April 27, 1948. H. WEINSTEIN 2,440,496

FLAT KNITTING MACHINE

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Fig. 1.

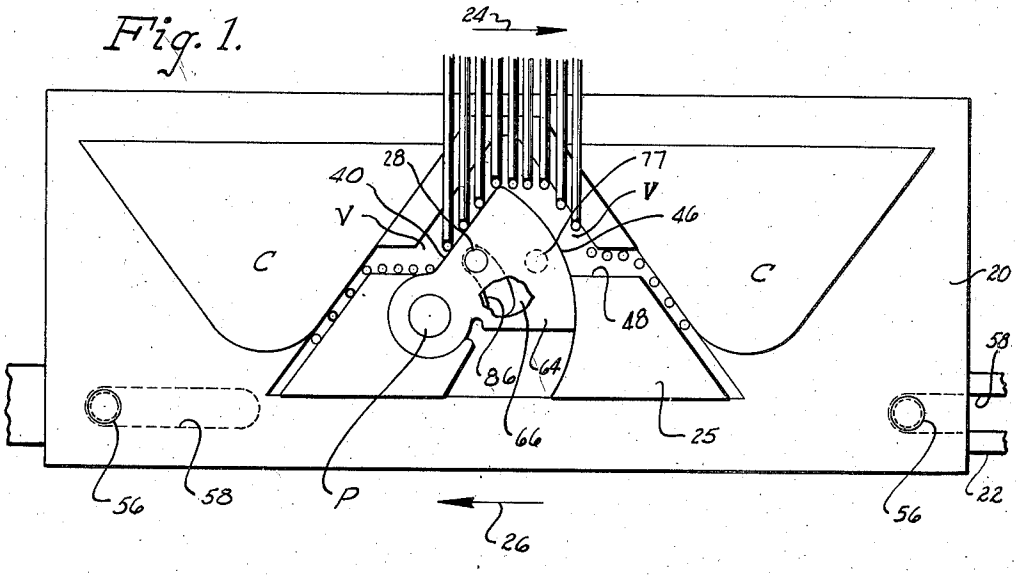


Fig. 2.

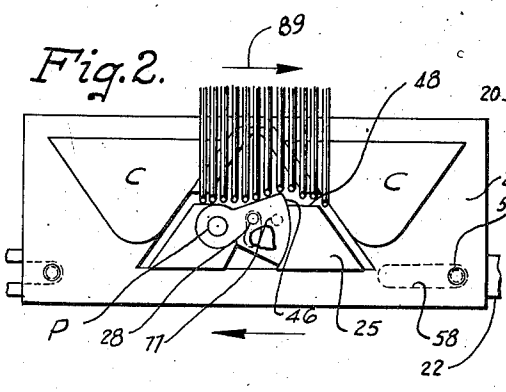


Fig. 3.

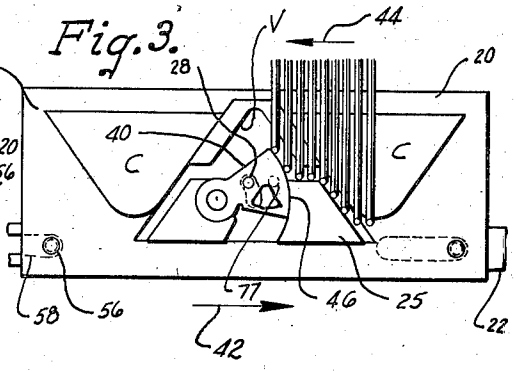
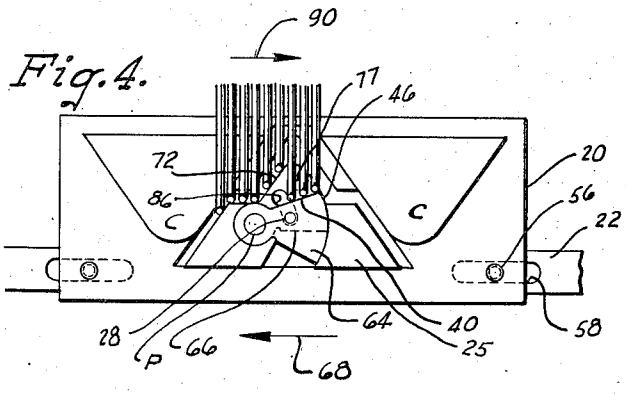


Fig. 4.



