Sept. 12, 1950 W. GRANOV 2,521,786

KNITTING MACHINE

Filed April 9, 1949 5 Sheets-Sheet 1

FIG. 4.

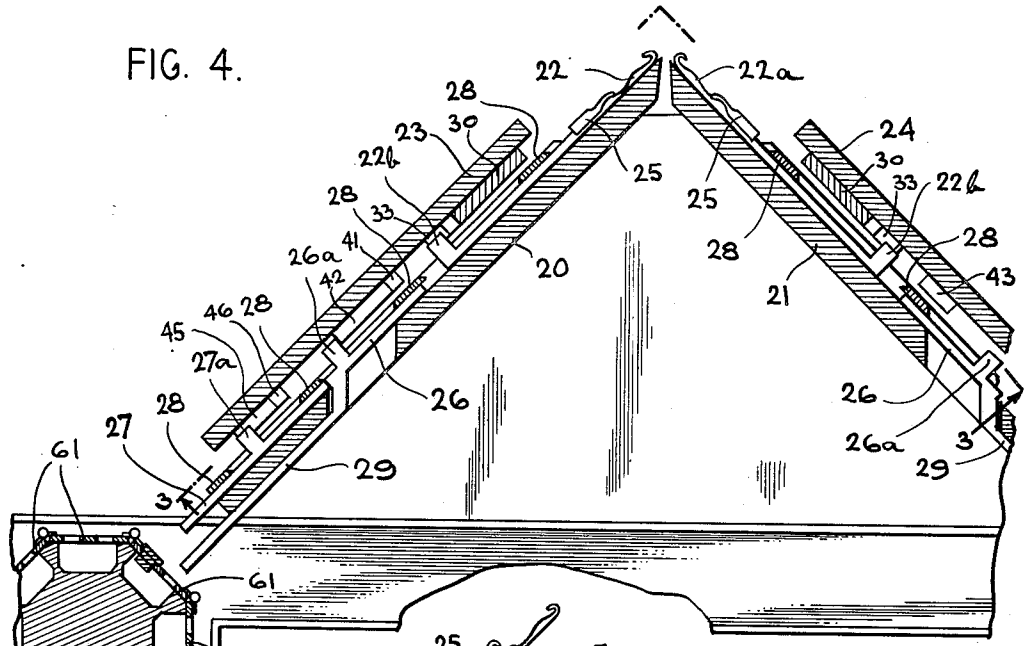


FIG. 5.

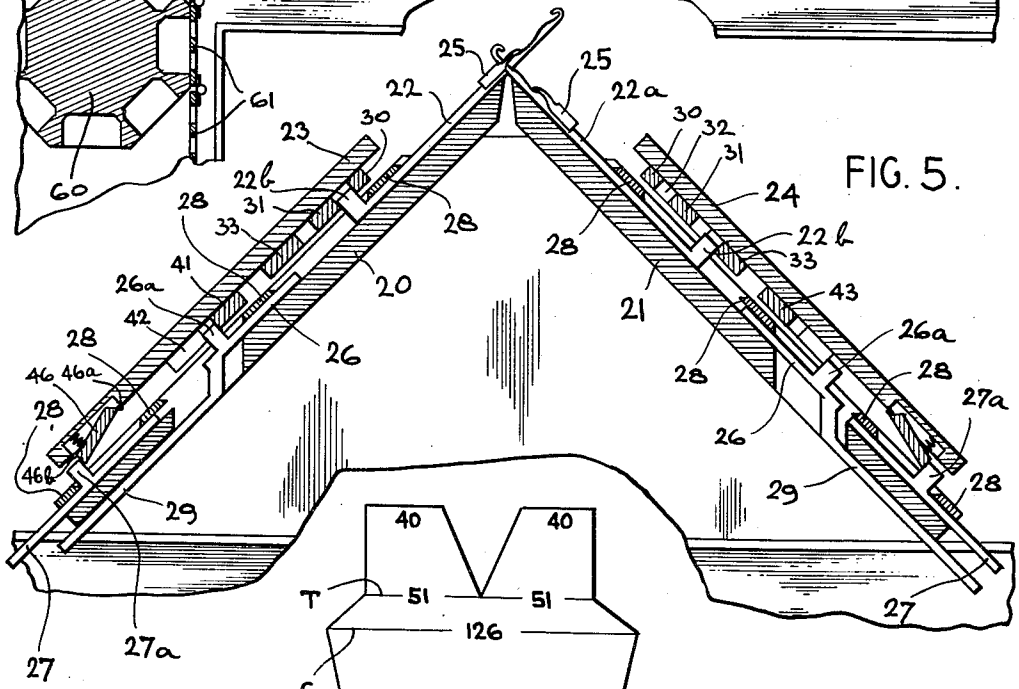
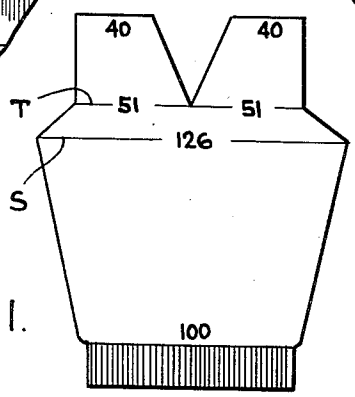


FIG. 1.



INVENTOR.
WALTER GRANOV

BY

Mock & Blum

ATTORNEYS

Sept. 12, 1950 W. GRANOV 2,521,786

KNITTING MACHINE

Filed April 9, 1949 5 Sheets-Sheet 2

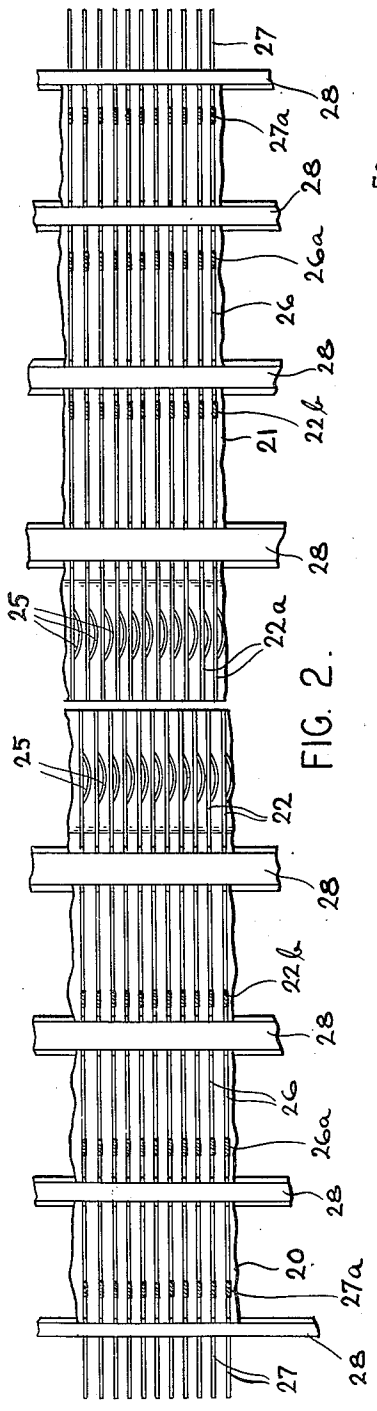


FIG. 2.

