June 8, 1954 J. VÁCLAVÍK 2,680,362

FLAT FULL-FASHIONED TYPE KNITTING MACHINE

Filed June 17, 1949 5 Sheets-Sheet 1

Fig. 1

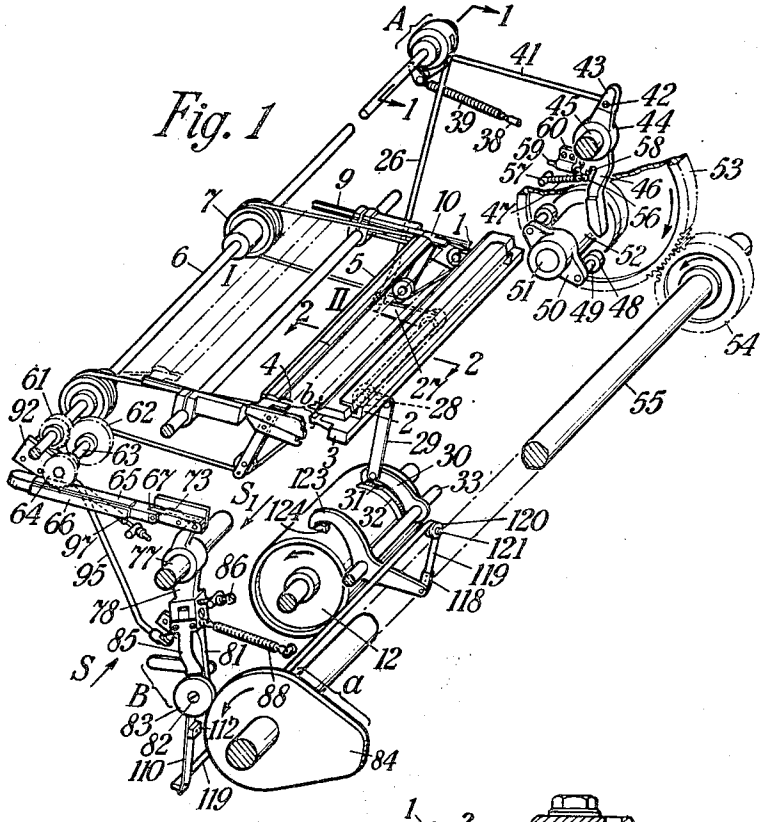


Fig. 5

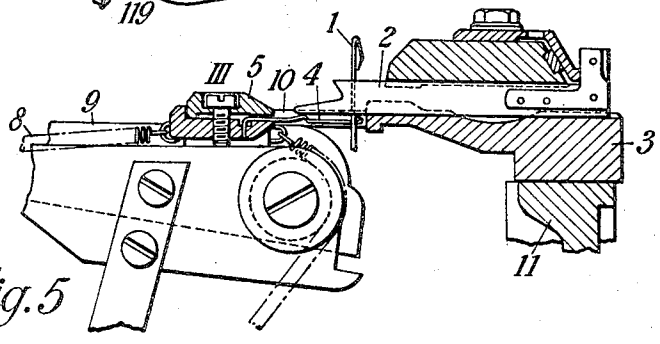
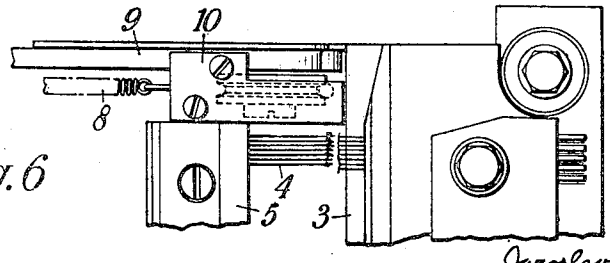