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Fig. 5.

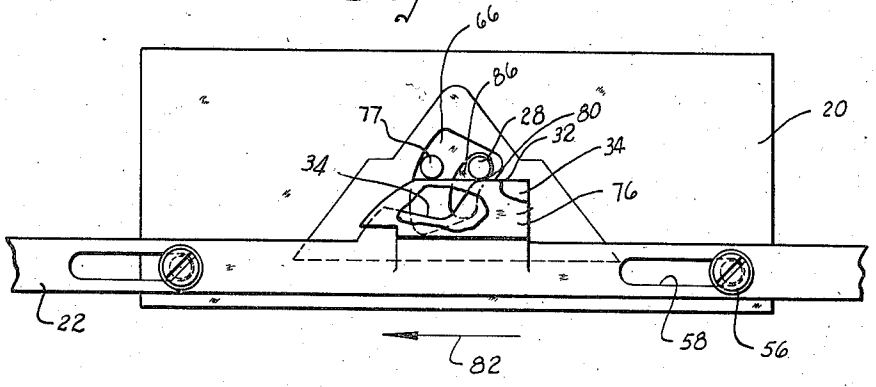


Fig. 7.

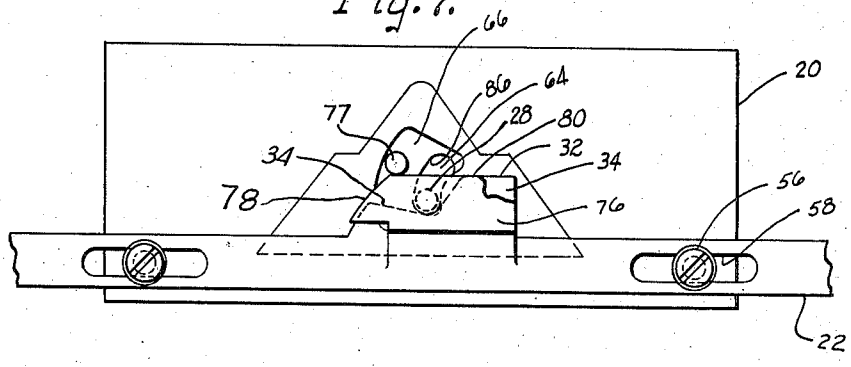
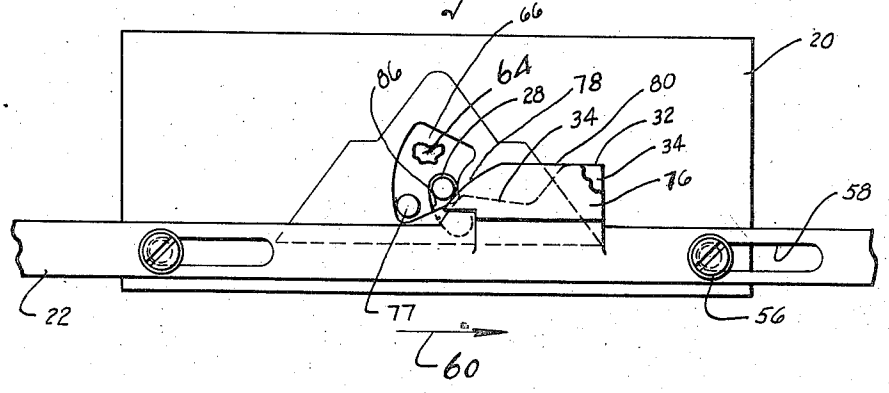


Fig. 6.



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Fig. 11.