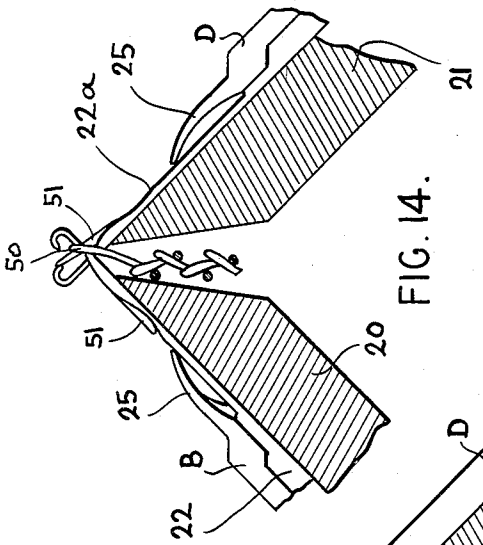


FIG. 14.

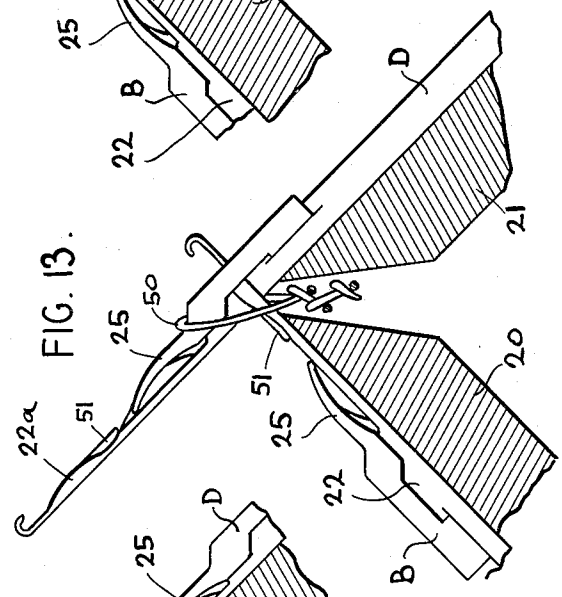


FIG. 13.

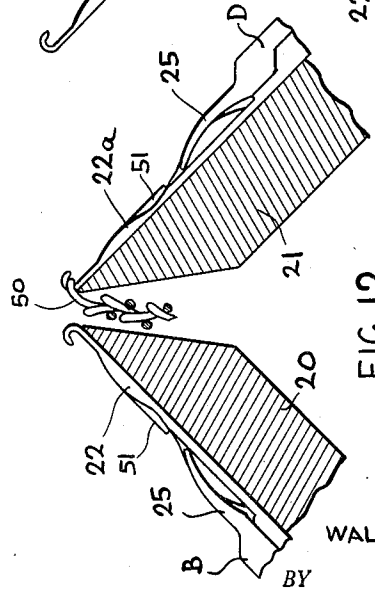


FIG. 12.

INVENTOR.
WALTER GRANOV

BY

Mock & Blum

ATTORNEYS

Sept. 12, 1950 W. GRANOV 2,521,786

KNITTING MACHINE

Filed April 9, 1949 5 Sheets-Sheet 3

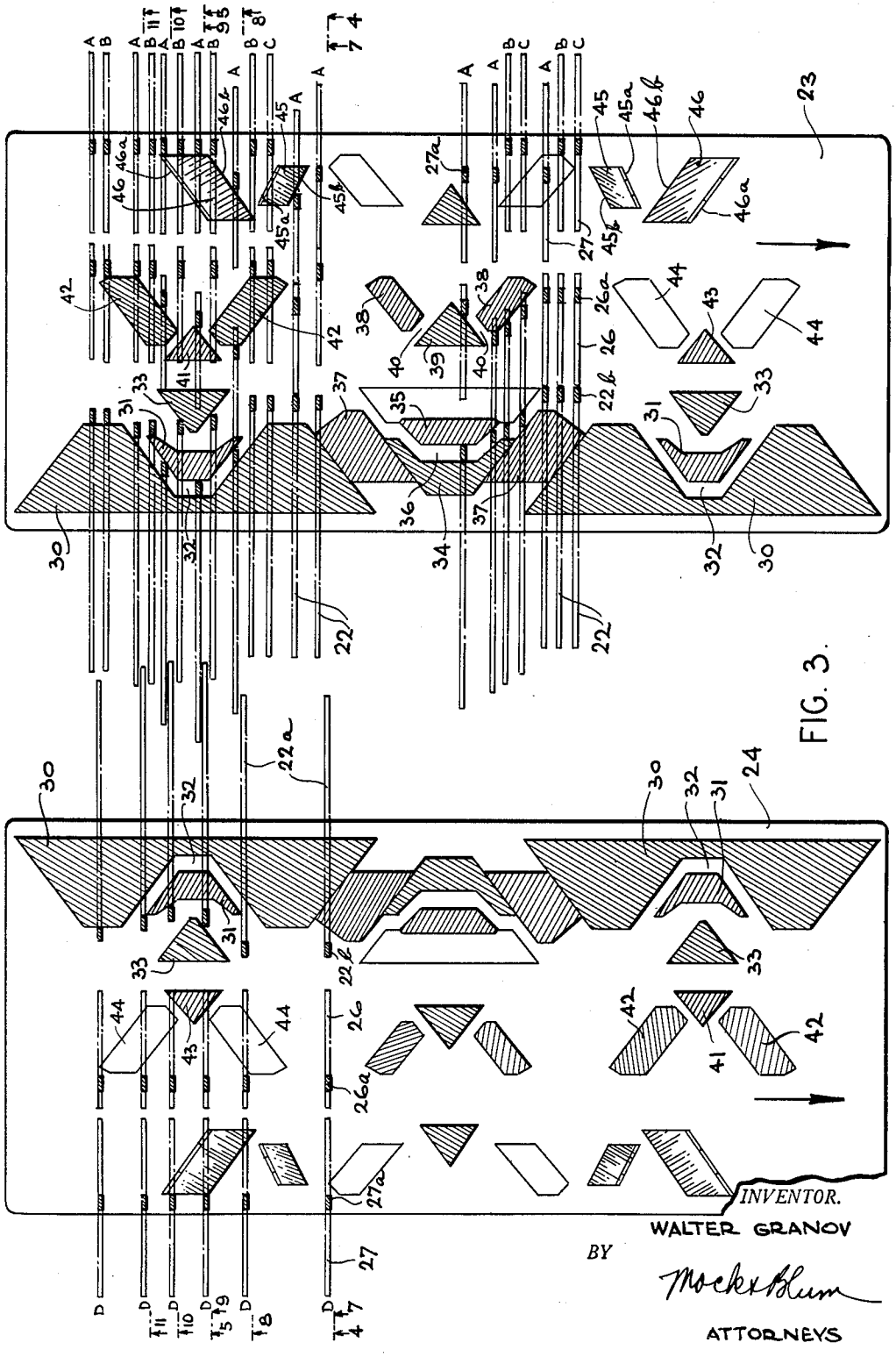


FIG. 3.