Fig. 6



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Fig. 2

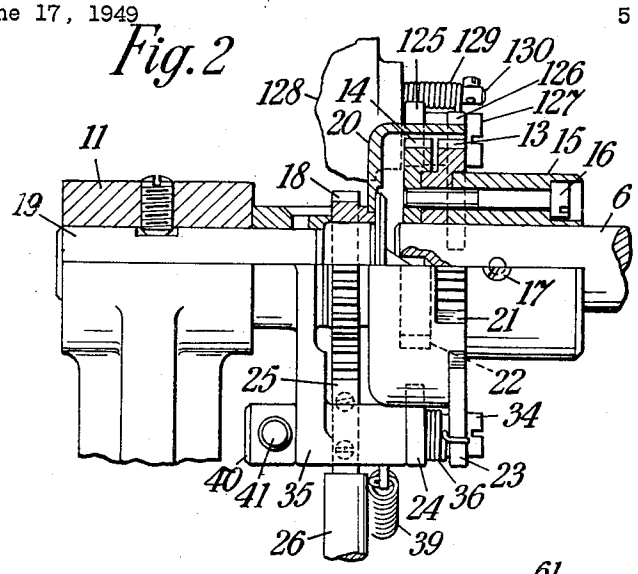


Fig. 3

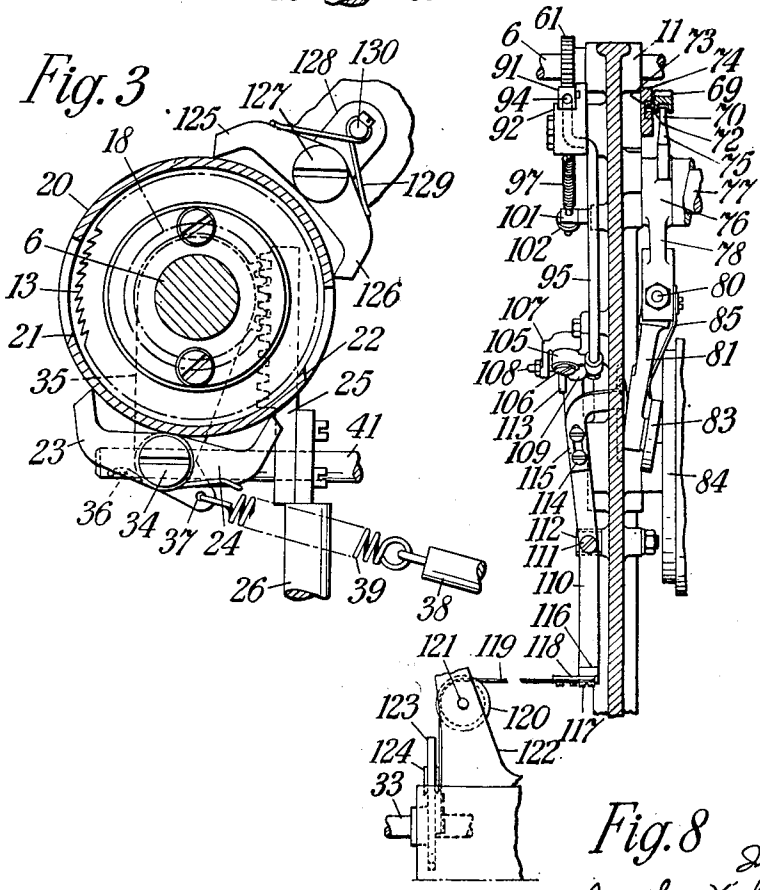


Fig. 8

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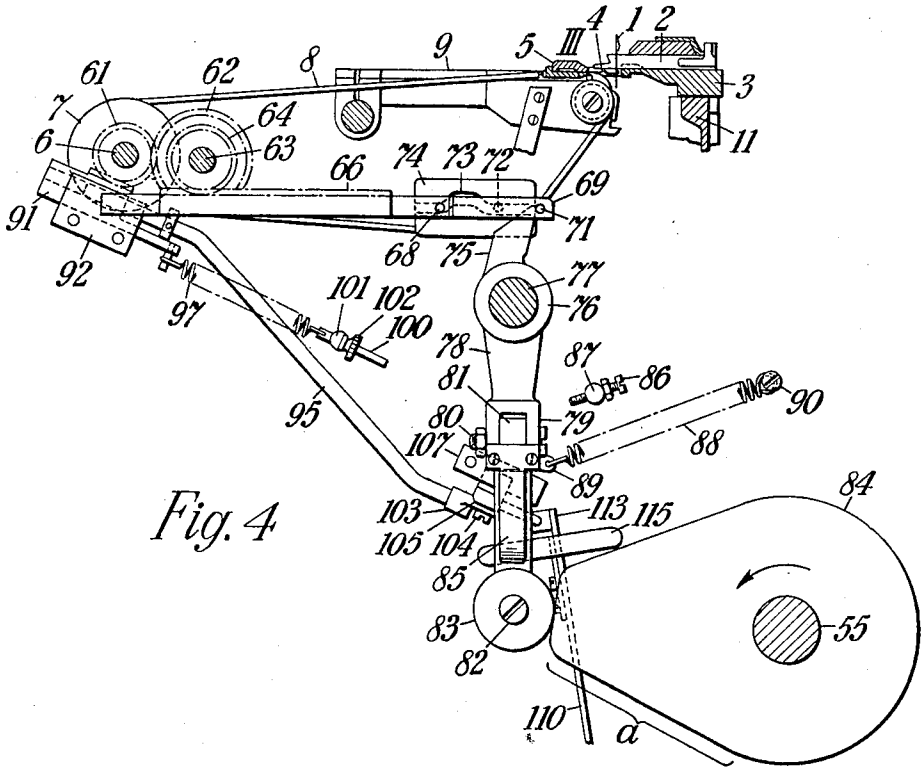


Fig. 4

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FLAT FULL-FASHIONED TYPE KNITTING MACHINE

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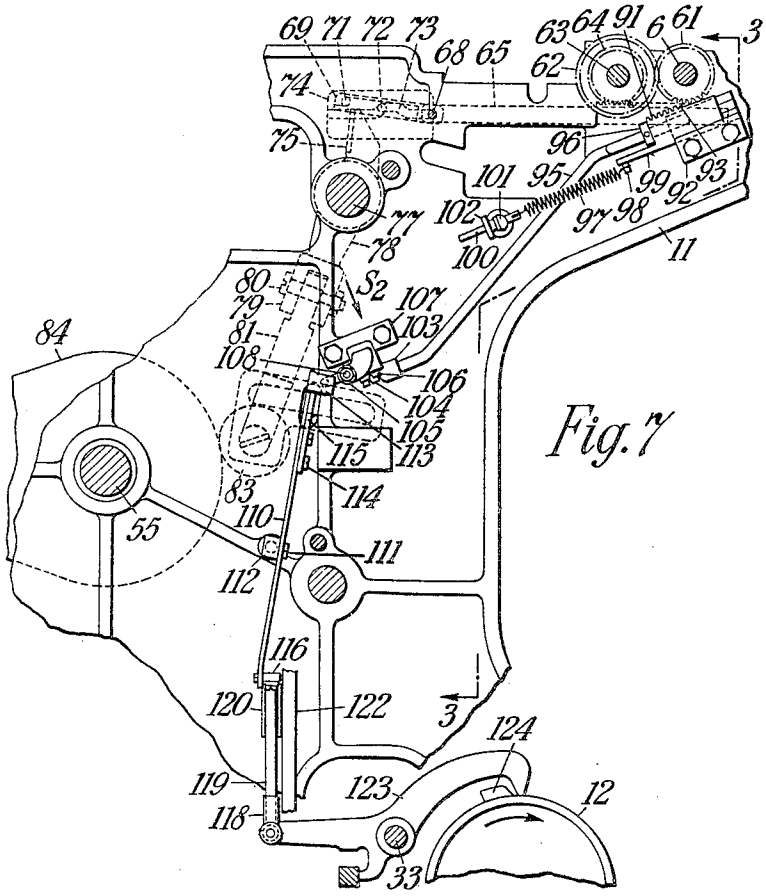


Fig. 7

Fig. 9

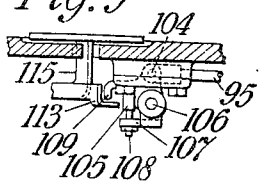
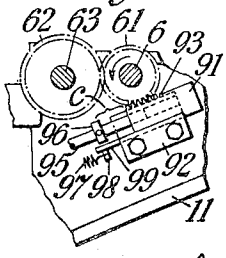


