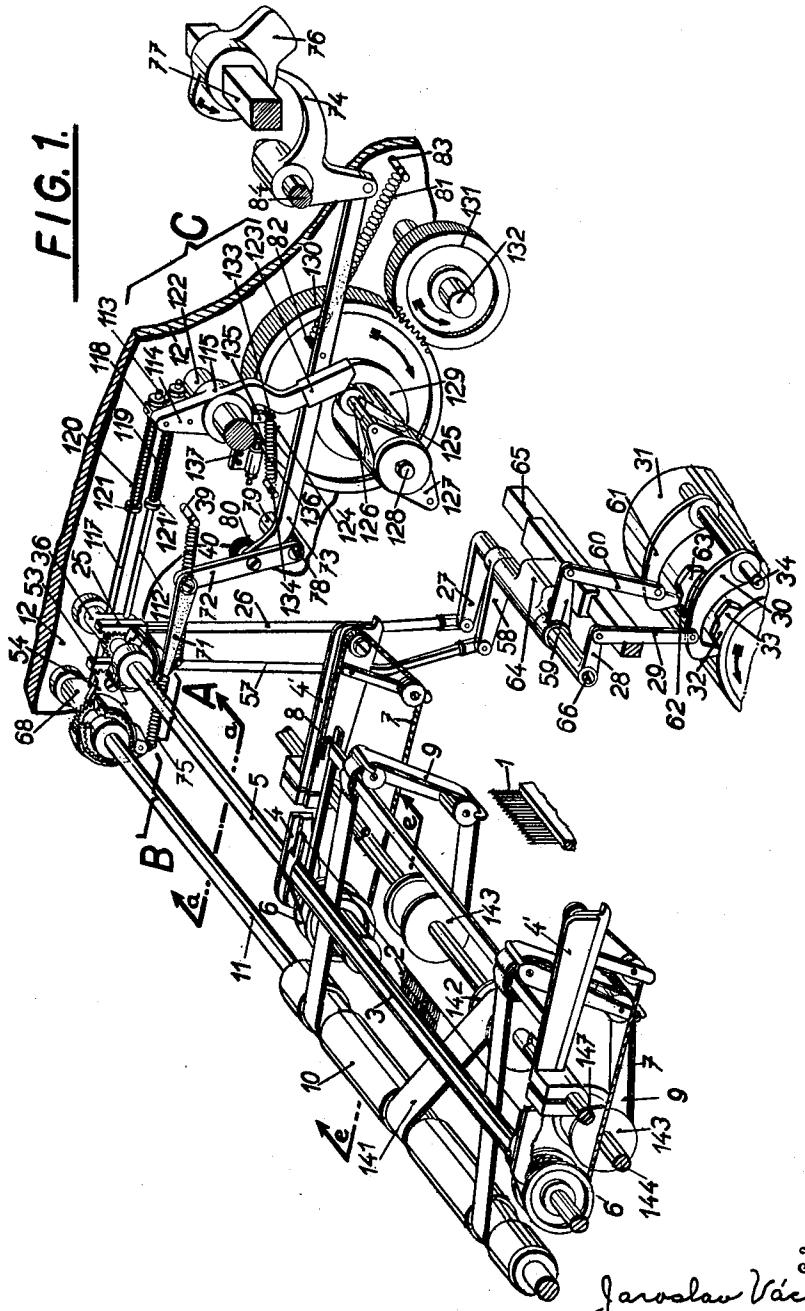
Dec. 23, 1952 J. VACLAVIK ET AL 2,622,422

METHOD FOR DRAWING OFF AND DISCHARGING THE HOSIERY IN FLAT WEFT KNITTING FRAMES, AND FRAMES DESIGNED FOR CARRYING OUT THE METHOD

Filed Dec. 28, 1949 5 Sheets-Sheet 1

FIG. 1.