INVENTOR.
WALTER GRANOV
BY
Mocker & Blum
ATTORNEYS

Sept. 12, 1950 W. GRANOV 2,521,786

KNITTING MACHINE

Filed April 9, 1949 5 Sheets-Sheet 4

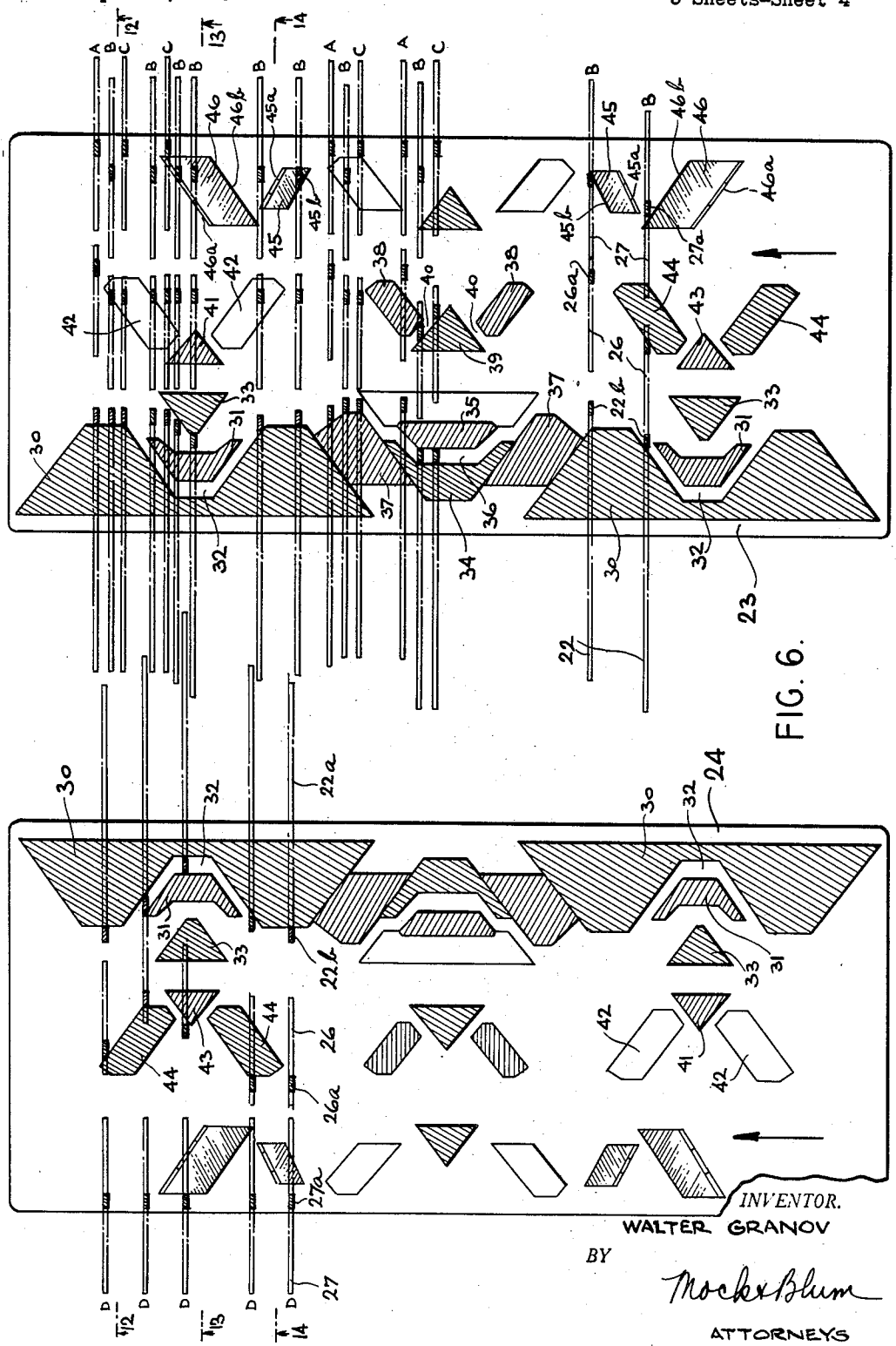


FIG. 6.

INVENTOR.
WALTER GRANOV
BY
Mocker & Blum
ATTORNEYS

Sept. 12, 1950 W. GRANOV 2,521,786

KNITTING MACHINE

Filed April 9, 1949 5 Sheets-Sheet 5

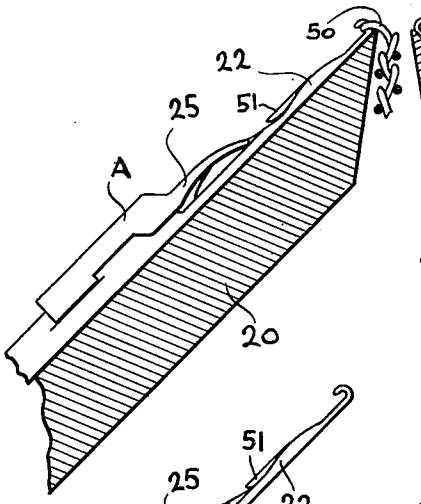


FIG. 7.

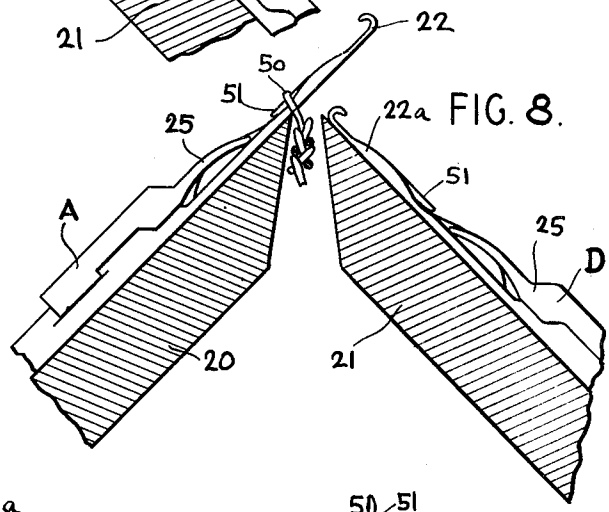


FIG. 8.