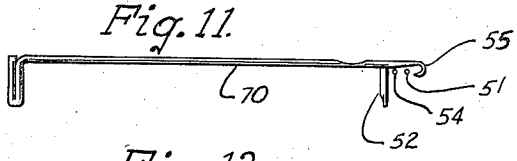


Fig. 12.

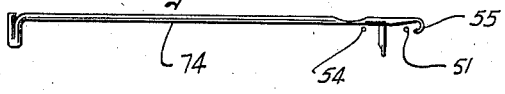


Fig. 8.

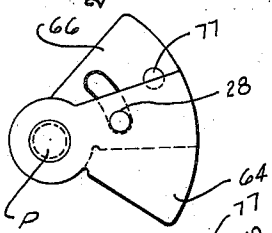


Fig. 13.

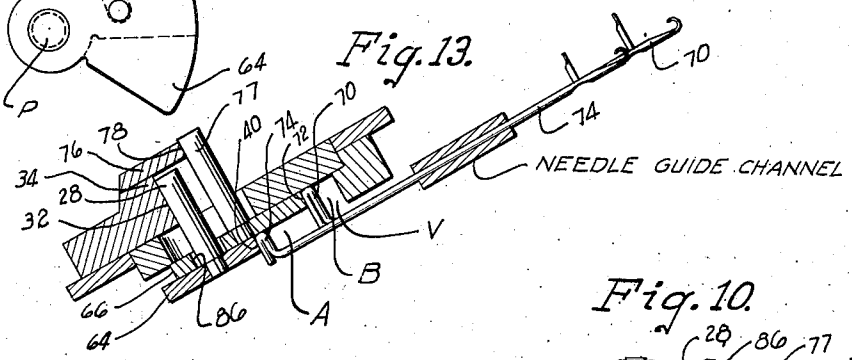


Fig. 10.

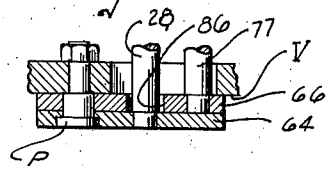
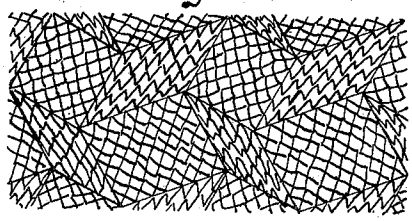


Fig. 14



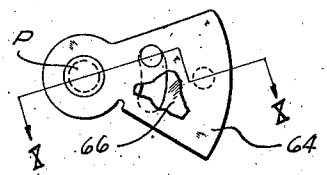


Fig. 9.

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UNITED STATES PATENT OFFICE

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FLAT KNITTING MACHINE

Harry Weinstein, Brooklyn, N. Y.

Application June 12, 1947, Serial No. 754,117

3 Claims. (Cl. 66—68)

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My invention relates to a flat knitting machine of the type which is used in making sweaters and other knit articles.

One object of the invention is to produce an improved knitting machine of the type set forth.

Knitting machines of the type referred to include a pivoted cam which is known as a drop lock, and which is movable to one position in which the needles will form tuck stitches and to a second position in which the needles will form regular or slip loops. The machine also includes means for locking the drop lock in one of said positions, or for leaving the drop lock free to move about its pivot, to one of said positions by the movement of the needle bed in one direction, and to the other of said positions by movement of the needle bed in the opposite direction, whereby both tuck and slip loop stitches may be selectively formed. Assuming, for the moment, that the knitting machine is provided with needles having uniform short latches, it will be seen that when the drop lock is locked in an upper, or outer position so as to move the needles nearer to the yarn, the short latch needles will form slip loop stitches exclusively. Conversely, if the the drop lock is fixed in its lower or inner position, the short latch needles will form cardigan stitches exclusively. When the drop lock is free to move to its lower position by movement of the needles in one direction, the short latch needles will form tuck stitches and when the drop lock is moved to its upper position by movement of the bed plate in the reverse direction, the short latch needles will form slip loop stitches. Usually, however, the knitting machines are equipped short latched and long latched needles, suitably interspersed, with the result that when the drop lock is in its lower position, the long latch needles will form slip loop stitches while the short latch needles will form tuck stitches. When the drop lock is in its upper position all of the needles will form slip loop stitches. By this means, different stitches can be produced and since different stitches present different appearances, it follows that by predetermined distribution or disposition of the different stitches throughout the fabric, different designs or visual effects are produced.