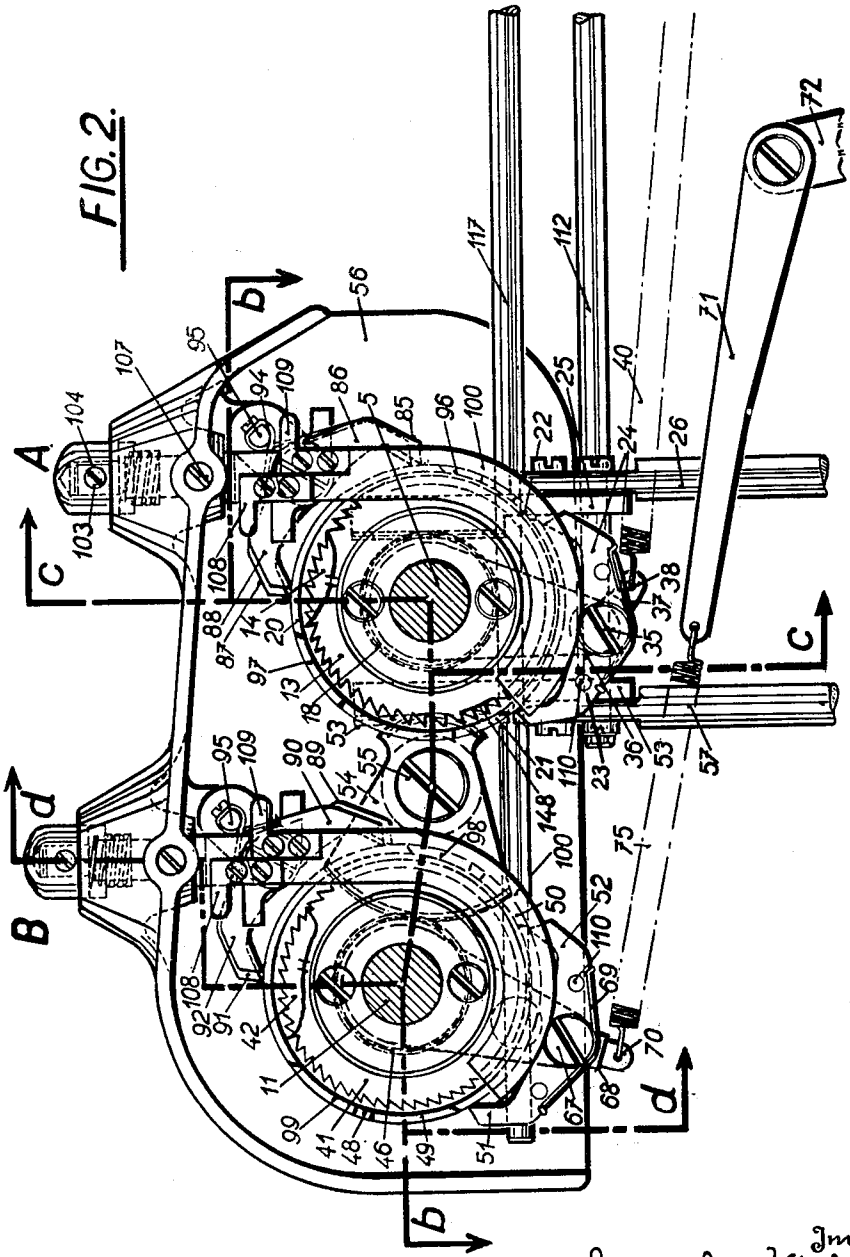
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FIG. 2.



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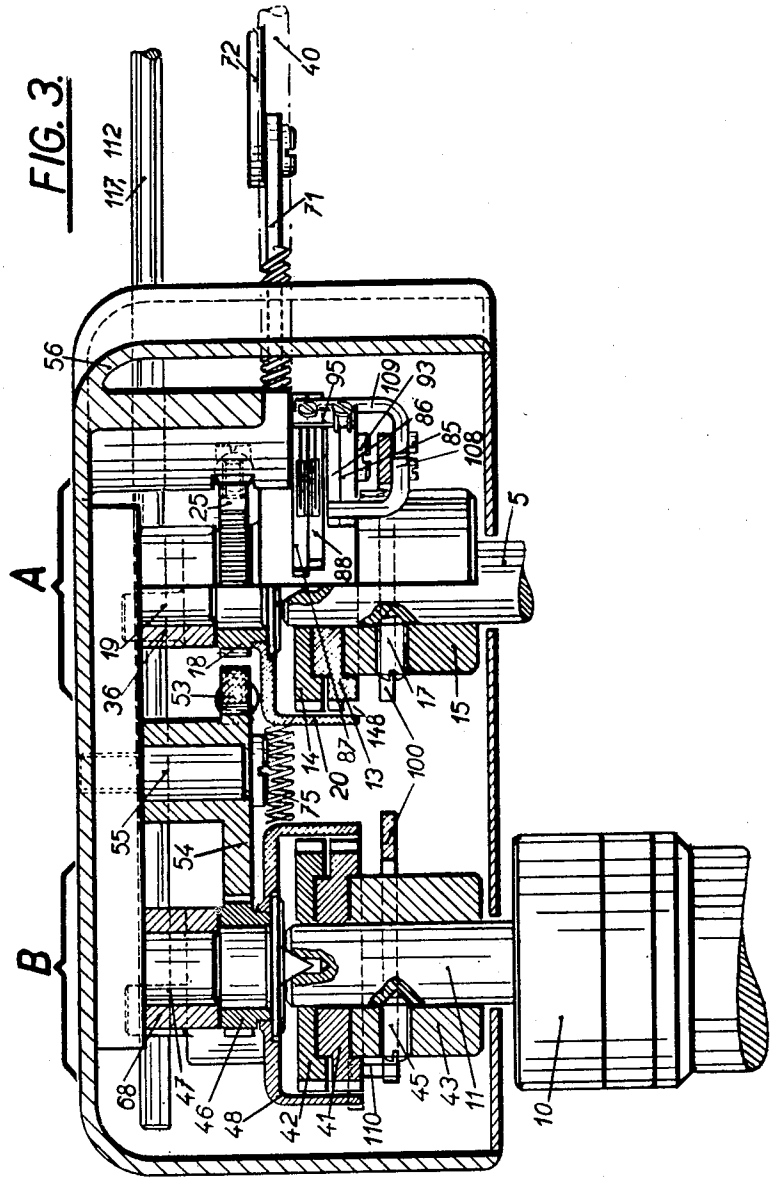
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FIG. 3.



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METHOD FOR DRAWING OFF AND DISCHARGING THE HOSIERY IN FLAT WEFT KNITTING FRAMES, AND FRAMES DESIGNED FOR CARRYING OUT THE METHOD

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FIG. 4

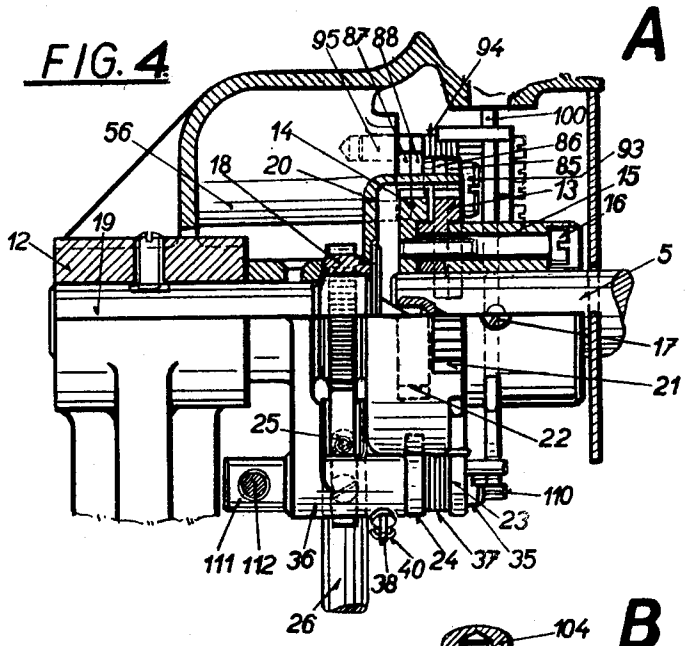
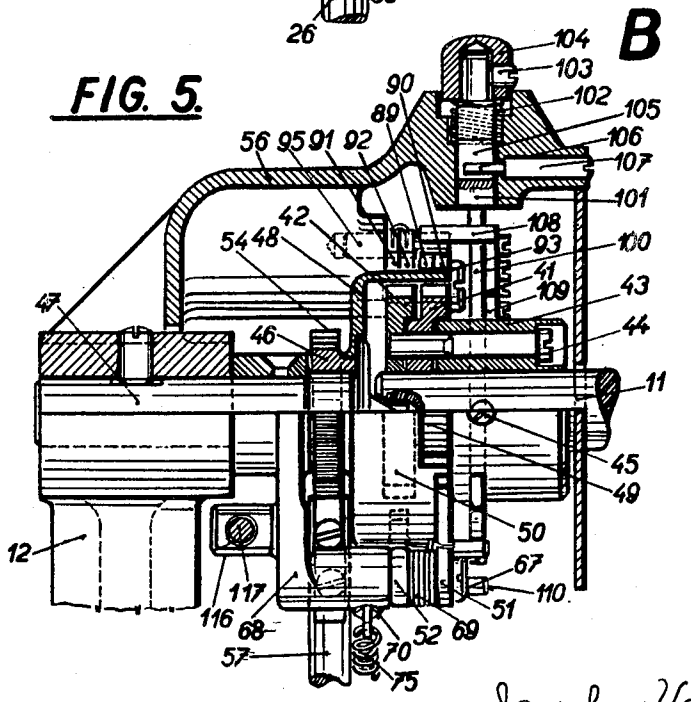


FIG. 5.

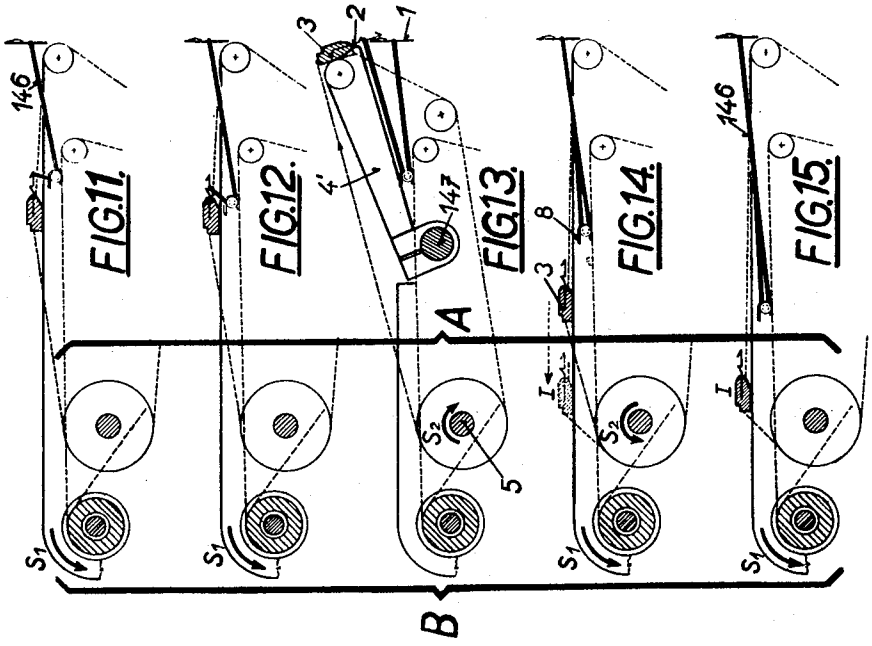


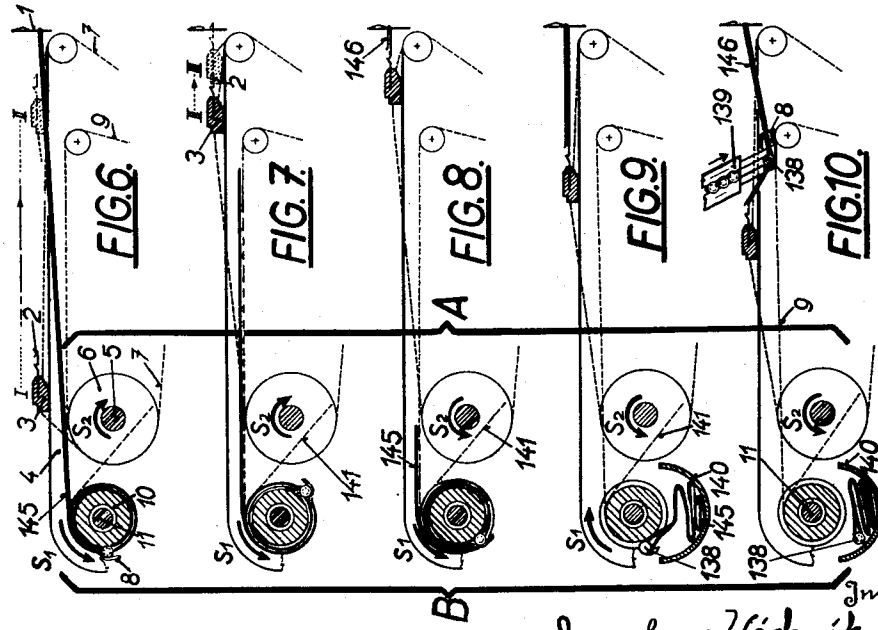
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UNITED STATES PATENT OFFICE

2,622,422

METHOD FOR DRAWING OFF AND DISCHARGING THE HOSIERY IN FLAT WEFT KNITTING FRAMES AND FRAMES DESIGNED FOR CARRYING OUT THE METHOD

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Application December 28, 1949, