Aug. 18, 1953 J. VÁCLAVÍK ET AL 2,648,960

APPARATUS FOR THE MANUFACTURE OF STOCKINGS IN A SINGLE WORKING PROCESS

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FIG. 2.

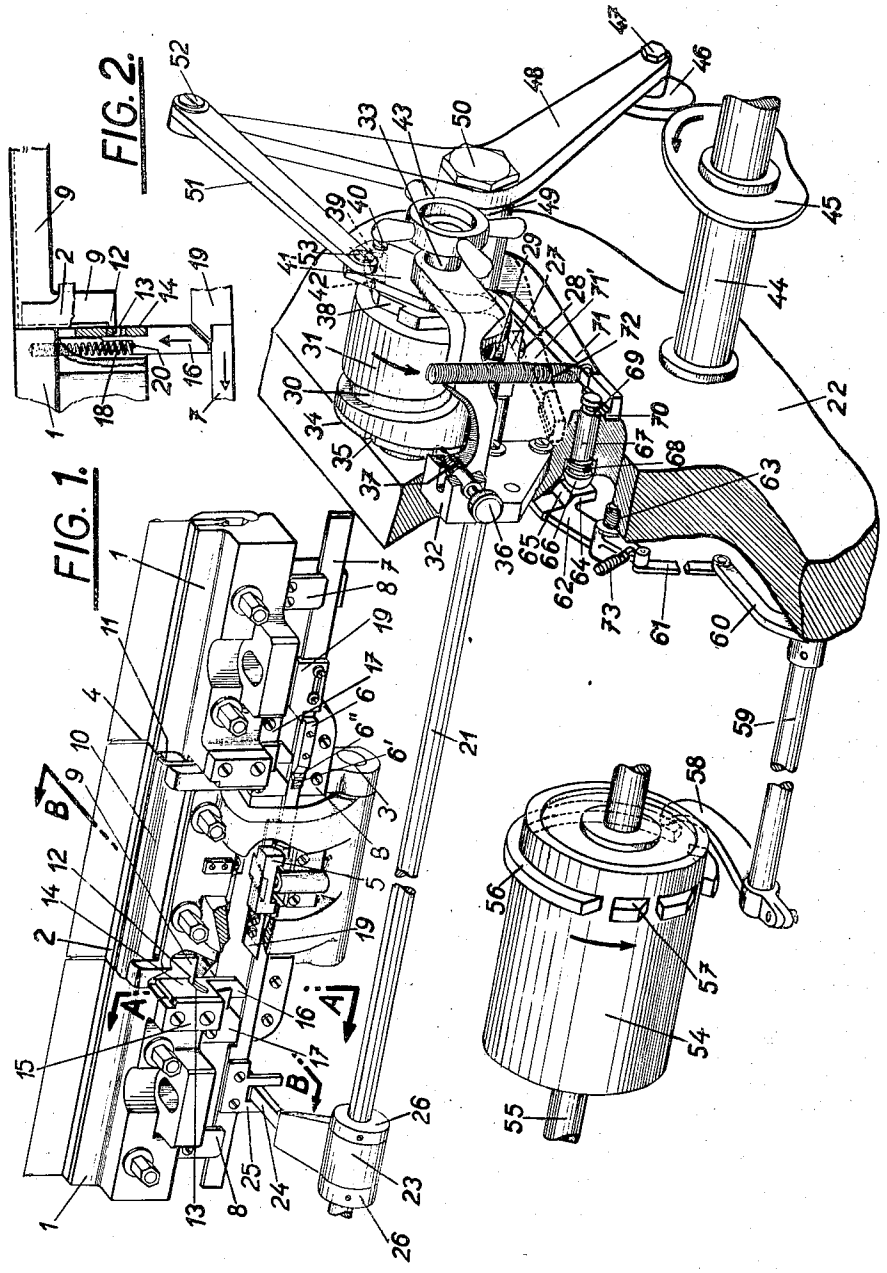

FIG. 1.

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FIG. 3.