However, the disposition of the tuck and slip loop stitches in the finished fabric is necessarily limited (*a*) by the two positions of the drop lock and (*b*) by the provision of long latch and short latch needles and by the distribution or disposition of the two types of needles. Therefore, the designs that can be produced are accordingly limited.

It is, therefore, a further object of the invention to produce an improved drop lock whereby a greater variety in the disposition of the different stitches can be attained, thereby automatically producing knitted fabrics having a large variety of predetermined but different designs.

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A still further object is to accomplish the foregoing objects by very simple and inexpensive means which can be readily incorporated in the structure of conventional machines without any material alteration of the structure of such machines.

These and other objects are attained by my invention as set forth in the following specification and as illustrated in the accompanying drawings in which:

Fig. 1 is a diagrammatic bottom plan view of a portion of the bed plate of a flat knitting machine embodying my invention and showing the drop lock in the position in which the needles will form slip loop stitches.

Fig. 2 is similar to Fig. 1 but showing the drop lock in the position in which the needles will form tuck stitches.

Fig. 3 is a view illustrating the manner in which, when the drop lock is not locked in position, it is moved by the needles from the position of Fig. 2 to the position of Fig. 1.

Fig. 4 is similar to Fig. 1, but showing the split drop lock of my invention in still another position thereof.

Fig. 5 is a plan view of the other or top side of the structure of Fig. 1 showing the position of the locking means which retain the drop lock when the latter is to be fixedly retained in the position of Fig. 1.

Fig. 6 is similar to Fig. 5, but showing the position of the locking means when the drop lock is free to move from the position of Fig. 2 to the position of Fig. 3 and vice versa.

Fig. 7 is a view similar to Fig. 5, but showing the position of the locking means when the drop lock is in a position to operate as illustrated in Fig. 4.

Fig. 8 is a bottom plan view of the split drop lock of my invention showing the parts thereof in angularly displaced or non-coinciding position.

Fig. 9 is similar to Fig. 8, but showing the parts of the drop lock in coinciding position.

Fig. 10 is a sectional view on line 10—10 on Fig. 9.

Fig. 11 is a plan view of a high-butt knitting needle forming part of the invention.

Fig. 12 is a plan view of a low-butt needle also forming part of the invention.

Fig. 13 is a diagrammatic sectional view illustrating the positions of the needles of Figs. 11 and 12 relative to the split-drop lock when the latter is in the positions of Figs. 4 and 8.

Fig. 14 is a diagrammatic view illustrating some of the designs which can be formed in a fabric knit on a conventional flat machine equipped with the split-drop lock and the two types of needles of my invention.

In the drawings there is shown a bed plate 20 carried by a reciprocating frame or housing which is conventional and is, therefore, not shown or described. It is sufficient for the purposes of this application to state that, a machine of the type under consideration includes two plates 20 which are juxtaposed at about a 45 degree and that, in performing the usual knitting operation, the bed plates and the arms 22 carried thereby, reciprocate as shown by the arrows 24 and 26 in Fig. 1.

On its under side, each plate 20 is provided with fixed or adjustable cams which are generally and collectively designated by the letter C. These cams coact with fixed lugs 25 to form a sinuous channel which is engaged by the butts of the needles to guide and predetermine the action of the needles. Since these cams and lugs form no part of the invention, they will not be further described; it being merely pointed out that the needles only knit while their butts are passing across the apex of the V-shaped portion of the channel which for convenience of reference is designated by the letter V. See Fig. 3.