Fig. 10



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FLAT FULL-FASHIONED TYPE KNITTING MACHINE

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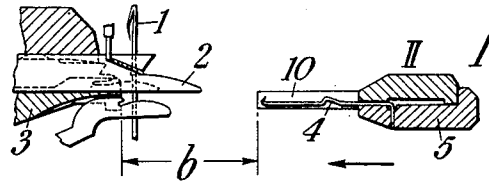


Fig. 11

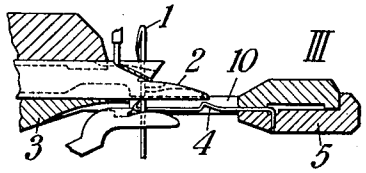


Fig. 12

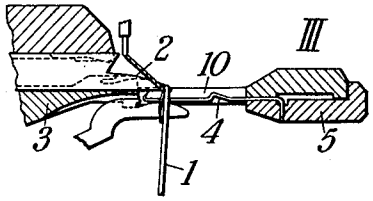


Fig. 13

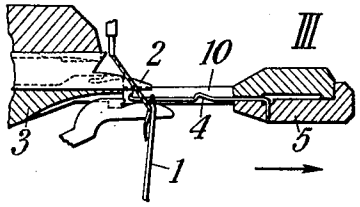


Fig. 14

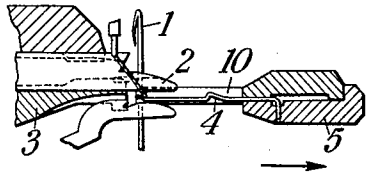


Fig. 15

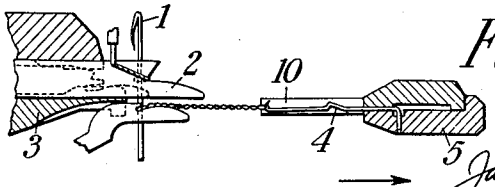


Fig. 16

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UNITED STATES PATENT OFFICE

2,680,362

FLAT FULL-FASHIONED TYPE KNITTING MACHINE

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Application June 17, 1949, Serial No. 99,781

Claims priority, application Czechoslovakia June 21, 1948

16 Claims. (Cl. 66—96)

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This invention relates to a flat full fashioned type knitting frame for knitting hosiery with automatically acting devices for receiving and drawing off the initial courses of double welts, more particularly with horizontally disposed welt bars and automatic forcing off of the knitted piece from the frame needles of the continuously running frame.

In the hitherto known full fashioned type knitting frames of this kind the single mechanical shifting of all the welt bars out of the position of rest into the operative position, that is to say into the range of action of the frame needles, only takes place during the sinking of the loops of the initial courses of the knitted fabric and while the person attending the frame is present, who by suitable manipulations prepares or regulates the action of the appropriate devices. That has the disadvantage, that, if the attendant has a number of frames to watch, the knitting of the hose will not progress synchronously at all the frames and therefore the attendant, even when excising the greatest care, will not be able to carry out at the right moment those manual operations which are necessary for receiving the initial courses of loops on the welt bar needles and for the more powerful drawing off during the knitting of the first course, which will have a detrimental effect on the quality of the knitted goods. Moreover, the relatively long path travelled by the welt bars out of the position of rest into the operative position will, with the frame running more slowly, require a more rapid motion of these welt bars, which is not favourable for obtaining a definite, correct extreme position of the welt bar needles between the frame needles.

In one of the latest constructional forms of flat full-fashioned type of knitting frames with horizontally arranged double welt bars the single, mechanical displacement of the welt bars out of the position of rest into the operative position at the moment, in which the stitches of the initial course are cast off the sinkers, corresponds, after allowing for a suitable transmission ratio, to the total throw of the working eccentric and at the same time overcomes the force stored in a tension spring. This spring commences without any interruption in the running of the frame automatically and independently to draw off the welt bars, as soon as the first course of stitches has been received on their bearded needles, which continues until the welt bars have returned into their initial position, whereby with the continuous increase in the courses of the welt the original stressing of the spring will decrease to a definite initial stressing. This arrangement also necessitates an undesirably long and rapid displacement of the welt bars in the direction towards the frame needles and the presence of the attendant. The considerable ultimate initial stressing of the withdrawing spring renders a sensitive adjustment of the withdrawing strength of the welt bars impossible, which thus on the one hand partially lose the capacity for reliably holding the initial courses or on the other hand cause damage to the stitches or the bearded welt needles.

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A further modern constructional form of flat full-fashioned type knitting frame is known, which is fitted with automatically acting devices for receiving and drawing off the first courses of the welt and which with the frame running continuously and automatic carrying out of some operations seeks to reduce the otherwise considerable losses in output and partially to eliminate the manual operations of the attendant. In this frame the welt bars are mounted so as to be capable of rocking above the row of frame needles in such a manner that for taking up the first course of stitches they will move mechanically out of the position of rest into the operative position. This construction as well requires a relatively great and considerable acceleration in the rocking motion of the welt bars and partial preparation of and control of the work by the attendant, whilst this sufficiently costly and relatively complicated device requires careful maintenance.

In contradistinction to this known state of the art the essential novelty and technical advance of the invention hereinafter described consists in this, that during the knitting of the last courses of the toe of the hose the welt bars move through the automatic rotation of the associated welt bar shaft jointly out of the position of rest into a preparatory position in the vicinity of the frame needles, out of which position these welt bars, the frame running continuously, are given only at the moment of the formation of the next-following initial course of the welt through the rotation of the same welt bar shaft a further, single, common displacement into the operative position, that is into the range of action of the frame needles. With the displacement of the welt bars out of the preparatory position into the operative position the auxiliary drawing off means is at the same time stressed, which then, during the motion of the welt bars out of the operative position into the position of rest or on the initial course of the knitted fabric being formed, performs the drawing off operation without any action on the part of the attendant.

The simultaneous advance displacement of the welt bars out of the position of rest into the preparatory position during the knitting of the last courses of the hosiery is of advantage for the continuous and reliable working of the frame, more particularly for the reason that the next-following single travel of the welt bars out of the preparatory into the operative position is short and may easily correspond to the total throw of the operative eccentric, which with a reduced speed of rotation of the frame causes a retarded displacement of the welt bars into the operative position, resulting more particularly in greater accuracy and reliability of the whole arrangement.

A further improvement in the construction of the knitting frame according to the present invention consists in this, that both the putting into and the putting out of operation of the welt bar shaft is effected step by step by means of two, independently operating drives, for instance a pawl and ratchet drive and a roller actuated drive, which, controlled by the pattern drum, come into operation each time and independently one after the other. The pawl and ratchet drive, by turning the welt bar shaft, brings about the repeated forward feed of all the welt bars out of the position of rest into the preparatory position, whilst the roller actuated drive acts both for the single forward feed of all the welt bars out of their preparatory position into their operative position and for the simultaneous putting into operation of the auxiliary drawing off motion.

The automatic action of the auxiliary drawing off motion guarantees the immediate and reliable reception and holding of the initial courses on the welt bar needle hooks.

A further feature of the present invention resides in this, that the main as well as the auxiliary drawing off by the welt bars operate jointly only during the forming of a definite number of initial courses, after which the automatic interruption of the activity of the auxiliary drawing off is brought about by the tractive force of the shortening spring, whilst the main drawing off action of the welt bars, driven by the pawl and ratchet gear, ceases to act only at the moment of coming into action of the welt rods which are controlled by the take-up straps of the known fabric drum shaft. The motion of the welt bars in the direction of the frame needles ceases automatically partly after the change-over of the welt, partly after the displacement of the welt bars into the position of rest.

The present invention has for its main object completely to eliminate any influence of the attendant on the action of the frame in the period of time, which ends with the last course of the toe of the hose and commences with the first course of the welt, while the frame runs continuously. The manual work of the attendant is restricted entirely to minor operations, such as withdrawing the welt rods out of the welts of the knitted fabric and placing these rods into storing containers and taking off, checking over and sorting the finished knitted goods, changing the bobbins and so forth.

The nature and the advantages of the present invention are clearly laid down in the following description of a constructional example which is illustrated in the accompanying drawings, in which:

Figure 1 is an axonometric representation of the operative part of a flat full-fashioned type knitting frame with automatically acting devices

for receiving and drawing off the initial courses of the welt at the moment, in which a welt bar in the preparatory position is by the further advance of the pattern drum displaced into the operative position;

Figure 2 a vertical section through the pawl and ratchet drive according to I—I of Figure 1 to an enlarged scale;

Figure 3 a side elevation of Figure 2;

Figure 4 a side elevation of Figure 1, viewed in the direction of the arrow "S," but at the moment, in which the welt bar is in the operative position and the auxiliary drawing off arrangement in action;

Figure 5 a detail of the welt bar in the operative position, but to a larger scale;

Figure 6 a view from above of Figure 5;

Figure 7 a partial side view of Figure 1 in the direction of arrow "S_1," the auxiliary drawing off arrangement being out of operation;

Figure 8 a vertical section on the line 3—3 of Figure 7;

Figure 9 a partial view from above on Figure 7 in the direction of arrow "S_2";

Figure 10 a detail of the auxiliary drawing off means in the operative state, that is at the moment, in which the welt bar is in the operative position;

Figures 11 to 16 cross-sections through the sinker head and welt bar on the line 2—2 of Figure 1 during the forming, receiving and drawing off of the first course of loops, the individual figures representing:

Figure 11 sinking the loops of the first course at the moment, in which the distributing sinkers commence to move in the direction towards the frame needles and the welt bars out of their preparatory position II into their operative position III;

Figure 12 the end of the forward motion of the distributing sinkers, the welt bars also having finished its horizontal motion, by its stop pieces bearing against the outer edge of the press of the sinker head, and being in the operative position III;

Figure 13 the placing of the first course of loops on the needles of the welt bar after the pressing of the frame needles;

Figure 14 the receiving of the first course of loops on to the welt bar needles, the auxiliary drawing off at the same time coming into action;

Figure 15 the drawing away of the welt bar out of the range of the frame needles, causing the loops to put themselves into the hooks of the welt bar needles, and

Figure 16 the drawing off of the first and subsequent courses of loops of the welt.

The automatically acting devices illustrated in the aforesaid drawings are provided on a flat full-fashioned type knitting frame, of which only those parts of a working place are to be seen, which have refrence to the subject matter of the invention.

In Figure 1 are to be seen of the known basic appliances for forming the loops the frame needles 1 which coact with the sinkers 2 guided in the sinker head 3 and the welt hooks 4 fixed in the welt bar 5. The welt bar is horizontally displaced in a known manner in the guides 9 by turning the welt bar shaft 6 and the pulleys 7 fixed thereon and through a tension spring 8 embracing the associated pulley 7 being attached with its free ends to the end of the welt bar 5 (see Figures 4 to 6 as well). The welt bar is provided

at its ends with stops 10 which at the end of the forward motion of the welt bar, that is in the operative position III (see more particularly Figures 5, 6 and 12) bear against the outer edge of the pressure-exerting part of the sinker head 3 in such a manner that any damage to the welt hooks 4 which penetrate between the frame needles will be prevented. The welt bar shaft 6 which causes the motion of the welt bar 5 in the direction of the frame needles or back is supported in the walls 11 of the frame, so as to turn loosely therein (Figure 8), which walls are omitted in Figure 1 for the sake of clearness. The rotation of the welt bar shaft 6 is produced either by the pawl and ratchet drive "A" (Figure 1) or the roller gear "B." Both drives are controlled from a pattern drum 12 in such a manner that they are brought into action independently and one after the other.

The pawl and ratchet drive "A" consists, as will be seen from Figures 2 and 3, of two ratchet wheels 13, 14 designed for oppositely directed engagement, which are mounted next to one another at the end of the welt bar shaft 6 and are fixed by screws 16 to the hub 15. The hub 15 is itself fixed by means of a securing screw 17 to the welt bar shaft 6. Around the ratchet wheels 13 and 14 is fixed on a toothed pinion 18, which turns loosely on the fixed pin 19 of the frame wall 11, a circular case 20, the side wall of which is provided with diametrically disposed slots 21, 22 (see more particularly Figure 3). The position at any time of the slots 21, 22 determines which of the two pawls 23, 24 is to engage in the teeth of the associated ratchet wheels and thereby the direction of rotation of the welt bar shaft 6. The pawl 23 and the associated ratchet wheel 13 are the means for turning the welt bar shaft 6 in the clockwise sense (Figure 3), that is for horizontally displacing the welt bar 5 out of its position of rest I into the preparatory position II (see Figure 1), and the pawl 24 with its associated ratchet wheel 14 for turning the welt bar shaft 6 in the opposite sense, that is for withdrawing the welt bars 5 out of their operative position III (Figures 4, 5, 6) into the position of rest I (Figure 1).