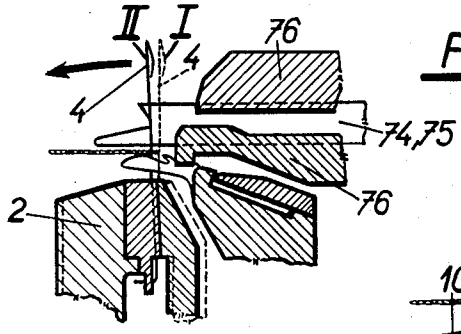


FIG. 4.

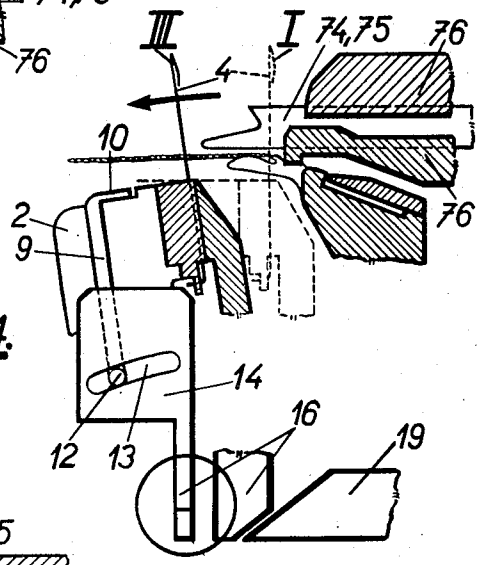


FIG. 5.

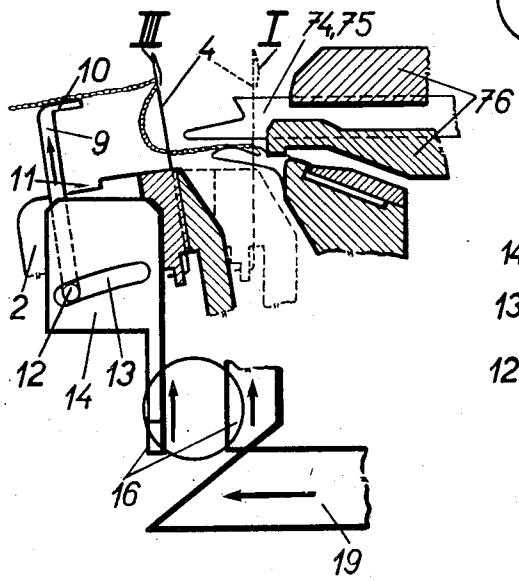
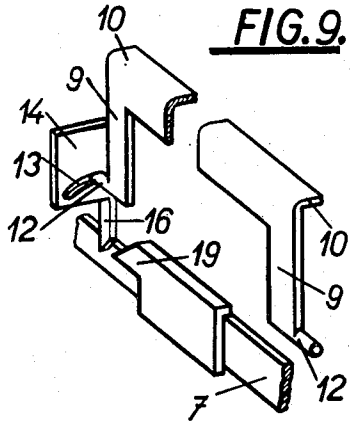


FIG. 9.



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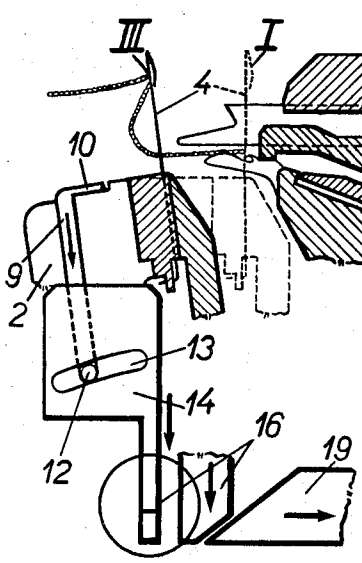

FIG. 6.