In conventional machines, a one-piece drop lock is pivoted at P and is movable to either of the positions of Fig. 1 or 2 and can be locked in the position of Fig. 1 by means of a pin similar to the pin 28 which is adapted, in one position of the arm 22, to ride on the straight edge 32 of a cam 34 located on the upper side of the plate 20 and carried by the arm 22. The operation of the conventional cam, being to a certain extent identical with the operation of my invention, and being deemed necessary to provide an appropriate background for a proper appreciation of the present invention is, briefly, as follows:

When the pin 28 rides off the straight edge 32 of the cam 34, from the position of Fig. 5 to the position of Fig. 6, the drop lock will be free to move from the position of Fig. 1 to the position of Fig. 2, and vice versa. Therefore, when the bed plate is moved in the direction of the arrow 26 to produce apparent (not real) movement of the needles relative to the channel V, in the direction of the arrow 24, the needles move over the edge 40 of the drop lock which is now in the position of Fig. 2. During this stroke of the bed plate the needles form the tuck stitch. When the bed plate is moved in the opposite direction, or in the direction of the arrow 42 in Fig. 3, to produce apparent (not real) motion of the needles in the direction of the arrow 44, the needles engage the portion of the curved edge 46 of the drop lock which, in the lowest position of the drop lock, as viewed in Fig. 2, projects above the edge 48 of the right-hand lug 25, and move the drop lock to the position of Fig. 1. In Fig. 3, the drop lock is shown in the process of being raised from the position of Fig. 2 to the position of Fig. 1. In the position of Fig. 1, and assuming that all of the needles have the same length latch, the slip loop stitch will be produced. This is due to the fact that when the needles are at the apex of the V-shaped channel, one of the yarns 51 will be between the latch 52 and the hook 55 of a needle, while the yarn 54 will be between the latch 52 and the butt of the needle, as shown in Fig. 12. Therefore, the latch will close on the yarn 51 only. On the other hand, when the needles move away from the apex of the channel V, as for example, to the position shown in Fig. 2, the yarns 51 and 54 will both be between the latch and the hook, as shown in Fig. 11, and the latch will close on the yarns 51 and 54.

Of course, if the short latch needles of Fig. 12 are interspersed with the long latch needles of Fig. 11, the action of the needles will vary according to the positioning of the drop lock and according to the distribution of the needles.

The drop lock is actuated to, and is retained in, the position of Fig. 1 by means of the bar 22 which is slidably secured to the plate 20 by means of bolts 56 which engage elongated slots 58 formed in the arm 22. The ends of the arm 22 are adapted, when the bed plate reciprocates, to engage adjustable cams or stops (not shown) so as to move the arm 22 longitudinaly relative to the plate 20. For example, when the bed plate moves in the direction of the arrow 60 in Fig. 6, the right-hand end of the arm 22, as viewed in this figure, will strike a cam or stop (not shown) and will move from the position of Fig. 6 to the position of Fig. 5, thus causing the pin 28 to ride over the curved portion of the cam 34 until it comes to rest on the straight edge 32 of the cam, or to the position shown in Fig. 5. In this position, a one-piece drop lock is held in the position of Fig. 1. When the bed plate moves in the opposite direction, the left-hand end of the arm 22 will strike another stop (not shown) and will move the cam 34 out of engagement with the pin 28, as shown in Fig. 6, in which position the drop lock is free to move about its pivot P from the position of Fig. 1 to the position of Fig. 2, and vice versa.

The timing and the stroke of the arm 22 in its action on the drop lock is determined by the location of the stops which coact with the opposite ends of the arm 22 and, obviously, if the stops are removed, or are so spaced as not to engage the ends of the arm 22, the drop lock will be free to move on its pivot by the relative movement of the needles.

In order to carry out my invention, I split the drop lock to form identical parts 64 and 66, both of which are mounted for free movement on the common pivot P, and I provide means for locking one or both parts of the drop lock in the positions of Figs. 1 or 4, or for permitting free, but joint, movement of both parts of the drop lock, as shown in Figs. 2, 3, and 6. Also, I provide high and low-butt needles for cooperating with split drop lock.

Referring now to Figs. 4 and 8 to 13, inclusive, it will be seen that when the parts 64 and 66 are angularly displaced, the portion B of the channel V, which is adjacent to the edge of the part 66 of the drop lock, will be of the original depth, and that the portion A of the channel occupied by the part 66 will be made shallower by the thickness of the parts 66, as shown in Fig. 13. As the bed plate moves in the direction of the arrow 68 in Fig. 4, the butts of the high-butt needles 70 will engage the edge 72 of the upper part 66 of the drop lock and will be compelled to travel in the deep portion B of the channel V, while the butts of the low-butt needles 74 will clear the edge of the part 66 of the drop lock and will ride over the surface of the part 66 and in contact with the edge 40 of the part 64 of the drop lock, as shown in Figs. 4 and 13. By this means, the function of the short and long latch needles is reversed. To make this sufficiently clear, it is pointed out that, without the split drop lock, and assuming other conditions to be the same, the long latch of the high butt needle will normally close over the two yarns 51 and 54 to form a tuck stitch, while the short latch of the low butt needle will close on only one yarn to form a slip loop stitch. But by

the arrangement shown in Figs. 4 and 13, the butts of the long-latch high-butt needles are at the apex of the channel V, so that the yarn 54 now slips over the latch to the position of Fig. 12, while the butts of the short-latch low-butt needles are remote from the apex of the channel so that the latch will close over the yarns 51 and 54 as shown in Fig. 11. In other words, in addition to the action of the long and short latch needles and the conventional one piece drop lock, I add the novel feature of reversing the functions of the short and long latch needles by raising the long latch needles to a position in which the latch will close on only one yarn to form a slip loop stitch, and by simultaneously lowering the short latch needles to cause the latch to close over both yarns to form a tuck stitch.

By composing the needle bank of low and high-butt needles, judicially disposed or distributed, the formation of tuck stitches and slip loop stitches can be predetermined. For example, if ten high-butt needles are followed by five low-butt needles, which, in turn, are followed by fifteen high-butt needles, and so on and on, a fabric having patches of different appearances or designs, such as that diagrammatically shown in Fig. 14 may be produced, and by varying the number and/or dispositions of the high and low-butt needles, other predetermined patterns are produced. Likewise by using the split-drop lock of my invention in the same manner as a one piece drop lock at certain intervals and by using it as shown in Figs. 4 and 13 to reverse the action of the two types of needles at other intervals, I produce new designs, such as example as those diagrammatically shown in Fig. 14, which designs could be produced by the cooperation of the long latch and short latch needles with a one piece drop lock as in conventional practice.

In combination with the split drop lock and the high-butt and low-butt needles, I provide means for controlling the position of the parts 64 and 66 of the drop lock. This means includes an additional cam 76, also carried by the arm 22, and a pin 77 carried by the upper side of the part 66 of the drop lock and adapted to ride over the curved surface 78 and onto the straight edge 80 of the cam 76, as shown in Figs. 5 and 7. The operation of pin 77 and the cam 76 supplements the operation of the pin 28 and the cam 34 and is as follows:

When the arm 22 moves to its extreme position in the direction of the arrow 82 in Fig. 5, the cams 34 and 76 both move to a position in which the pins 28 and 77 will ride on the straight edges 32 and 80 of the cams 34 and 76, respectively. This retains the drop lock parts 64 and 66 in their coinciding position of Fig. 1, and the needles, as long as this condition prevails, will form slip loop stitches exclusively, regardless of whether the needles used are low or high-butt needles. The operation of the machine now is identical with that of a machine having a one-piece drop lock which is locked in the position of Fig. 1 by the pin 28 riding on the straight edge 32 of the cam 34. When the arm 22 moves to its extreme position in the direction of the arrow 60 in Fig. 6, both the pins 28 and 77 drop off the cams 34 and 76, as shown in Fig. 6. The parts 64 and 66 of the drop lock are now free to move about their pivot, but, because of the fact that in this position the pin 28 of the part 64 engages the end of the slot 86 in the part 66 of

the drop lock, it follows that, if the part 64 is moved, as for example, in clockwise direction, as viewed in Fig. 6, the parts 66 and 64 of the drop lock will be integrated and will move jointly. Therefore, when the needles have apparent motion in the direction of the arrow 44 in Fig. 3, the parts 64 and 66 of the drop lock will be engaged by the needles and will be moved, as a unit, to the position of Fig. 1. Conversely, when the needles have apparent motion in the direction of the arrow 89 in Fig. 2, both parts of the drop lock will move jointly to the position shown in Fig. 2.