The setting of the rotatable slotted case 20 and its slots 21 and 22 in one direction or the other is effected by means of a rack 25 which meshes with the toothed pinion 18 (Figures 2 and 3). This rack 25 is fixed to a pull bar 26, the vertical motion of which is derived by means of rodwork 27, 28, 29 and 30 (Figure 1) from the pattern drum 12 of a known kind, on the surface of which segments 31 and 32 of different height, arranged one behind the other, coact at certain times with the end of the lever 30 which is supported so as to be capable of turning loosely on a pin 33 fixed in the frame wall 11. The segments 31, 32 of different height determine the position of the slotted case 20 (Figures 2 and 3) and thereby the functioning of the pawl and ratchet drive "A." Thus, for instance, the lower segment 31 effects the setting of the slotted case 20 into a neutral position and the higher segment 32 the turning of the slotted case 20 into a position corresponding to the displacing of the welt bars 5 in the direction of the frame needles 1 (Figures 14, 15, 16).

The pawls 23 and 24 are supported so as to be capable of turning on the pin 34 of a one-armed lever 35 (Figures 2, 3) which is supported so as to be capable of rocking on a pin 19 fixed in the frame wall 11. A spring 36 between the pawls

23 and 24 keeps the latter either in engagement with the associated ratchet wheels 13 and 14 or against the surface of the slotted case 20. A tension spring 39 which is hooked at one end into the eye 37 of the lever 35 and at the other end into the holder 38 fixed to the frame wall pulls the pawls 23 and 24 after each forward feed back into their original position, thus causing the well bar shaft 6 to turn. The position of the ratchet wheels 13 and 14 after each completed forward feed is secured by detents 125 and 126 (Figure 3) which are mounted so as to be capable of rocking on a pin 127 screwed into a bracket 128. A helical spring 129 slipped over a pin 130 forces the two detents 125 and 126 into permanent engagement with the associated ratchet wheels 13 and 14 or against the surface of the slotted case 20.

With the pin 40 supported rotatably in the one-armed lever 35 (Figure 2) is rigidly connected one end of a pull bar 41, the other end of which is rigidly connected with the pin 42 (Figure 1) supported rotatably in the arm 43 of the two-armed lever 44. The two-armed lever 44 is mounted so as to rock on a supporting pin 45 fixed in the wall 11 of the frame. The end of the other lever arm 46 is drawn by means of a tension spring 47 into the circular path of two rollers 48 which are supported so as to be capable of rotating on pins 49 screwed into the yoke 50. The yoke 50 is keyed on to the reduced end of a short shaft 51 which is supported so as to be loosely rotatable in a bearing 52 screwed to the wall 11 of the frame. At the other reduced end of the shaft 51 a large gear wheel 53 is keyed on, which meshes with a gear wheel 54 of half the size, fixed on the main eccentric shaft 55 of the frame. The extent of the rocking motion of the two-armed lever 44 and with it the extent of the forward feed of the ratchet wheels 13 and 14 is determined by a set screw 59 in the holder 60 of the frame wall 11, against the free end of which the stop 58 of the lever arm 46 is caused to bear by the action of the tension spring 47, when the end of the lever arm 46 does not slide on the rollers 48. The tension spring 47 has one of its ends hooked in an eye 56 screwed into the lever arm 46 and its other end round a pin 57 fixed in the frame wall 11. Each intermittent forward feed of the ratchet wheel 13 or 14 takes place during one revolution of the main eccentric shaft 55.

On the continuous well bar shaft 6 is fixed close to the frame wall 11 a pinion 61 (Figure 8) which meshes with a second pinion 62 fixed on the end of the shaft 63 supported rotatably in the frame wall 11 (Figures 1, 7, 10). On the other end of the shaft 63, extending beyond the frame wall 11, is mounted a pinion 64 which meshes with a rack 65 slidably supported in the guide 66 of the frame wall. One end of the rack 65 is provided with a slot 67 (Figure 1), in which on a pin 68 (Figures 4 and 7) one end of a sliding piece 69 is pivotally supported. On the under side of the quadrangular sliding piece 69 is a rectilinear groove 70 (Figure 8) which at the other end of the sliding piece is bridged over by a pin 71 which extends right across (Figures 1, 4 and 7) and the length of which corresponds to the side of the sliding piece. Out of one side wall of the sliding piece 69, formed by the groove 70, there projects a guide pin 72 (Figure 8), the end of which engages in the non-rectilinear groove 73 of a templet 74 fixed on the frame wall 11 and so causes the rocking motion of the sliding piece 69 about the pin 68.

In the rectilinear groove 70 of the pivotally supported sliding piece 69 engages the shorter arm 75 of the two-armed lever 76 (Figures 1, 4, 7 and 8), the end of which bears temporarily against the pin 71. The two-armed lever 76 is mounted so as to rock on a continuous shaft 77 which, journaled in the frame walls 11, serves the purpose of driving a device of a known kind. The longer arm 78 of the lever 76 forms a fork 79 which on a pin 80 extending across it carries a rockable arm 81. At the free end of this extended arm 81 there is supported so as to rotate freely on a fixed pin 82 a roller 83 which at a definite time rolls along the periphery of the working eccentric 84. The position of rest of the extended lever arm 81 including the roller 83 is secured in such a manner by a leaf spring 85 fixed to the fork 79, that the free end of the leaf spring forces the lever arm 81 and its roller 83 out of the operative range of the eccentric 84 (see more particularly Figure 8). The entire working stroke of the eccentric 84 or the incidental rolling of the roller 83 on that portion of the periphery of the eccentric 84, which is marked "*a*," (Figures 1, 4) corresponds to the forward motion "*b*" of the well bars 5 out of their preparatory position II (Figure 11) into the operative position III (Figure 12). The rocking of the arms 78, 81 of the lever 76 in the direction towards the eccentric shaft 55 is limited by a set screw 86 (Figures 1 and 4) which is screwed into the pin 87 of the frame wall 11. A tension spring 88, one end of which is hooked into the eye 89 fixed to the arm 78 and the other end into the eye 90 on the frame wall 11, draws the longer arm 78 of the lever 76 against the pin 87 of the frame wall 11.