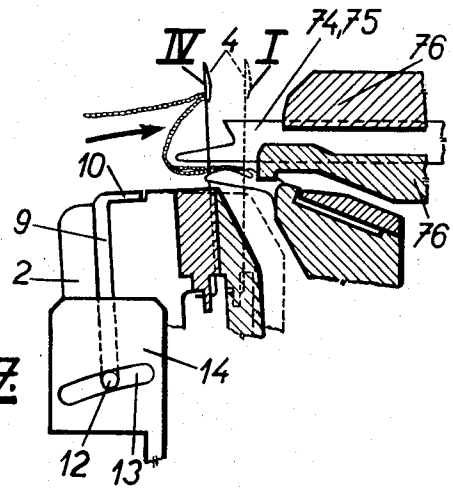

FIG. 7.

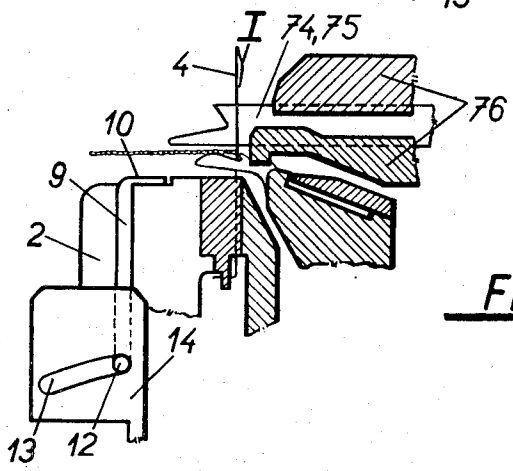

FIG. 8.

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APPARATUS FOR THE MANUFACTURE OF STOCKINGS IN A SINGLE WORKING PROCESS

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Application November 1, 1950, Serial No. 193,384
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2 Claims. (Cl. 66—82)

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The present invention relates to an improved method and apparatus for the manufacture of stockings in a single working process, the apparatus being constituted by a flat weft knitting machine having a sectional needle bar with the middle section of the bar mounted to rock relatively to the main body of the same.

With the use of prior knitting frames of this type, when the knitting of the heel pockets has been terminated and before closing the middle section of the needle bar, the attendant has to lift by hand the knitted vamp of the stocking, which is supported on the needles of the rocked middle section of the needle bar and has not yet been pressed off, in the direction of the needle axes up to a position beneath the needle hooks and this operation is to be carried out separately for each needle bank. The purpose of this operation is to secure reliable and perfect closing of the middle section of the needle bar, more particularly of the end zones, where the vamp and the heel pockets meet when the heel pockets are knitted in to continue the knitting of the following courses extending over the whole width of the stocking foot.

With a plurality of machines to be served by a single attendant, especially if the number of their needle banks is small, the knitting operations on the various machines are not synchronous, so that it is necessary to lift by hand the middle parts or vamps of the stockings at different times and this requires the particular attention of the attendant as should the attendant fail to perform this operation at the right moment, the articles produced may be of lower grade.

The above disadvantages are eliminated by the new method of manufacturing stockings in a single working process in which a sectional needle bar is used of which the middle section is arranged to rock relatively to the main body of the needle bar, the vamp part of the stocking supported on the shanks of the needles of the rocking middle portion of the needle bar being lifted, when the knitting of the heel pockets has been terminated, by an automatically controlled lifting device in the direction of the needle axes up to a position beneath the needle hooks. The automatic operation of the lifting device, when the knitting of the heel pockets has been terminated, does not take place until after the middle section of the needle bar has been rocked to a position out of reach of the sinkers.

The apparatus for carrying out the above outline method, which is formed by a flat weft knitting frame, is designed with the lifting device

