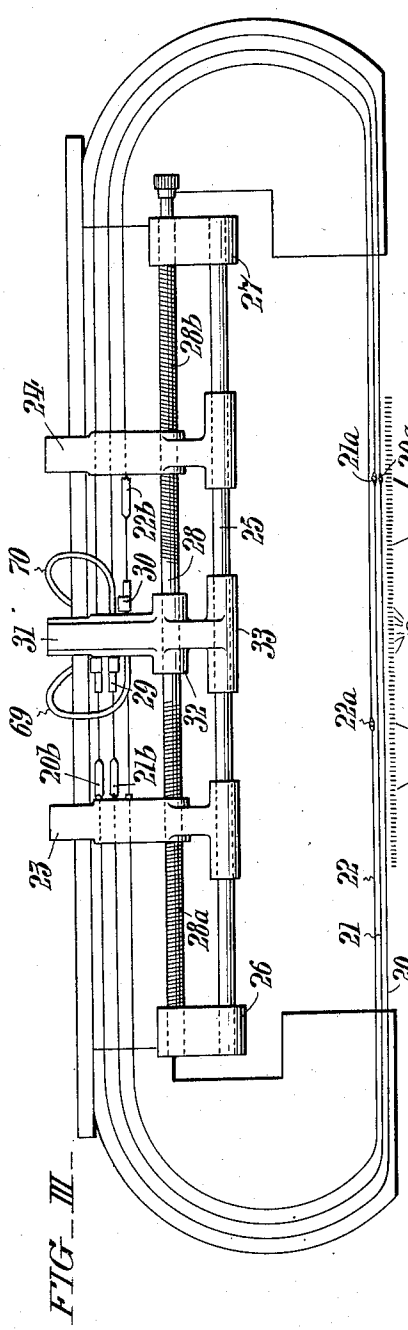


FIG. III

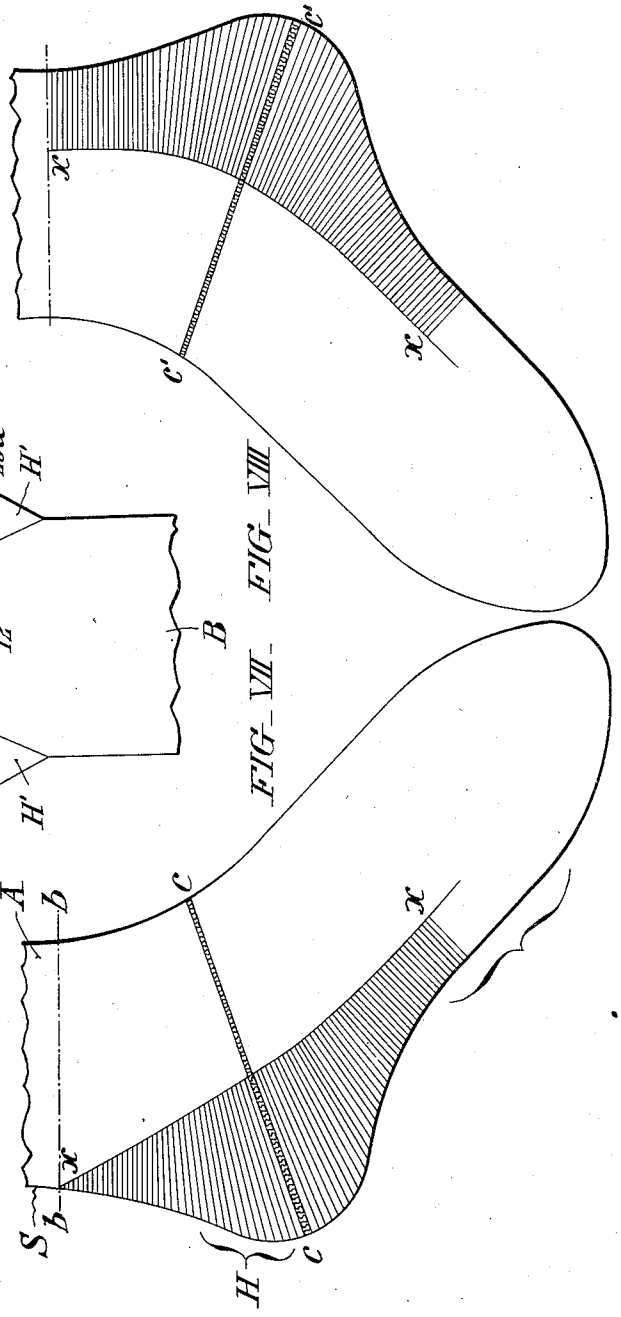


FIG. VIII

FIG. VIII

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Patented July 9, 1940 2,207,606