The auxiliary drawing off arrangement which serves the purpose of increasing the drawing off force of the normal welt drawing off means and only comes into action after the reception of the initial course of loops by the welt hooks 4 of the welt bar 5 (Figure 14) consists of a rack 91 (Figures 1, 4, 7, 8 and 10) which is supported so as to be slidable below the pinion 61 in a guide 92 screwed to the frame wall 11. In order to ensure reliable meshing between the rack 91 and the pinion 61, that tooth 93 of the rack 91, which first enters into engagement with the pinion 61, is made lower than the remaining teeth of the rack (Figure 7). In the opening 94 (Figure 8) of the rack 91 there engages the extended end of the pull bar 95, against the fixed collar 96 of which (Figures 4 and 7) the end of the rack 91 is caused to bear through the action of the tension spring 97. One end of the tension spring 97 is hooked into a pin 98 fixed in the extension 99 of the rack 91, whilst the other end is hooked into the adjustable pin 100 which is screwed into the holder 101 of the frame wall 11 and is secured by a nut 102. The other end of the pull bar 95 is fixed in a holder 103 which is connected by means of a pin 104 with a two-armed lever 105 (Figure 9). This lever is pivotally supported on a pin 106 which is screwed into the bracket 107, the position of the lever end 109 and the lever 105 with respect to the below described parts of the roller drive "B" (Figure 1) being controlled by means of an adjustable stop 108.

The roller drive device "B" (Figure 1 and also 4, 7, 8 and 9) which serves the purpose both of putting into operation the single forward feed of all the welt bars 5 out of their preparatory position II into the operative position III and of at the same time putting the auxiliary drawing off means into operation consists mainly of a two-armed lever 110 adapted to pivot about a pin 111 which is screwed into the holder 112 of the frame wall. One end of the lever 110 is bent over at right angles in the form of a tappet 113 (see more particularly Figure 9) for the purpose of coacting at a certain time with the previously mentioned end 109 of the lever 105. On the same end of the lever 110 is fixed by means of screws 114 a pressure exerting piece 115 which is adapted to act on the extended arm 81 of the two-armed lever 76. The other end of the two-armed lever 110 is provided with a pin 116 adapted to turn about its longitudinal axis, on which is rotatably fixed by means of a pin 117 a holder 118 which carries the end of a steel drawing off band. This band 119 which travels over a guide roller 120 is at its other end which is also provided with a holder 118 fixed to one arm of a cranked lever 123. The guide roller 120 is supported so as to turn loosely on a pin 121 which is screwed to a bracket fixed on the frame wall 11. The cranked lever 123 is supported so as to turn loosely on a pin 33 which has already been referred to. The end of the other arm of this cranked lever 123 coacts at a certain time with the segment 124 fixed on the surface of the pattern drum 12.

The described arrangement operates in the following manner:

While the last courses of the hosiery are still being knitted, all the welt bars being in their position of rest I (Figure 1), by turning the pattern drum 12 in the direction of the arrow the pawl and ratchet drive "A" is put in operation, which so turns the welt bar shaft 6 and its pulleys 7 that all the welt bars 5 are displaced horizontally by tension springs 8 in the guides 9 out of the position of rest I into the preparatory position II, that is in the direction towards the frame needles.

During the said advance or rotation of the pattern drum 12 the end of the lever 30 slides off a relatively low segment (not shown) on to the drum surface, whereby the lever 30, acting through the rod-work 29, 28, 27, 26 on the rack 25 (Figure 3), turns the pinion 18 and its slotted case 20 in such a manner that the slot 21 in the case enables the rocking pawl 23 temporarily to engage with the teeth of the ratchet wheel. During the forward motion of the welt bars 5 out of the position of rest into the preparatory position II (Figures 1, 11) the pattern drum is in such a position that the end of the lever 30 rests on the surface of the drum 12. The forward feed of the ratchet wheel 13 and the welt bar shaft 6 in the sense of the welt bar displacement, that is in the direction towards the frame needles, is effected in this case from the main eccentric shaft 55. A full revolution of this shaft 55 and of the small gear wheel 54 (Figure 1) corresponds to a half revolution of the large gear wheel 53 in the direction of the arrow and of the two rollers 48. The circling rollers 48 progressively contact the arm end 46 of the lever 44 and effect the rocking of the latter in the opposite sense to the action of the spring 47. Through the simultaneous rocking of the other lever arm 43 in the opposite direction the pull bar 41, the lever 35 and the pawl 23 engaging in the ratchet wheel 13 are carried along.

As soon as the welt bars 5 have in this way reached the preparatory position II, the automatic motion of the pattern drum 12 in the direction of the arrow into the position shown in Figure 1 takes place. During this motion of the drum the end of the lever 30 slides off the surface

of the drum 12 on to the sliding surface of the lower segment 31, whereby the rod-work 29, 28, 27, 26, the rack 25 and the pinion 18 (Figure 3) cause a rotation of the circular case 20 into a neutral position. This prevents engagement of the pawls 23 and 24 in the associated ratchet wheels 13 and 14, so that during the continued operation of the frame the welt bars 5 will remain in the preparatory position II. This will continue until the formation of the initial course of loops of the following welt, the pawl and ratchet drive "A" (Figure 1) remaining out of operation for the time being.

Before the sinking of the loops of this initial course the pattern drum 12 is advanced in the direction of the arrow (Figure 1), causing the end of the lever 123 to run on to the segment 124, the end of the lever 30 still remaining on the sliding surface of the lower segment 31. Through the raising of the end of the lever 123 by the height of the segment 124 the steel band 119 slides in the direction of the frame wall 11 (see more particularly Figure 8) so as to put the roller drive "B" in operation (see also Figure 1). The pull of the steel band 119 causes the rocking of the two-armed lever 110 and its tappet 113 and pressure-exerting piece 115 in the direction towards the working eccentric 34 (Figure 8). Through the action of the part 115 (Figure 8) on the extended arm 81 of the lever 76 there is brought about under the pressure of the leaf spring 85 a rocking of the arm 81 about the pin 80 and with it a displacement of the roller 83 on to the periphery of the rotating working eccentric 34. Through the simultaneous action of the tappet 113 (Figure 8) on the end 109 of the lever 105 (Figures 7 and 9) a rocking of this lever and a displacement of the pull bar 95 along with the collar 96 in the direction towards the rack 91 is brought about, until the collar 96 bears with its front surface, overcoming the pull of the helical spring 97, against the rack 91 and brings the latter into engagement with the not yet turning pinion 61 (Figure 7).

After the sinking of the loops of the initial course and during their distribution by the distributing sinkers the roller 83 rolls, after the main eccentric shaft 55 has performed half a revolution, along the periphery "a" (Figure 1) of the working eccentric 34, thereby causing a rocking of the two-armed lever 76, the pull of the spring 88 (Figure 4) being overcome. At the same time the shorter arm 75 of this lever bears against the pin 71 bridging the rectilinear groove 70 of the sliding piece 69 which is thereby carried along together with the rack 65 in the direction of motion of the shorter arm 75, that is the direction towards the frame needles. Through the horizontal displacement of the rack 65 the pinions 64, 62, 61 and the welt bar shaft 6 together with the pulleys 7 fixed on the latter are rotated, so that with the aid of the spring pull members 8 a single advance of all the welt bars 5 out of the preparatory position II into the operative position III is produced, the operative position being, as already stated, accurately determined through the stops 10 of the welt bars 5 bearing against the outer edge of the pressure-exerting part of the sinker head 3 (Figures 4, 5, 6, 12, 13 and 14).

With the turning of the pinion 61 in the same direction as the forward motion of the welt bars 5 into the operative position III the auxiliary drawing off arrangement also passes into a state of tension, namely by carrying along the rack 91 in the direction of the collar 96 which for the time being remains at rest. The distance "c" (Figure 10) travelled by the rack 91 corresponds to the amount by which the tension spring 97 becomes lengthened or tensioned. As soon as the roller 83 has passed along a portion "a" of the periphery of the working eccentric 34 (Figures 1, 4) and the welt bars 5 reach their operative position III, in which their hooks 4 receive the loops of the initial course (Figure 14), a further forward step of the pattern drum 12 in the direction of the arrow takes place. By this means both the pawl and ratchet drive "A" (Figure 1) is put in operation for the purpose of drawing the welt bars 5 out of range of the frame needles 1 (Figure 15), that is in the direction towards the position of rest I, and thereby also the auxiliary drawing off arrangement is released. For this purpose the end of the lever 123 (Figures 1, 7) slides off the segment 124 on to the surface of the drum 12 and the end of the lever 30 at the same time from the sliding surface of the lower segment 31 on to that of the higher segment 32. The end of the lever 30 thereby caused to rise induces the movement of the rod-work 29, 28, 27, 26 and of the rack 25 and pinion 18 (Figure 3), causing the slotted case 20 to turn in such a manner that its slot 22 allows the pawl 24 to come into temporary engagement with the ratchet wheel 14. The advance of the wheel 14, the welt bar shaft 6 and the pinion 61 in a direction which is the same as that of the drawing off action from the frame needles 1 (Figure 15) is again derived from the main eccentric shaft 55 with the means already alluded to and continues up to the knitting of the second half of the welt of the hose, that is up to that moment, in which the drawing off hooks of the main drawing off means seize the ends of the welt rods, in order to take over the work of drawing off the fabric, which up to there the hooks 4 of the welt bars 5 had carried out, till the entire hose is finished. The end of forward feed of the ratchet wheel 14 and of the drawing off of the not yet transferred welt by the hooks 4 of the welt bars 5 is brought about by the renewed sliding of the lever end 30 on to the sliding surface of the lower segment 31.

Through the lever end 123 sliding off the segment 124 on to the surface of the drum 12 an untensioning of the steel band 119 takes place, so that the leaf spring 85 brings the extended arm 81 and the associated roller 83 into the position of rest (Figure 8). At the same time the extended arm 81 exerts a pressure on the part 115, so that the lever 110 with the tappet 113 also returns into the original position of rest. The tension spring 88 causes the lever arm 78 to strike against the set screw 86, so that the end of the shorter lever arm 75 removes itself from the pin 71 of the sliding piece 69.

The forward motion of the ratchet wheel 14 causes, as already stated, the rotation of the welt bar shaft 6 and the pinion 61 in a direction which is in conformity with that of the welt bar displacement out of its operative position III, that is away from the frame needles, and has for its object to ensure the well-timed and reliable receiving and drawing off of the initial courses of loops, which is further aided by the action of the tension spring 97 extended by the amount "c" (Figure 10). As the number of intial courses of loops increases (Figure 16), the rack 91 returns into its original position (Figure 7), where it bears against the face of the collar 96, so that the rack comes out of engagement with the pinion

61 which continues to rotate during the operation of the pawl and ratchet drive "A" (Figure 1). In this way after the knitting of a certain number of courses of loops, for instance 15 to 20 (Figure 16), the action of the auxiliary drawing off means is automatically interrupted.

During the drawing off of the first courses the rack 65 is through the rotation of the pinions 61, 62 and 64 carried along with the pivotally supported sliding piece 69 in the direction away from the frame needles 1. The pin 72 which projects from the sliding piece 69 and is guided in the non-rectilinear groove 73 of the templet 74 passes during the said backward displacement of the rack 65 into the higher lying horizontal portion of the groove 73, whereby the sliding piece 69 is rocked upwards about the pin 68 to such an extent that the pin 71 bridging the groove 73 will no longer come into engagement with the arm 75 of the lever 76, which is also desirable for the subsequent reversal of the welt.

The turning over of the first row of stitches held by the hooks 4 of the welt bars 5 onto the frame needles 1 is brought about by a drive of its own, not shown in the drawing, which effects a single rotation of the welt bar shaft 6 in the direction toward the frame needles 1 as soon as oscillatable guides, also not shown, of the welt bars are lifted by rotational displacement of a shaft, not shown.