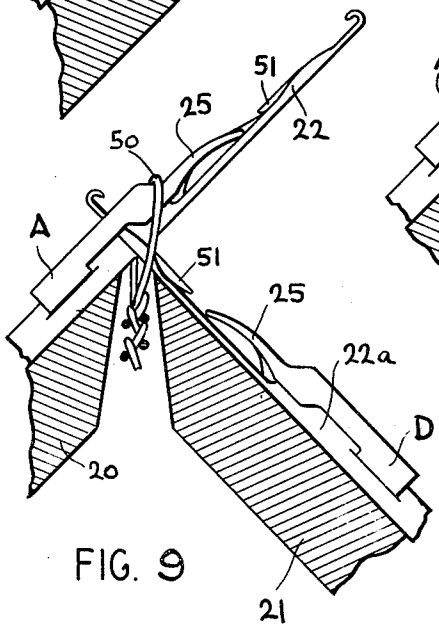


FIG. 9

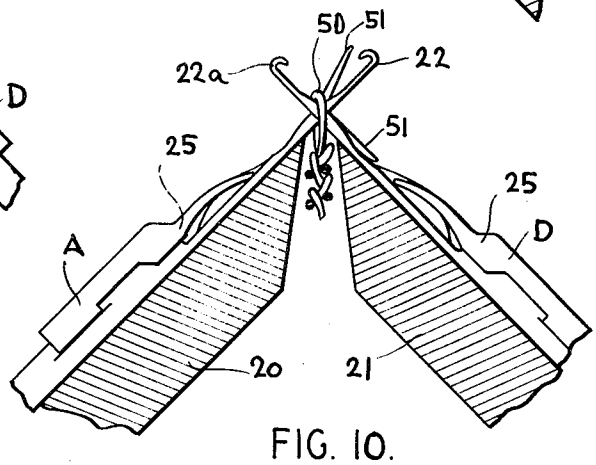


FIG. 10.

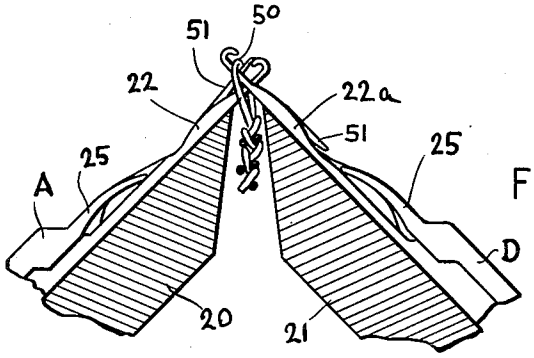


FIG. 11.

INVENTOR.
WALTER GRANOV

BY

Mock & Blum

ATTORNEYS

Patented Sept. 12, 1950 2,521,786

UNITED STATES PATENT OFFICE

2,521,786

KNITTING MACHINE

Walter Granov, Brooklyn, N. Y.

Application April 9, 1949, Serial No. 86,523

12 Claims. (Cl. 66—70)

1

This invention relates to improvements in knitting machines and is concerned more especially with knitting machines of the V-bed type having inclined needle beds.

In machines of the type indicated two upwardly inclined needle beds are arranged substantially perpendicularly to each other and the knitting operation is performed in the longitudinally extending space between the two needle beds. Needles and needle jacks or pushers are slidable in grooves or channels formed in each bed and the motion of the needles and needle jacks are controlled through the agency of a system of cam blocks mounted on cam plates forming a part of the carriage reciprocating over the needle beds.

A primary object of the invention is to provide a novel construction for selectively controlling the motion of predetermined needles in the needle beds in such a manner as to increase or diminish, as desired, the number of stitches in successive rows or courses of a knitted article without requiring interruption of the knitting operation or resetting of the machine once the initial adjustments have been made. In carrying out this object of the invention I employ stitch-transferring needles substantially of the type disclosed in Patent No. 2,326,694 issued to Julius Sirmay and dated August 10, 1943. These needles are of the sliding, latch type and are provided with a laterally extending loop-opening, transfer clip. While the identified patent illustrates a transfer needle having a transfer clip extending on the right side of the needle body, I find it necessary to employ two types of such transfer needles, one having a transfer clip on the right side of the needle body and the other having a transfer clip on the left side of the needle body, the needles being arranged symmetrically with respect to the central axis of symmetry of the knitted article and the transverse center line of the needle beds and the arrangement of the transfer clips on both sides of the transverse center line of the machine being determined by the direction in which it is desired to diminish the stitches, as will appear more fully hereinafter.

Another object of the invention is the provision of a novel construction of the character indicated including a novel arrangement of cam blocks and a dual jack control of each transfer-clip needle so that for a single traversing movement of the carriage over the needle bed it will be possible for all of the needles of the front needle bed to undergo a knitting operation, while certain of the needles may be preselected to

2

undergo a transferring operation, subsequent to their knitting operation, wherein their loops will be temporarily transferred to an adjacent needle of the rear bed; the diminution of one or more stitches in the succeeding row of the article being accomplished upon the return stroke of the carriage by the transfer of the previously transferred stitch or stitches from the needle of the rear bed to a respective needle of the front bed inwardly adjacent or outwardly adjacent the original front transfer needle, depending upon the direction of diminution of stitches desired in a given case.

An additional object of the invention is the provision of a novel construction of cam blocks and dual jack control wherein certain of the cam blocks are movable and wherein the dual jacks may be operatively preadjusted in such a manner as to select certain needles for a transferring operation in order to diminish the number of stitches in successive rows of the knitted article, the movable cam blocks and the dual jacks cooperating in such a manner as to accomplish a sequence of knitting and transferring of the selected needles in a given direction of travel of the carriage and to reverse the sequence during the return stroke of the carriage.

A further object of the invention is the provision of a knitting machine of the character indicated wherein the sequential operations of the machine may be carried out rapidly, smoothly and automatically.

The foregoing objects as well as additional objects and advantages of the invention will be readily apparent in the course of the following detailed description taken in connection with the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:

Fig. 1 illustrates diagrammatically a portion of a garment which may be knitted employing the knitting machine of the invention and indicates the necessity for increasing and diminishing the number of loops or stitches in successive rows at different portions of the garment;

Fig. 2 is a fragmentary top plan view of the needle beds with transfer needles and dual needle jacks or pushers in position;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 4 showing the arrangement of cam blocks on the underside of the carriage and diagrammatically illustrating the progressive movement of certain of the needles and their associated jacks or pushers in a given direction of travel of the carriage indicated by the arrow;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 3;

Fig. 6 is a view similar to Fig. 3 illustrating the movement of the needles during the return stroke of the carriage; and

Figs. 7 to 14 are fragmentary detail views illustrating the sequential steps in the operation of transferring a stitch from a preselected needle of the front bed to an adjacent needle of the rear bed and thence back to a needle of the front bed adjacent the original transfer needle in order to diminish successive rows of the knitted article by one stitch. Figs. 7, 8, 9, 10 and 11 are taken on lines 7—7, 8—8, 9—9, 10—10 and 11—11 of Fig. 3 while Figs. 12, 13 and 14 are taken on lines 12—12, 13—13 and 14—14 respectively of Fig. 6.