UNITED STATES PATENT OFFICE

2,207,606

KNITTING MACHINE

Emil J. Berger, Hatfield, Pa., assignor to Dexdale Hosiery Mills, Lansdale, Pa., a corporation of Pennsylvania

Application July 8, 1939, Serial No. 283,410

6 Claims. (Cl. 66—82)

This invention relates to knitting machines; and it has reference more particularly to straight knitting machines of the "Cotton" type such as are commonly used to produce flat fashioned blanks for stockings and the like.

The chief object of my invention is to make it possible to progressively vary the size of the loops in individual courses of the fabric produced on machines of the kind referred to, either concurrently with widening and narrowing operations, or with reinforcing operations, or both. This objective I attain, as hereinafter more fully disclosed, through provision of simple and reliable control mechanism whereby during traverse of the yarn carriers, the needle bar of the knitting machine is gradually moved relative to the sinkers to cause sinking of more or less yarn as the case may be and thereby determine correspondingly graduated loops in individual courses. My present invention is particularly advantageous in connection with the production of full fashioned stockings for the purpose of rounding out the heel tabs and thereby predetermining fuller and better fitting heels in the finished product.

Another object of my present invention is to attain the foregoing advantages with control mechanism which lends itself to ready incorporation in standard types of flat knitting machines without entailing any changes either in their construction or normal mode of operation. Other objects and advantages will appear from the following detailed description of the attached drawings, wherein

Fig. I is a fragmentary view in cross section of a flat knitting machine embodying my invention.

Fig. II is a fragmentary view of the machine partly in elevation and partly in section taken as indicated by the angled arrows II—II in Fig. I.

Fig. III is a diagrammatic plan view of the machine showing a stocking blank in the process of formation.

Fig. IV is a detail view on a larger scale looking as indicated by the angled arrows IV—IV in Fig. II.

Fig. V is a view looking toward the right of Fig. IV.

Fig. VI is a fragmentary sectional view taken as indicated by the arrows VI—VI in Fig. IV.

Fig. VII is a fragmentary view showing the foot portion of a stocking produced in the machine, and

Fig. VIII is a view similar to Fig. VII showing a slightly modified foot structure.

The knitting machine chosen for convenience of exemplifying my invention is of the single unit type featured in U. S. Patent No. 1,982,991, granted to Kenneth Howie and Charles C. Krieble on December 4, 1934.

Referring to Figs. I and II, the needle bar 1 of the machine is secured to a horizontal rod 2 which is pivotally supported by fixed arms 3 on a longitudinally-extending rock shaft 4 journaled in bearings on the end frames 5 and 6 of the machine. Also secured to the rock shaft 4 is an arm 7 with a roller 8, which, by means of a spring 9, is maintained in running contact with the periphery of a rotary cam 10 on the main cam shaft 11 of the machine. By this means, the needles 12 are moved up and down relative to the sinkers 13 to form the fabric loops in the usual way. Fast on the main cam shaft 11 is another rotary cam 15 on which travels a roller 16 at the end of a spring-pulled arm 17 freely fulcrumed on the rock shaft 4. Through a notched horizontal link 18, the arm 17 is detachably coupled with a pendant arm 19 fast on the pivot rod 2 for the needle bar 1 so that, under the action of the cam 15, the needles 12 are moved in and out relative to the sinkers 13 to normally produce fabric loops of predetermined uniform size in a manner also well understood. The machine has a plurality of horizontally-arranged endless bands of which but three are shown respectively at 20, 21 and 22 in Figs. I and III, with eyes 20*a*, 21*a* and 22*a* by which different yarns are fed to the needles. The band 20 may be assigned, for example, to feed the main yarn used in the knitting, and the bands 21, 22 to respectively feed the yarns used in reinforcing the heel cheeks H' (Fig. III) during the knitting of the blank B for the stocking. By suitable means (not illustrated) the bands 20—22 are oscillated to carry the yarns back and forth along the needles 12. Affixed to the bands 20, 21, 22 at the rear of the machine are stops 20*b*, 21*b* and 22*b* which are arranged to coact with abutment members 23, 24, thereby to limit the outward movement of the yarn eyes 20*a*, 21*a* and 22*a* in opposite directions. The abutment members 23, 24 are slidable along a longitudinally extending guide rod 25 secured at its opposite ends in fixed brackets 26, 27, and are shiftable toward or away from each other by a reversely rotatable screw spindle 28 with right and left hand threads 28*a*, 28*b*, to variantly limit the travel of the thread guide bands 20, 21 and 22 as required to narrow or widen the stocking blank. As shown, the screw spindle 28 is journaled at opposite ends in the fixed brackets 26, 27. The inward movement of the reinforcing yarn eyes 21*a*, 22*a* is limited through engagement of the stops 21*b*, 22*b*