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arranged in part in the rockable middle section and in part in the main body of the needle bar so that the lifter, which is guided in the middle section of the needle bar, is adapted to co-operate with sliding members guided in the adjacent main sections of the needle bar whereby the sliding members and the lifter are raised or lowered conjointly in the direction of the needle axes. The co-operation of the lifter with the sliding members is secured by means of two pins which are provided on the lifter and extend from both sides of the middle section of the needle bar so as to engage into closed arcuate slots in the two sliding members. The lifting device is controlled positively in a manner known per se by lateral displacement of a rail which is arranged on the sectional needle bar and is provided with cam elements. The movement of the rail and the rocking of the middle section of the needle bar follow each other at such a sequence that when the knitting of the heel pockets is initiated by a partial displacement of the rail, the middle section of the needle bar is caused to swing and thereby assume a position out of reach of the pressing edge of the sinker head. When a part of the heel pockets has been knitted, a further displacement of the rail takes place causing the middle section of the needle bar to rock to a position out of reach of the sinkers. When the heel pockets are completed, the respective cam elements will raise the lifter whereby the knitted fabric of the vamp portion of the stocking, which is held on the shanks of the needles of the rocked middle section of the needle bar, will be shifted up to a position beneath the needle hooks.

An apparatus for carrying out the method in accordance with the present invention is shown by way of example in the accompanying drawings in which:

Fig. 1 is an axonometric view of the sectional needle bar in position of rest, in conjunction with a lifting device which is controlled by the main cam shaft and pattern drum;

Fig. 2 is a part sectional view at an enlarged scale along the line A—A of Fig. 1 extending parallel to the needle row;

Figs. 3 to 8 are cross-sectional views of the needle bar with the sinker head along the vertical plane B—B of Fig. 1 extending at right angles to the needle row, the parts being shown in different working phases, as is explained more fully hereinafter; and

Fig. 9 is an axometric view of the lifting device.

The sectional needle bar shown in the drawings

is of the known type and comprises two fixed main working sections 1 and a rockable middle section 2, Fig. 1, which is mounted on a pivot pin 3 carried by the needle bar and partakes of all the movements of the main working sections 1 of the needle bar. The rocking of the middle section 2 of the needle bar during the period of knitting the heel pockets and the wedging of the said middle section towards the line of the needles 4 of the main working sections are effected by a closing device 5, known per se, which is arranged upon the rockable middle section 2 and is actuated by a cam element 6 on a rail 7, known per se, mounted for sliding movement in bearings 8 on the main working sections 1 of the needle bar. The cam element 6 is provided with three cam surfaces of different heights, i. e. a lowest face 6' connected through an intermediate face 6'' with the highest face which is level with the surface of the cam element 6.

The lifting device comprises a lifter 9 which is mounted slidably in the rockable middle section 2 of the needle bar and has a part 10 of the same bent out at right angles to the plane of the lifter and adapted to engage into a recess 11 of the rockable middle section 2 of the needle bar whenever the lifter is moved out of its working position (Fig. 4). Pins 12 (Fig. 9) projecting from the lifter 9 on both sides of the rockable middle section 2 of the needle bar engage into arcuate slots 13 formed in sliding members 14. The sliding members 14, which are mounted movably on both sides of the lifter 9 in the fixed main working sections (Fig. 1) and in the lids 15, are provided with projections 16 guided in lids 17 which are fastened on the fixed main sections 1 of the needle bar, and under the effect of compression springs 18 (Fig. 2) the projections 16 are caused to slide either over the upper face of the rail 7 or over cam elements 19 which are adjustably secured to the rail 7 by means of small screws. Each spring 18 mounted vertically in a fixed main working section 1 of the needle bar exerts pressure by its free end on a shoulder 20 of the projection 16 of the sliding member 14 (Fig. 2).

The device for controlling automatically the lateral displacement of the rail 7 for rocking the middle section 2 of the needle bar and producing vertical movement of the lifting device comprises a control rod 21 (Fig. 1) which is parallel with the needle bar and is mounted in the side members 22 of the knitting frame. Within the range of each needle bar the rod 21 has secured thereon a single armed shifting lever 23 of which the free end 24 engages into a fork 25 fastened to the rail 7. The lateral position on the lever 23 is fixed by set rings 26 which are fastened to the control rod 21 on both sides of the hub of the lever 23. The free end of the control rod 21 is mounted slidably in a bracket 32 screwed on the outer wall of the side member 22 and is provided with a block 27 which carries a pivot pin 28 for a roller 29 adapted to engage into a groove 30 formed in a drum 31. The drum 31 is fastened on a short shaft 33 which is mounted with its one end in the side member 22 and with its other end in the bracket 32. On one front face of the drum 31 adjacent to the side member 22 is fastened by screws a division wheel 34 having notches 35 to receive a locking pawl 36. The pawl 36 is mounted slidably in the bracket 32 and is urged by a spring 37 into engagement with the notches 35 of the wheel 34. On the other front face of the drum 31 is fastened by screws a ratchet wheel 38 the teeth of which engage with a pawl 39. The pawl 39 is