Referring now to the drawings in greater detail, 20 designates the front bed and 21 the rear bed of a knitting machine of the V-type wherein said front and rear beds are upwardly inclined and substantially perpendicular to each other. Each of said needle beds is provided with a plurality of grooves or channels which slidably retain knitting needles having stitch-transferring means or so-called transfer clips which are operative in the position of extreme forward projection of the needle, hereinafter designated the transfer position. An important feature of the invention resides in the provision of means including dual jacks or pusher elements for each transfer clip needle and a novel arrangement of cooperating cam blocks mounted on the underface of the reciprocating carriage of the machine so that certain of the needles may be preselected for movement to transfer position and the transferring of one or more stitches may be accomplished simultaneously with the knitting operation which normally occurs during the reciprocation of the carriage. The arrangement of the present invention establishes an automatic sequence of operations whereby all of the needles (including those needles preselected for movement to transfer position) execute a knitting operation, the preselected needles executing, in addition to their knitting operation, a subsequent stitch-transferring operation, as will be more fully described hereinafter.

It has been found desirable to employ stitch-transferring needles having transfer clips of the type described in the aforementioned Patent No. 2,326,694 to Julius Sirmay wherein the transfer clips are illustrated extending laterally on the right side of the needle body. However, since the diminution of the number of stitches in successive rows of a fashioned knitted article will generally be carried out symmetrically on both sides of the article, as shown in Fig. 1, it is necessary to employ two types of transfer needles, one having a transfer clip on the right side of the needle body which has been designated 22 and the other type, 22*a*, having its transfer clip on the left side of the needle body (see Fig. 2).

The carriage of the machine comprises a pair of reciprocating members or cam plates 23 and 24, the cam plate 23 being the front member and the cam plate 24 being the rear member of the carriage, said cam plates being reciprocable in unison over the front and rear needle beds 20 and 21. Each cam plate carries on its underface a plurality of cam blocks arranged in such a manner as to control the movement of all the needles to their knitting position and to selectively control the movement of certain of the needles to transfer position in a continuous, automatic operation without any interruption of the knitting operation and without any interference with the normal reciprocatory movement of the carriage.

In the drawings the needles 22 and 22*a* are illustrated as being of the single latch type having transfer clips 25 and the movement of each needle into operative engagement with selected cam blocks on cam plates 23 and 24 is controlled by preadjusting one or both jacks or pusher elements 26 and 27 in a manner to be more fully described. For purposes of convenience and clarity, elements 26 will be designated the inner jacks or pushers and elements 27 will be designated the outer jacks or pushers corresponding to their disposition within the needle bed. Needles 22 and 22*a*, inner jacks 26 and outer jacks 27 are provided with projections or lugs 22*b*, 26*a* and 27*a* respectively, and are actuated within their respective channels by the engagement of said lugs against respective controlling cams carried by cam plates 23 and 24 in order to perform the sequential knitting and transferring operations, as will appear more fully hereinbelow. The needles and the inner and outer jacks 26 and 27 may be held against displacement from their channels by means of longitudinally extending retaining strips 28 or in any other suitable manner. It will be noted that inner jacks 26 are formed with a lower, offset, rearward extension 29 and the needle bed is constructed in such a manner that said offset extension of each inner jack 26 underlies the respective outer jack 27 and the ends of both jacks normally extend outwardly of the needle bed in inoperative position, with respect to their controlling cams. It will be understood that either one or both of the jacks 26 and 27 may be moved forwardly to an operative position, from which position their subsequent movement effecting the desired sequential operations of the machine will be controlled by certain of the cam blocks of the carriage, as will be now described. The setting of the jacks 26 and 27 may be accomplished by a jacquard mechanism or other suitable mechanism, as will be apparent to those skilled in the art.

Front cam plate 23 and rear cam plate 24 of the carriage are identical and each of said cam plates carries a plurality of cam blocks arranged symmetrically with respect to the transverse center line of the cam plate and further arranged in three groups extending longitudinally of the cam plate. The foremost or inner group of cam blocks, with respect to the longitudinal center line of the machine includes the outer transfer cams 30 and 31 defining therebetween a transfer camway 32, and an auxiliary cam block 33. Between said transfer cams are disposed central cams 34 and 35 defining therebetween a knitting camway 36. Stitching cams 37 are interposed between central cams 34 and the outer transfer cams 30. The foremost group of cam blocks just described control the projection and retraction of the needles in their knitting and transferring positions by engagement of the needle lugs 22*b*, as will be more fully described. The second or middle group of cam blocks control the movement of the inner jacks 26 and includes a centrally disposed pair of wing cams 38 and a triangular resetting or retracting cam 39 defining the resetting camways 40. The outer members of the middle group of cam blocks comprise a triangular resetting cam 41 and a pair of wing cams 42 on one side of the cam plate and another triangular resetting cam

43 and another pair of wing cams 44 on the opposite side of the cam plate. Both of the wing cams 42 and both of the wing cams 44 are movably mounted on cam plate 23 and are arranged for alternate reversible extension and retraction depending upon the direction of travel of the carriage. For example when the carriage moves in the direction of the arrow in Fig. 3, wing cams 42 will be extended and wing cams 44 will be retracted but when the carriage reverses its direction during its return stroke as shown in Fig. 6 wing cams 42 will be retracted and wing cams 44 will be extended. Since any suitable means may be employed for achieving the described alternate reversible extension and retraction of wing cams 42 and 44 and since said means does not in itself constitute the subject matter of the present invention, a more detailed description is not required here. It will be understood that the movement of said cams may be varied, depending upon the particular sequence of operation desired.

The third or outer group of cam blocks controls the movement of the outer jacks 27 and comprise a pair of preferably wedge-shaped cams 45 and 46 on opposite sides of the cam plate and which are resiliently pivoted to cam plate 23 along axes 45*a* and 46*a* respectively. It will be understood, therefore, that as a result of the described arrangement, one pair of wedge cams 45 and 46 will be operative to project and retract outer jacks 27 when the jack lugs 27*a* engage against the leading extended side edges 45*b* and 46*b* of said wedge cams, as shown in Fig. 3, and the opposite pair of said wedge cams will be operative during the return stroke of the carriage, as shown in Fig. 6, in a manner similar to the alternate operation of wing cams 42 and 44 controlling the movement of the middle jacks 26. Said wedge cams, however, may be urged into normal extended operative position by spring tension and may be retracted into their inoperative position by the action of the lugs 27*a* of outer jacks 27 in passing over the bottom inclined surfaces of said wedge cams causing the wedge cams to turn upon their pivot axes 45*a* and 46*a* into temporary retracted position.

As has been previously pointed out the ends of inner jacks 26 and outer jacks 27 extend outwardly of the needle bed and said jacks are normally retained in inoperative position so that the jack lugs 26*a* and 27*a* will pass rearwardly of their respective controlling cams. However, if the jacks are pushed slightly forwardly to their operative positions they will be engaged by their respective controlling cams during the reciprocation of the carriage and will influence the movement of their respective needles to perform the sequential knitting and stitch-transferring operations of the machine, as will now be described.