After automatic, known turning over of the welt edge, the advance of the pattern drum 12 again occurs in the indicated direction of the arrow, whereby the empty welt bars 5 return to their position of rest I according to the method of operation of the drive A as already described, while the welt rod hooks of the main draw-off mechanism, gripping the ends of the welt rods, take over the drawing off of the material, which was done by the needle hooks 4 of the bars 5, until termination of the entire stocking. As soon as the welt bars 5 reach the inoperative position I, the advance of the pattern drum occurs again, which disconnects the drive A with the means described before. The described process of knitting of the stockings then repeats itself.

The invention is not confined to the constructional example illustrated, but is also suitable for other machines with similar working conditions.

I claim:

1. In a flat full-fashioned type knitting frame provided with automatically operated devices for producing welted hosiery blanks in a continuous cycle of operation, including needle series and automatically actuated devices for receiving and drawing off the initial courses of loops of the welt from the needle series comprising horizontal welt bars having a position of rest out of cooperative relation with the needles during the knitting of leg and foot portions of the fabric and automatic means for forcing off the knitted fabric from the needles, pattern control means for said automatically operated devices and driving means for said welt bars under control of said pattern control means for displacing said welt bars from their position of rest into a preparatory position in the vicinity of the needles during the knitting of the final foot portions, for moving said welt bars with the frame running uninterruptedly, into operative position with respect to said needles upon the knitting of the initial courses of the following hosiery blanks for receiving and for drawing off the initial courses of the welts from the needles.

2. A flat full-fashioned type knitting frame as claimed in claim 1 including auxiliary drawing off mechanism and actuating means under control of said pattern control means for placing said auxiliary drawing off mechanism into operation simultaneously with displacement of the welt bars from the operative position in the drawing off of the fabric from the needles to assist in such drawing off.

3. A flat full-fashioned knitting frame as claimed in claim 2 in which the auxiliary drawing off mechanism cooperates with the welt bar driving means during the formation and drawing off of a definite number of initial courses only and thereafter ceases operation while the welt bar driving means continues to operate until the usual welt rods become operative to draw off the fabric.

4. A flat full-fashioned knitting frame as claimed in claim 3 wherein the driving means for displacing the welt bars to the various positions comprises two automatic successively acting drives.

5. A flat full-fashioned knitting frame as claimed in claim 4 in which one of said successively acting drives is a pawl and ratchet drive and the other is a cam-roller drive.

6. A flat full-fashioned knitting frame as claimed in claim 5 in which the pawl and ratchet drive effects both the displacement of the welt bars out of the position of rest into the preparatory position and out of the operative position during the drawing off operation back to the position of rest and the cam roller drive effects the displacement of the welt bars from the preparatory position into the operative position and at the same time puts the auxiliary drawing-off mechanism into operation.

7. A flat full-fashioned knitting frame as claimed in claim 5, in which the welt bar driving means includes a welt bar shaft having pulleys thereon and spring pulley belts by which the welt bars are carried, driven by said welt bar shaft providing a yielding connection between said welt bar shaft and said welt bars.

8. A flat full-fashioned knitting frame as claimed in claim 5 in which the pawl and ratchet drive is driven from the main eccentric shaft of the knitting machine and comprises revolving cam rollers, a rocking lever having one arm engaged by said cam rollers to rock the same, a pull rod connected to the other arm of said rocking lever a pawl arm pivoted on the welt bar shaft, pawls on said pawl arm and ratchet wheels secured to said welt bar shaft for driving the same by actuation of said pawls.

9. A flat full-fashioned knitting frame as claimed in claim 5 in which the cam roller drive is driven from the main eccentric shaft of the knitting machine and includes an eccentric fixed on the main eccentric shaft, a two armed lever having a roller on one end movable into position to engage said eccentric, a rack actuated by the other arm of the two armed lever, toothed gearing including a pinion engaged by said rack for driving said welt bar shaft, and means for shifting the roller on the two armed lever into and out of the path of said eccentric.

10. A flat full-fashioned knitting machine as claimed in claim 9 in which the eccentric includes a face portion corresponding to the forward displacement of the welt bars from the preparatory position into the operative position of the same.

11. A flat full-fashioned knitting frame as claimed in claim 10 in which between the rack and the end of the two armed lever is arranged a sliding piece supported to rock about a pivot

pin at the end of the rack and which is provided with a rectilinear inner groove and a pin fixed at the end of said groove which is engageable by the end of the arm and a fixed templet is mounted on the frame having a non-rectilinear groove in which a projecting end of said pin engages to rock said sliding piece about its pivot.

12. A flat full-fashioned knitting frame as claimed in claim 1 wherein said welt bar driving means includes a rotatable welt bar shaft having pulleys thereon and spring pulley belts, by which said welt bars are carried, driven by said welt bar shaft providing a yielding connection between said welt bar shaft and said welt bars, a pawl and ratchet drive and a cam-roller drive acting in succession to rotate said welt bar shaft, and which further includes auxiliary drawing-off mechanism comprising a rack, a pinion on the welt bar shaft meshing with said rack which upon the auxiliary drawing-off mechanism being placed in operation is shifted to overcome the tension of a spring which in the following operation assists in rotation of the welt bar shaft through the biasing action of said spring on the rack.

13. A flat full-fashioned type knitting frame as claimed in claim 12 in which the control of the auxiliary drawing off mechanism as well as the driving means for the welt bars is effected from the pattern control means.

14. A flat full-fashioned type knitting frame as claimed in claim 13, in which the control of the pawl and ratchet drive of the welt bar shaft comprises a rod and lever means actuated from the pattern control means and a slotted cover for the ratchet wheels actuated by said rod and lever means to control the engagement and disengagement of the pawls with the ratchet wheels and thus the motion and direction of drive of the welt bar shaft.

15. A flat full-fashioned type knitting frame as claimed in claim 14 in which the control of the cam-roller drive comprises a lever actuated from the pattern control means, a pull band, a first two-armed lever operated by the pull band, and a second two-armed lever, one arm of said second lever carrying the roller of said cam-roller drive and being actuatable by an arm of said first lever into the path of the cam on the main cam shaft.

16. A flat full-fashioned type knitting frame as claimed in claim 15 in which said first lever is provided with a tappet, and further including a third two-armed lever and pull bar actuated thereby to engage the rack of the auxiliary drawing off mechanism to engage the same with the pinion on the welt bar shaft to put the auxiliary drawing-off mechanism into operation upon actuation of the cam-roller drive.

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