pivoted by means of a pin 40 to a driver 41 and is urged by a coiled spring 42 into engagement with the ratchet wheel 38. The driver 41 of the pawl 39 is mounted pivotally on a shoulder of the drum 31. To the end of the small shaft 33 extending from the bracket 32 is fastened a hand wheel 43 which permits to turn the drum 31 by hand.

A partial rotation of the drum 31 (Fig. 1) to control automatically the rocking movement of the middle section of the needle bar and the vertical movement of the lifting device is derived from the main cam shaft 44 of the machine which is mounted rotatably in the side members 22 and carries a cam disc 45. The circumference of the cam disc co-operates during an appropriate period with a roller 46 which is mounted rotatably on a fixed pin 47 provided on one of the arms of a lever 48. The lever 48 is mounted by means of its hub 49 pivotally on a pin 50 screwed into the side member 22 of the machine. The other arm of the lever 48 is connected to the driver 41 by means of a link 51 which at its ends is mounted pivotally on fixed pins 52 and 53.

The apparatus is operated by a pattern drum 54 (Fig. 1) which is mounted rotatably on a supporting spindle 55 carried by the side member 22. The pattern drum is provided on its periphery with a number of wedges 56, 57 which are of the same height but of different lengths and co-operate with a small lever 58 rigidly connected to a shaft 59 mounted in the side member 22. A lever 60 which similarly to the lever 58 is rigidly connected to the shaft 59, is coupled with a link 61 of which the other end is connected to one arm of a small lever 62 freely rotatable about a pin 63 screwed into the side member 22. The other arm of the lever 62 is provided at its free end with a finger 64 and a cam face 65 which is adapted to act for a certain period upon the head 66 of a pin 67 slidable in a bore formed in the side member 22. A spring 68 surrounding the pin 67 and bearing with its ends against the head 66 of the pin and the side member 22, respectively, keeps the head 66 of the pin 67 permanently in contact with that end of the arm of the lever 62 which carries the finger 64. The free end of the pin 67 is provided with a groove 69 which during a certain period receives a lug 70 on a lever 71. The lever 71 is fastened adjustably on the shouldered hub 49 of the double-armed lever 48. A spring 72 secured at its one end to the lever 71 and at its other end to an anchor (not shown) on the side member 22 serves to cause at suitable moments either engagement of the lug 70 on the lever 71 with the groove 69 of the pin 67, or engagement of the roller 46 with the cam discs 45. A spring 73 fastened with its one end to the lever 62 and with its other end to an anchor (not shown) on the side member 22 keeps the end of the lever 58 in contact with the wedges 56 and 57 or with the surface of the pattern drum 54.

The apparatus as far described operates in the following manner:

Before the knitting of the heel pockets is initiated, the needles 4 of the main working sections 1 and of the rockable middle section 2 of the needle bar are all in the same plane (Figs. 1 and 8—position I). At this stage the end of the lever 58 lies on the cam face of the longest wedge 56 on the pattern drum 54 and the finger 64 of the lever 62 exerts pressure upon the head 66 of the pin 67, whereby the groove 69 in the pin 67 engages with the lug 70 on the lever 71 and the roller 46 is out of contact with the circumference

of the cam disc 45. The drum 31, rail 7 and lifter 9 are in their position of rest shown in Figs. 1 and 8.