Figs. 3 and 6 are sectional views through the cam blocks looking upwardly toward the cam plates 23 and 24 and illustrate diagrammatically the progressive movement of certain of the needles and their associated jacks in the front and rear needle beds to perform the sequential knitting and transferring operations for one complete traversing movement of the carriage. It will be assumed that the machine has been knitting an article, such as the sweater front illustrated in Fig. 1, to the row marked S and that the sweater is now to be fashioned by diminishing the number of loops in successive rows in the vicinity of the armhole. For purposes of clarity the drawings illustrate the operation of the machine to diminish successive rows by a single loop

or stitch. A, B, and C designate three adjacent needles 22 and their associated inner jacks 26 and outer jacks 27 in front needle bed 20, A being the outermost active needle on the left side of the front needle bed. D designates a needle 22*a* and its associated jacks in the rear bed 21 said needle being disposed opposite needles A and B. Needles 22 and 22*a* are similar except that their transfer clips 25 extend on opposite sides of the needle body, the transfer clip of needle 22 being disposed on the right side of its body and the transfer clip of needle 22*a* being disposed on the left side of its body (looking toward the front or hooked end of the needle in both cases) in order to make possible the stitch-transferring or diminishing operation. The arrangement of the invention establishes a sequence wherein, by preadjustment of the inner and outer jacks before each stroke of the carriage, all of the needles may execute a knitting operation while certain of the needles may be preselected for executing a transferring operation. In more specific terms needles A, B and C will first knit and needle A will subsequently transfer its previously formed stitch or loop to needle D of the rear bed during one course of the carriage. Upon the return stroke of the carriage needle D will transfer its loop to needle B of the front bed, after which needles B and C will knit in the usual manner while needle A, having no loop thereon, is rendered inoperative. The overall effect during a complete traversing movement of the carriage is to diminish the number of stitches in successive rows (at both ends) while the knitting operation is simultaneously carried out in an automatic, smooth and uninterrupted manner.

Referring to Fig. 3 the carriage is moving in the direction indicated by the arrow, the inner jacks 26 of needles A, B and C have all been pushed forwardly from inoperative position and the outer jack 27 of needle A only has been pushed forwardly, the outer jacks of needles B and C remaining in inoperative position for the complete stroke of the carriage in the given direction. Wing cams 44, being retracted during this stroke of the carriage, will not interfere with the raised lugs 26*a* of the inner jacks 26 of needles A, B, and C. The carriage will advance causing inner jack lugs 26*a* to engage wing cam 38 and move inner jacks 26 forwardly until the needle lugs 22*b* are engaged in the knitting camway 36, defined between central cams 34 and 35, thereby moving the needles A, B, and C to knitting position where fresh yarn is laid in the needle hooks. Inner jacks 26 are retracted by the engagement of lugs 26*a* within resetting camway 40 and against the inner side of the second wing cam 38 as the needles A, B, and C execute a knitting operation during their retraction by stitching cam 37.

The carriage continues its advance until the outer jack 27 of needle A is raised by engagement of lug 27*a* against the leading extended side edge 45*b* of wedge cam 45 (outer jack 27 of needle A having previously been raised to operative position as described above). As outer jack 27 of needle A is raised it pushes inner jack 26 into operative engagement against wing cam 42, which is extended during the stroke of the carriage illustrated in Fig. 3, and the lug 22*b* of needle A is caused to enter transfer camway 32 defined between transfer cams 30 and 31 to effect the transfer of the loop 50 from needle A to needle D, as shown in Figs. 7 to 11. It will be noted that outer jack 27 of needle A will be retracted

to inoperative position by engagement of its lug 27a against the leading extended side edge 46b of wedge cam 46.

As needle A is gradually projected to its transfer positions corresponding to the apex of transfer camway 32, needle D of the rear bed undergoes a forward motion by the normal engagement of its lug 22b against auxiliary transfer cam 33 of the rear cam plate 24, as shown in Figs. 3 and 9, so as to position the hooked end of needle D within and above the transfer clip 25 of needle A and within expanded loop 50 in position to receive the said loop upon retraction of needle A. Upon retraction of needle A the free end of the transfer clip 25 of needle A rides over needle D and loop 50 will hang on both needle A and D. Further retraction of needle A will result in the closing of latch 51 of needle A, as shown in Figs. 10 and 11, and final retraction of both needles will leave the loop 50 on needle D, as shown in Fig. 12.

The completion of the stitch-transferring operation occurs during the return stroke of the carriage to accomplish the transferring of loop 50 from needle D to needle B of the front bed, as will be understood upon reference to Fig. 6. Before the carriage begins its return stroke the inner and outer needle jacks are properly adjusted. The inner jacks 26 of needles B and C will be pushed forwardly since said inner jacks control the knitting operation and the outer jacks 27 of needle B will be pushed forwardly to select needle B for transferring a stitch, the initial adjusted positions of the jacks before passage of the carriage thereover being shown at the top right-hand side of Fig. 6. It will be noted that the inner and outer jacks of needle A both remain in inoperative position since needle A is no longer an active needle. Also the inner jack 26 of needle D, which has previously received loop 50 from needle A, will be pushed forwardly. As the carriage advances in the direction of the arrow in Fig. 6, raised lug 26a of the inner jack 26 of needle D will be engaged by extended wing cam 44 of the rear cam plate 24, thereby pushing needle D forwardly and causing the lug 22b thereof to enter transfer camway 32 defined between transfer cams 30 and 31 of said rear cam-plate. As needle D is projected forwardly to transfer position, needle B will move forwardly into loop-receiving position by the normal engagement of its lug against auxiliary cam 33 of the front cam plate 23, the relative positions of needles B and D at this point being illustrated in Fig. 13. Upon retraction of needle D loop 50 will bear against and close the latch 51 of needle D, as shown in Fig. 14, whereupon said loop will be transferred to needle B to complete the loop-transferring operation.

As the carriage continues its advance, needles B and C will undergo a knitting operation as a result of the engagement of inner jack lugs 26a by the central wing cam 38, causing the lugs of said needles to enter the knitting camway 36 defined between central cams 34 and 35. It will be understood that needle B will temporarily retain two loops after receiving loop 50 from needle D, one of said loops being the transferred loop 50 and the other being the loop formed during the previous stroke of the carriage in Fig. 3, and both of said loops will be cast off during the subsequent knitting operation of needle B to form a new loop. However, in order to simplify the showing, transferred loop 50 only is illustrated in the drawings.

Following the knitting operation of needles B and C, the carriage will continue to advance until the previously raised outer jack 27 of needle B is engaged by the extended leading edge 45b of wedge cam 45, thereby pushing inner jack 26 of needle B into operative engagement against extended wing cam 44 and causing needle B to move into transfer position in a manner similar to that described for needle A during the previous stroke of the carriage. Needle B will then transfer its loop to a needle of the rear bed inwardly adjacent needle D and upon the next stroke of the carriage (corresponding to the stroke illustrated in Fig. 3) the transferred loop will be received by needle C, needle B being rendered inoperative.

The cycle of operations may be repeated indefinitely until the article being knitted has been fashioned to the desired extent by the diminution of the required number of stitches in successive rows of knitting according to a predetermined plan. Thus, as shown in Fig. 1 where the numerals indicate the number of stitches in a given row and where it has been assumed that the diminution of stitches has begun at row S which contains 126 stitches, the process described above may be carried out progressively diminishing the number of stitches at both sides of the garment until row T, containing 102 stitches, is reached.

It will be apparent that the construction and arrangement of the present invention will also readily allow the progressive increase of the number of stitches in successive rows of the article being knitted by preadjusting the inner jacks of additional needles in the front bed, but the increase of stitches will not involve the transferring operation described above. Further the described arrangement of cam blocks does not preclude the use of additional cams which may be used for varying the pattern or knitting design and for other purposes not directly related to the present invention. For this reason certain of the cam blocks shown in Figs. 3 and 6 have not been assigned reference numerals and a description of their particular function has been omitted.

The initial selective adjustment of the inner and outer jacks 26 and 27 and subsequent setting of the jacks between strokes of the carriage may be accomplished by a suitable jacquard mechanism 60 or other suitable mechanism. The inner jacks 26 and the outer jacks 27 of each needle are independently and selectively adjustable to operative position for engagement by their respective controlling cams and both of said jacks normally extend outwardly of the needle bed for actuation by the jacquard mechanism. Accordingly, the jacquard cards 61 will have two series of perforations which will control the inner and outer jacks and certain of the perforations may be closed by plugs. Thus all of the inner jack perforations will be plugged and all of the outer jack perforations will be free for those needles which are to execute a normal knitting operation while both the inner and outer jack perforations will be plugged for those needles which are to knit and transfer loops. The patterns of the jacquard cards will be varied in order to obtain the desired sequence of operations.

Since certain modifications may be made in the knitting machine of the invention without departing from the scope thereof, it is intended that all matter contained in the foregoing specification and shown in the accompanying draw-

ings be interpreted merely as illustrative and not in a limiting sense.

By proper symmetrical arrangement of the transfer clip needles on both sides of the transverse center line of the needle beds and by appropriate adjustment of the inner and outer jacks, the number of stitches in successive rows of the knitted article may be progressively diminished outwardly from the center of the article in both directions to form a V-neck, as illustrated diagrammatically in Fig. 1.

What is claimed is:

1. In a knitting machine of the V-bed type having upwardly inclined front and rear needle beds and a carriage reciprocating over said needle beds, transfer clip needles slidable in said needle beds and having rearwardly disposed lugs, outer jacks slidable in said needle beds, intermediate jacks slidable in said needle beds, lugs on said outer and intermediate jacks, said intermediate and outer jacks being independently adjustable to forward operative position, front and rear cam plates mounted on said carriage, each of said cam plates defining a centrally disposed knitting camway for reception of the needle lugs in knitting position, outer fixed transfer cams on both sides of said cam plate defining a pair of transfer camways for selectively receiving certain of the needle lugs in extreme forward transfer position, auxiliary transfer cams disposed rearwardly of said outer transfer cams and normally advancing all of the needle lugs to a receiving position rearwardly of said transfer position, centrally disposed controlling cams cooperating with said knitting camway and adapted to engage the lugs of said intermediate jacks for advancing the needles to knitting position, extensible and retractable outer controlling cams alternately cooperating with each of said transfer camways in opposite directions of travel of the carriage and adapted to engage the lugs of the intermediate jacks of selected needles for advancing said needles to transfer position, and rearwardly disposed alternately operating controlling cams adapted to engage the outer jacks of said selected needles for advancing their respective intermediate jacks to operative position, whereby to position selected needles in transfer position subsequent to their knitting operation and simultaneously effect knitting and stitch-transferring operation diminishing the number of loops in successive rows of a knitted article during a complete traversing movement of the carriage.

2. In a knitting machine of the V-bed type having upwardly inclined front and rear needle beds and a carriage reciprocating over said needle beds, transfer-clip needles slidable in said needle beds and having rearwardly disposed lugs, outer jacks slidable in said needle beds, intermediate jacks slidable in said needle beds, lugs on said outer and intermediate jacks, said intermediate and outer jacks being independently adjustable to forward operative position, said intermediate jacks and said outer jacks both extending outwardly of said needle beds, front and rear cam plates mounted on said carriage, each of said cam plates defining a centrally disposed knitting camway for reception of the needle lugs in knitting position, outer fixed transfer cams on both sides of said cam plate defining a pair of transfer camways for selectively receiving certain of the needle lugs in extreme forward transfer position, auxiliary transfer cams disposed rearwardly of said outer transfer cams and normally advancing all of the needle lugs to a receiving position rearwardly of said transfer position, centrally disposed controlling cams cooperating with said knitting camway and adapted to engage the lugs of said intermediate jacks for advancing the needles to knitting position, extensible and retractable outer controlling cams alternately cooperating with each of said transfer camways in opposite directions of travel of the carriage and adapted to engage the lugs of the intermediate jacks of selected needles for advancing said needles to transfer position, and rearwardly disposed, alternately operating controlling cams adapted to engage the outer jacks of said selected needles for advancing their respective intermediate jacks to operative position, whereby to position selected needles in transfer position subsequent to their knitting operation and simultaneously effect knitting and stitch-transferring operations diminishing the number of loops in successive rows of a knitted article during a complete traversing movement of the carriage.

3. In a knitting machine of the V-bed type having upwardly inclined front and rear needle beds and a carriage reciprocating over said needle beds, transfer-clip needles slidable in said needle beds and having rearwardly disposed lugs, outer jacks slidable in said needle beds, intermediate jacks slidable in said needle beds, lugs on said outer and intermediate jacks, said intermediate and outer jacks being independently adjustable to forward operative position, said intermediate jacks and said outer jacks both extending outwardly of said needle beds, each of said intermediate jacks having an offset, rearward leg portion underlying a respective outer jack, front and rear cam plates mounted on said carriage, each of said cam plates defining a centrally disposed camway for reception of the needle lugs in knitting position, outer fixed transfer cams on both sides of said cam plate defining a pair of transfer camways for selectively receiving certain of the needle lugs in extreme forward transfer position, auxiliary transfer cams disposed rearwardly of said outer transfer cams and normally advancing all of the needle lugs to a receiving position rearwardly of said transfer position, centrally disposed controlling cams cooperating with said knitting camway and adapted to engage the lugs of said intermediate jacks for advancing the needles to knitting position, extensible and retractable outer controlling cams alternately cooperating with each of said transfer camways in opposite directions of travel of the carriage and adapted to engage the lugs of the intermediate jacks of selected needles for advancing said needles to transfer position, and rearwardly disposed, alternately operating controlling cams adapted to engage the outer jacks of said selected needles for advancing their respective intermediate jacks to operative position, whereby to position selected needles in transfer position subsequent to their knitting operation and simultaneously effect knitting and stitch-transferring operations diminishing the number of loops in successive rows of a knitted article during a complete traversing movement of the carriage.