on the bands 21, 22 with abutments 29, 30 projecting laterally from opposite sides of a fixed central bracket 31 which provides a medial bearing 32 for the screw spindle 28 and also a medial support 33 for the guide rod 25. The means for rotating the screw spindle 28 in opposite directions to vary the positions of the abutments 23, 24, may be like the mechanism provided for that purpose in the Howie et al. patent supra, and has therefore been omitted from the drawings.

The loop regulating mechanism of the machine includes a longitudinal shaft 35 in the lower part of the machine frame at the front, whereto is secured an arm 36 with an adjustable pin 37 in its end for limiting movement of the roller arm 17 in the direction toward the main cam shaft 11. A second arm 38, which is normally loose on the regulating shaft 35, has a pin and slot connection at 39 with the lower end of a cam follower in the form of an arm 40 which is freely fulcrumed on and slidable along a horizontal shaft 44 at a higher level at the front of the machine in opposition to a spring 44a (Fig. II). A lateral rounded protuberance 40a on the arm 40 is adapted to be engaged by outwardly-tapering cam wing projections 41, 42 arranged in pairs at diametrically opposite points, on the inner face of a disk 43 which is fast on a stub shaft 45 journaled in a bearing 46 on the end frame 5 of the machine. The stub shaft 45 is driven at half the speed of the main cam shaft 11 through a pair of intermeshing spur gears designated at 47 and 48 in Figs. I and II. Pivoted at 49 to a fixed collar 50 on the loop regulating shaft 35 is a clutch arm 51 which is arranged to be controlled from the pattern mechanism (not shown) of the machine by a link rod 52. Ordinarily the clutch arm 51 occupies the position shown in Fig. I, with its inner end out of contact with a screw 53 which is adjustable in the tail 38a of the arm 38. Thus, normally, the arm 51 is ineffective to move the regulating shaft 35 notwithstanding impartation of movement to the arm 40 by the segmental cam wings 41, 42 on the rotary disk 43. However, when the clutch arm 51 is moved downward at the commencement of the heel tab reinforcing stage of the knitting, the loose arm 38 is moved clockwise slightly about the regulating shaft 35 by action of clutch arm 51 upon the screw 53 in the lug 38a of the arm 38 exactly as in the Howie et al. patent hereinbefore referred to. As a result, the arm 36 is moved counterclockwise and through its pin 37 moves the roller arm 17 in a direction away from the main cam shaft 11, to cause formation of larger loops in the reinforced portions of the stocking to compensate for the added thickness of the reinforcing or splicing yarns.

The usual means for determining the configuration of the inner boundaries of the heel and foot reinforcements of the stocking blank includes a heart shaped cam 55 (Fig. I), which, together with a ratchet wheel 56, is fixed to a shaft 57 at the back of the machine. By means of a pawl 58 on an arm 59 which has a roller 60 engaging another rotary cam 61 on the main cam shaft 11, the ratchet wheel 56 is intermittently rotated. Normally, the pawl 58 is held retracted from the ratcheted wheel 56 by a pawl guard 62 arranged to be operated through a flexible rod or wire 63 from the pattern mechanism (not illustrated) of the machine. Resting on the heart shaped cam 55 is a roller 65 which is carried at the lower end of the carriage 66 confined to up and down movement in a fixed guide 67 on a fixed frame member 68 of the machine. By means of flexible rods or wires 69 and 70 (Fig. III), the movements of the carriage 66 are transmitted to the stops 29 and 30 to effect a gradual increase in the traverse of the splicing yarn guide bands 21 and 22 as the knitting of the heel cheeks progresses. Also connected to the carriage 66 is another flexible wire or rod 70a for shifting the arm 40 back and forth along the shaft 44 in accordance with the dictates of the heart shaped cam 55.

In order to adapt a knitting machine such as described up to this point to the purpose of my invention, the cam wings 41 and 42 of the respective pairs (Figs. I, IV and V) are oppositely pitched with their outer surfaces eccentric to the axis of the disk 43 instead of being concentric as ordinarily. While the wings 41, 42 may be integral with the disk 43, I prefer to make them as separate elements and to provide for their independent adjustment both circumferentially and angularly of said disk. As shown in Fig. V, the rear edges 41c, 42c, of each pair of wings 41, 42 are square with the inclined side edges, and projecting from them near to the inclined edges 41b, 42b and in parallelism with the latter, are pivot studs 71 and 72 which extend into receiving apertures in mounting block 73 and 74 attached to the disk 43. As shown, the cam wings 41 and 42 are held in place by retaining set screws 41d and 42d which are threadedly engaged in the blocks 73 and 74 and which extend into circumferential grooves in the studs 71 and 72. As shown, the cam wings 41 and 42 are formed with lugs 75 and 76 which overhang the periphery of the disk 43. By means of screws 77 and 78 respectively engaged in the lugs 75 and 76 and bearing against the periphery of the disk 43, the cam wings 41 and 42 may be angularly adjusted about the axis of the studs 71 and 72. As instanced in Fig. VI, the curved inner edges of the mounting blocks 73 and 74 engage a circumferential recess 79 on the hub 80 of the disk 43, and each of them is formed with an arcuate ridge 81 which fits into an annular groove 82 in the face of the disk. Cap bolts 83 and 84 passing through arcuate slots 85 and 86 in the disk 43 and engaging into the mounting blocks 73 and 74, serve to secure the latter in circumferentially adjusted positions.

In producing the blank for a stocking, the leg portion may be formed in the usual way down to the line b—b in Fig. VII, whereupon the reinforcing yarn carrier bands 21 and 22 are set into action and the clutch arm 51 is operated to clutch the roller arm 38 to the loop regulating shaft by means (not shown) provided for that purpose on the machine. The shaping of the outer edges of the heel cheeks H' is, of course, determined by gradual increase in the outward travel of the yarn guide bands 20, 21 and 22 through rotation of the screw spindle 28 in one direction for a time, and then by gradual decrease in the travel of said bands for a time. The shaping of the inner edges of the reinforced heel portions is, on the other hand, determined through control of the inner stops 29 and 30 for the reinforcing yarn guide bands 21 and 22 by the heart shaped cam 55 through which the arm 40 is shifted back and forth along the cam wings 41, 42. As a consequence of the eccentric rounding and opposed arrangement of the cam wings 41 and 42, it will be apparent that, throughout the knitting of the heel cheeks H', the loop regulating mechanism will be so controlled as to de-

termine progressive loop enlargement in individual courses in opposite directions outwardly from the lines x—x (Fig. III) marking the inner limits of the reinforcements, to the selvages. It will be evident, therefore, that with a knitting machine embodying my invention, it is possible to produce stocking blanks with improved rounder and fuller profiled heels as expeditiously and economicaly as stockings having heels of the conventional types.

Through the adjustment facilities provided as hereinbefore described, it will be seen that the cam wings 41 and 42 may, on the one hand, be accurately positioned on the disk 43 for proper coordination with the action of the heart shaped cam 55, in determining starting of the loop enlargement from the line x—x, and on the other hand to vary the rate of progressive enlargement of the loops in the individual fabric courses.