When the arm 22 moves to the intermediate position of Fig. 7, the pin 77 of the part 66 of the drop lock will ride on the straight edge 80 of the cam 76 so as to lock the part 66 in the position of Fig. 4, while the pin 28 of the part 64 of the drop lock continues to ride on the low edge of the cam 34, as shown in Fig. 7. The part 66 of the drop lock is thus locked in the position of Fig. 4, while the part 64 remains free to move from the position of Fig. 2 to that of Fig. 1 and vice versa. In this position, also, when the needles have apparent motion in the direction of the arrow 90 in Fig. 4, the high-butt needles will ride in the portion B of the channel V, with the butts of the needles in contact with the edge of the part 66 of the drop lock, while the short-butt needles will ride over the surface of the part 66 of the drop lock and in contact with the edge of the part 64 of the drop lock. On the other hand, when the needles have apparent motion in the direction of the arrow 44 in Fig. 3, the needles will engage the edge of the part 64 of the drop lock and will move it, in direction, as viewed in Fig. 4, to a position in which the part 64 coincides with the part 66 of the drop lock. In this position, all the needles, low-butt or high-butt, will travel in the apex or deep portion B of the channel V.

Since the order in which the low-butt and high-butt needles can be arranged to be varied at will, and since the action of the arm 22 in moving the cams 34 and 76 into and out of engagement with the pins 28 and 77 can also be varied at will, it will be seen that a large variety of designs, not heretofore obtainable, can be produced in a fabric which is knit on a machine provided with the split drop lock and the requisite number of low-butt and high-butt needles embodying my invention.

I claim:

1. A flat knitting machine including a reciprocating bed plate, wall structure disposed on one side of said plate and defining a recess, a bank of needles, means supporting said needles adjacent said bed plate with the butts of said needles engaging said channel, said needles being movable, by the reciprocal movement of said bed plate, in a direction normal to the direction of the movement of said bed plate, certain of said needles having relatively high butts and relatively long latches, and certain of said needles having relatively low butts and relatively short latches, a stitch regulating device disposed in said recess and coacting with said wall structure to define a V-shaped channel, said regulating device being movable to a first position in which the butts of all of said needles are moved toward the apex of said channel, and to a second position in which the butts of the high butt needles are moved toward the apex of said channel and the butts of the low butt needles are moved away from the apex of said channel to vary the type

of stitch formed by said low and high butt needles, and means operable by the reciprocal movement of said bed plate to move said stitch regulating device into either of said positions.

2. The structure recited in claim 1 in which said stitch regulating device includes a pair of cams, a pivot common to said cams for securing them in position, said cams being moveable about said pivot to a first position in which said cams coincide and are located near the apex of said channel to cause the butts of all of the needles to move toward the apex of said channel, to a second position in which said cams also coincide but are located at a point spaced from the apex of said channel to cause the butts of all of the needles to move away from the apex of said channel, and to a third position in which one of said cams is located near the apex of said channel and forces the butts of the high butt needles to

move toward the apex of said channel, and the other of said cams is located at a point spaced away from said apex to cause the butts of the low butt needles to move away from the apex of said channel, and in which said actuating means is operable to move said cams jointly to the first and third positions, and separately to said second position, and is adapted to lock said cams in either of said first or third positions.

3. The structure recited in claim 2 in which one of said cams is provided with an arcuate slot and the other of said cams is provided with a pin which passes through said slot, and in which said actuating means is arranged for selectively engaging and moving either or both of said pins, selectively to move said cams to any of the said three positions.

HARRY WEINSTEIN.