4. A knitting machine in accordance with claim 1 further characterized in that said last-mentioned controlling cams are wedge-shaped and retractable, presenting opposed extended leading edges in their operative extended position.

5. A knitting machine in accordance with

claim 2 further characterized in that said last-mentioned controlling cams are wedge-shaped and retractable, presenting opposed extended leading edges in their operative extended position.

6. A knitting machine in accordance with claim 3 further characterized in that said last-mentioned controlling cams are wedge-shaped and retractable, presenting opposed extended leading edges in their operative extended position.

7. In a knitting machine of the V-bed type having upwardly inclined front and rear needle beds and a carriage reciprocating over said needle beds, transfer-clip needles slidable in said needle beds and having rearwardly disposed lugs, outer jacks slidable in said needle beds, intermediate jacks slidable in said needle beds, lugs on said outer and intermediate jacks, said intermediate and outer jacks being independently adjustable to forward operative position, front and rear cam plates on said carriage, each of said cam plates having a foremost longitudinal group of cam blocks defining a centrally disposed knitting camway for reception of the needle lugs in knitting position and a pair of outer transfer camways for selectively receiving certain of the needle lugs in extreme forward transfer position and auxiliary transfer cams disposed rearwardly of each of said transfer camways and normally advancing all of the needle lugs to a receiving position rearwardly of said transfer position; a second group of cam blocks comprising centrally disposed controlling cams cooperating with said knitting camway and adapted to engage the lugs of said intermediate jacks for advancing the needles to knitting position, said centrally disposed controlling cams comprising an intermediate triangular resetting cam and a pair of wing cams spaced from said resetting cam, and a pair of outer controlling cams alternately cooperating with each of said transfer camways in oposite directions of travel of the carriage and adapted to engage the lugs of the intermediate jacks of selected needles for advancing said needles to transfer position, each pair of said last mentioned controlling cams comprising a triangular resetting cam and a pair of extensible and retractable wing cams spaced therefrom; and a third group of alternately operating controlling cams adapted to engage the outer jacks of said selected needles for advancing their respective intermediate jacks to operative position, whereby to position selected needles in transfer position subsequent to their knitting operation and simultaneously effect knitting and stitch-transferring operation diminishing the number of loops in successive rows of a knitted article during a complete traversing movement of the carriage.

8. In a knitting machine of the V-bed type having upwardly inclined front and rear needle beds and a carriage reciprocating over said needle beds, transfer-clip needles slidable in said needle beds and having rearwardly disposed lugs, outer jacks slidable in said needle beds, intermediate jacks slidable in said needle beds, lugs on said outer and intermediate jacks, said intermediate and outer jacks being independently adjustable to forward operative position, said intermediate jacks and said outer jacks both extending outwardly of said needle beds, front and rear cam plates on said carriage, each of said cam plates having a foremost longitudinal group of cam blocks defining a centrally disposed knitting camway for reception of the needle lugs in knitting position and a pair of outer transfer camways for selectively receiving certain of the needle lugs in extreme forward transfer position and auxiliary transfer cams disposed rearwardly of each of said transfer camways and normally advancing all of the needle lugs to a receiving position rearwardly of said transfer position; a second group of cam blocks comprising centrally disposed controlling cams cooperating with said knitting camway and adapted to engage the lugs of said intermediate jacks for advancing the needles to knitting position, said centrally disposed controlling cams comprising an intermediate triangular resetting cam and a pair of wing cams spaced from said resetting cam, and a pair of outer controlling cams alternately cooperating with each of said transfer camways in opposite directions of travel of the carriage and adapted to engage the lugs of the intermediate jacks of selected needles for advancing said needles to transfer position, each pair of said last-mentioned controlling cams comprising a triangular resetting cam and a pair of extensible and retractable wing cams spaced therefrom; and a third group of alternately operating controlling cams adapted to engage the outer jacks of said selected needles for advancing their respective intermediate jacks to operative position, whereby to position selected needles in transfer position subsequent to their knitting operation and simultaneously effect knitting and stitch-transferring operation diminishing the number of loops in successive rows of a knitted article during a complete traversing movement of the carriage.

9. In a knitting machine of the V-bed type having upwardly inclined front and rear needle beds and a carriage reciprocating over said needle beds, transfer-clip needles slidable in said needle beds and having rearwardly disposed lugs, outer jacks slidable in said needle beds, intermediate jacks slidable in said needle beds, lugs on said outer and intermediate jacks, said intermediate and outer jacks being independently adjustable to forward operative position, said intermediate jacks and said outer jacks both extending outwardly of said needle beds, each of said intermediate jacks having an offset, rearward leg portion underlying a respective outer jack, front and rear cam plates on said carriage, each of said cam plates having a foremost longitudinal group of cam blocks defining a centrally disposed knitting camway for reception of the needle lugs in knitting position and a pair of outer transfer camways for selectively receiving certain of the needle lugs in extreme forward transfer position and auxiliary transfer cams disposed rearwardly of each of said transfer camways and normally advancing all of the needle lugs to a receiving position rearwardly of said transfer position; a second group of cam blocks comprising centrally disposed controlling cams cooperating with said knitting camway and adapted to engage the lugs of said intermediate jacks for advancing the needles to knitting position, said centrally disposed controlling cams comprising an intermediate triangular resetting cam and a pair of wing cams spaced from said resetting cam, and a pair of outer controlling cams alternately cooperating with each of said transfer camways in opposite directions of travel of the carriage and adapted to engage the lugs of the intermediate jacks of selected needles for advancing said needles to transfer position, each pair of said last-mentioned controlling cams comprising a triangular resetting cam and a pair of extensible

and retractable wing cams spaced therefrom; and a third group of alternately operating controlling cams adapted to engage the outer jacks of said selected needles for advancing their respective intermediate jacks to operative position, whereby to position selected needles in transfer position subsequent to their knitting operation and simultaneously effect knitting and stitch-transferring operation diminishing the number of loops in successive rows of a knitted article during a complete traversing movement of the carriage.

10. A knitting machine in accordance with claim 7 further characterized in that said third group of controlling cams are wedge-shaped and retractable, presenting opposed extending leading edges in their operative extended position.

11. A knitting machine in accordance with claim 8 further characterized in that said third group of controlling cams are wedge-shaped and retractable, presenting opposed extending leading edges in their operative extended position.

12. A knitting machine in accordance with claim 9 further characterized in that said third group of controlling cams are wedge-shaped and retractable, presenting opposed extending leading edges in their operative extended position.

WALTER GRANOV.

No references cited.