By keeping the heart shaped cam 55 stationary with its high point up, stockings with a square top heel such as shown in Fig. VIII may be formed with equal facility by the machine. It is furthermore possible by differently shaping the inner edges of the cam wings 41 and 42, to determine progressive lengthening of individual fabric courses C'—C' from the front center of the instep to the heel selvages as also shown in Fig. VIII, as will be readily understood by skilled knitters.

Having thus described my invention, I claim:

1. In a knitting machine, the combination of a series of needles; a series of cooperative sinkers; a reciprocating yarn carrier for feeding yarn to the needles to produce a flat web; a pair of reciprocating auxiliary yarn carriers for forming reinforced marginal areas along the side edges of the web; means for moving the needles toward and away from the sinkers to determine fabric loops of normal size, including a rotary cam and a cooperating roller arm; control means for varying the throw of the auxiliary carriers to ornamentally configure the inner boundaries of the reinforcements; and mechanism for changing the position of the roller arm relative to the last mentioned cam to determine progressive variation in the size of the fabric loops in individual courses within the reinforced areas.

2. A knitting machine according to claim 1, in which the control means includes a rotary cam with a pair of circumferentially spaced wings affording opposingly arranged segmental surfaces eccentric to the cam axis, the contiguous inner edges of said wings being shaped to define the configuration of the reinforcements, and means for shifting the follower back and forth along the cam wings.

3. In a knitting machine, the combination of a series of needles; a series of cooperative sinkers; a reciprocating yarn carrier for feeding yarn to the needles to produce a flat web; means for changing the throw of the yarn carrier to shape the web; means for moving the needles toward and away from the sinkers to determine fabric loops of normal size, including a rotary cam and a cooperative roller arm; and control mechanism for changing the position of the roller arm relative to the cam to determine progressive variation in the size of the fabric loops of individual courses outwardly in opposite directions from within the web toward its side edges, said control mechanism including a rotary cam with opposingly-arranged segmental eccentric surfaces, a follower in the path of said surfaces, and interposed means for transmitting the movements of the follower to the roller arm.

4. In a knitting machine, the combination of a series of needles; a series of cooperative sinkers; a reciprocating yarn carrier for feeding yarn to the needles to produce a flat web; means for changing the throw of the yarn carrier to shape the web; means for moving the needles toward and away from the sinkers to determine fabric loops of normal size, including a rotary cam and a cooperative roller arm; and control mechanism for changing the position of the roller arm relative to the cam to determine progressive variation in the size of the fabric loops of individual courses outwardly in opposite directions from within the web toward its side edges, said control mechanism including a rotary cam with segmental wings having opposingly arranged segmental eccentric surfaces, means whereby the wings can be adjusted for eccentricity, a follower in the path of said wings, and interposed means for transmitting the movements of the follower to the roller arm.

5. In a knitting machine, the combination of a series of needles; a series of cooperative sinkers; a reciprocating yarn carrier for feeding yarn to the needles to produce a flat web; means for changing the throw of the yarn carrier to shape the web; means for moving the needles toward and away from the sinkers to determine fabric loops of normal size, including a rotary cam and a cooperative roller arm; and control mechanism for changing the position of the roller arm relative to the cam to determine progressive variation in the size of the fabric loops of individual courses outwardly in opposite directions from within the web toward its side edges, said control mechanism including a rotary cam with wings having opposingly arranged eccentric segmental surfaces, means whereby the wings may be adjusted about axes substantially in line with their contiguous edges to vary their eccentricity, a follower in the path of said wings, and means for transmitting the movements of the follower to the roller arm.

6. In a knitting machine, the combination of a series of needles; a series of cooperative sinkers; a reciprocating yarn carrier for feeding yarn to the needles to produce a flat web; means for changing the throw of the yarn carrier to shape the web; means for moving the needles toward and away from the sinkers to determine fabric loops of normal size, including a rotary cam and a cooperative roller arm; and control mechanism for changing the position of the roller arm relative to the cam to determine progressive variation in the size of the fabric loops of individual courses outwardly in opposite directions from within the web toward its side edges, said control mechanism including a rotary cam with a pair of circumferentially spaced wings affording opposingly arranged segmental surfaces eccentric to the cam axis, and interposed means for transmitting the movements of the follower to the roller arm.

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