During the knitting of the first course of meshes of the heel pockets automatic advance of the pattern drum 54 takes place in the direction shown by the arrow in Fig. 1, so that the end of the lever 58 under the action of the spring 73 is caused to slide from the cam face of a wedge 56 down on to the surface of the pattern drum 54. Thereby the lever 60 and link 61 cause the lever 62 to rock so that the finger 64 with the cam face 65 is moved downwards. As at this moment the roller 46 of the lever 48 is brought against the highest point of the circumference of the cam disc 45, the lug 70 of the lever 71 is withdrawn from the groove 69 of the pin 67 and under the action of the compression spring 68 the head 66 of the pin 67 slides along the cam face 65 of the finger 64 on to the free lower end of the lever 62. Thereby the free end of the pin 67 with the groove 69 is caused to enter into the corresponding bore in the side member 22 so that under the action of the spring 72, and of the rolling movement of the roller 46 from the highest point of the cam disc 45 along a part of the circumference of the latter, the lever 71 is caused to rock upwards (to the dotted line position 71' in Fig. 1). At the same time the link 51 and driver 41 are moved back due to the rocking of the lever 48 so that the pawl 39 which slides idly over the circumference of the ratchet wheel 38 will engage with one of the ratchet teeth, whereby an advance of the drum 31 is permitted. Continued travel of the roll 46 around the periphery of the cam disc 45 will cause the ratchet wheel 38 and drum 31 to turn through a certain angle so that under the action of the curved groove 30 in the drum 31 the follower 29 and with it the control rod 21 are moved to the left in a horizontal direction. As soon as the advance of the drum 31 is terminated, the locking pawl 36 falls into a notch 35 of the division wheel 34 whereby the drum 31 is locked for a time in its position of rest. During the advance of the drum 31 the roller 46 has been brought again to the highest point of the circumference of the cam disc 45 and the end of the lever 71 has been brought under the lower edge of the retracted pin 67 against the action of the spring 72. At this moment another advance of the pattern drum 54 takes place causing the end of the lever 58, which still rests on the surface of the pattern drum, to ride up on to one of the short wedges 57. The lever 60 is lowered and the longer arm of the lever 62 is raised so that the cam face 65 of the finger 64 exerts pressure on the head 66 of the pin 67 so as to push the pin out of the side member 22. Immediately the roller 46 has left the highest point of the circumference of the cam disc 45, the lug 70 on the lever 71 will enter the groove 69 in the pin 67. Each rotation of the cam disc 45 corresponds to an advance of the drum 31. The horizontal displacement of the control rod 21 as referred to hereinbefore produces movement in the same direction of the shifting lever 23, fork 25 and rail 7. The closing device 5 of the rockable middle section 2 of the needle bar is unlocked at the beginning of the movement of the rail 7, and during the further movement of the rail, i. e. at the end of the first advance of the drum 31, the lowest cam face 6' of the cam element 6 causes the middle section 2 of the needle bar to rock to such an extent as to make the rocked needles ineffective for pressing (position II in Fig. 3). The first rocking movement of the middle section 2 is small and only sufficient to avoid breaking of the first meshes between the extreme needles of the fixed sections 1 and of the middle section 2 of the needle bars.

When a definite length of heel pockets has been knitted, advance of the pattern drum 54 takes place again, whereby the end of the lever 58 still resting on the surface of one of the short wedges 57 will slide down on to the surface of the pattern drum. The above described means cause the drum to be rotated through the same angle so that the rail 7 is moved further to the left until the inclined faces of its both cam elements 19 are arrested in front of the bevelled end of the extensions 16 of the sliding members 14 (Fig. 2). The highest face of the cam element 6 on the rail 7 will cause by its horizontal movement the middle section of the needle bar to swing through such an angle as to move the needles of this section out of range of the working sinkers 74, 75 (position III in Fig. 4). This provision is necessary in order to avoid damage of the meshes on the needles of the middle section 2 by contact with the sinkers during the constant movement up and down of the needle bar. Due to the said swing of the middle section 2 of the needle bar about the pin 3 to the position shown in Fig. 3, the pins 12 of the lifter 9 travel idly in the respective slots 13 of the sliding members 14, now stationary, so that the lifter 9 remains engaged with its bent part 10 in the middle section 2 of the needle bar. After the swing of the middle section 2 of the needle bar, and of the needles 4 of this section, to the position III (Fig. 4), the section is locked in this position till shortly before the knitting of the heel pockets is terminated, by another advance of the pattern drum 54 by which the end of the lever 58, still resting on the surface of the drum, is brought again to the next short wedge, whereby the advance of the drum 31 is terminated at the same time.

When the knitting of the heel pockets is terminated, an advance of the pattern drum 54 and of the drum 31 takes place in the manner described so that the rail 7 is shifted further to the left whereby the cam elements 19 on the latter will raise the extensions 16 of the sliding members 14 and thus also the lifter 9 to its working position (Fig. 5). Thereby the vamp portion of the stocking is raised in the direction of the needle axes up to a position beneath the needle hooks. With the needle bar middle section 2 and the needles 4 of the same still in the position III, in which the vamp position is held beneath the needle hooks, movement of the rail 7 is initiated in the opposite direction, i. e. to the right, under the action of the components parts described, whereby the extensions 16 of the sliding members 14 are lowered by the compression springs 18 (Fig. 2) from the level of the cam element 19 to the lower level of the surface of the rail 7 which is placed with its broader side in upright position (Fig. 6). The lifter 9 being taken along by the sliding members is returned from its working position to its initial position in which it is fully engaged in the middle section 2 of the needle bar. During the continued movement of the rail 7 to the right, at the moment when the entire needle bar is in its upper position and the pull-in sinkers 74 are retracted in the sinker head, the middle section 2 of the needle bar with the needles 4 return first to an intermediate position IV (Fig. 7) in which they remain during the period of sinking and distribution by the sinkers. Dur-

ing the just mentioned movement of the rail 7 to the right, the intermediate face 6'' of the cam element 6 permits the middle section 2 of the needle bar and the needles 4 to rock back from position III to position IV (Fig. 7). Upon a final advance of the pattern drum 54 and of the drum 31 and lateral movement of the rail 7 to the right, when the entire needle bar is moving downwards and the pulling-in sinkers 74 together with the distributing sinkers 75 are moving in the direction towards the sinker head 76, the needle bar middle section 2 and the needles 4 of the same will return from their intermediate position IV to their initial position I, in which all the needles of the needle bar lie again in the same plane (Figs. 1 and 8). By the return movement of the middle section 2 of the needle bar the knitted fabric is reliably applied on the noses of the retracting sinkers without damage, from position IV to the initial position. The pins 12 of the lifter 9 travel idly in the respective slots 13 of the sliding members 14 which at this stage are stationary so that the lifter 9 remains engaged in the middle section of the needle bar. At this stage the end of the lever 58 is moved again by the pattern drum 54 on to the face of the longest wedge 56 of the pattern drum, so that also the drum 31 and rail 7 are returned to their position of rest (Figs. 1 and 8).

The present invention is not limited to the example shown and described in which various structural modifications may be made without departing from the essential features of the invention. It should be understood that the invention may be applied also to other machines which work under similar conditions.

What we claim is:

1. A flat weft knitting machine comprising a divided needle bar having relatively fixed end sections and a relatively rockable middle section which is tiltable out of working position, a lifting device slidably mounted on said middle section and means part of which is carried by said end sections for automatically raising and lowering said lifting device while said middle section is tilted out of working position.

2. A flat weft knitting machine comprising a divided needle bar having relatively fixed end sections and a relatively rockable middle section, a lifting device slidably supported on said middle section, said lifting device having projections extending laterally over said end sections, sliding members mounted on said end sections adjacent said middle section, said sliding members having arcuate slots into which said projections extend, a rail slidably mounted on said end sections, said rail having cam surfaces adapted upon endwise reciprocation of said rail to engage cam surfaces on said sliding members to raise and lower the same and means for reciprocating said rail.

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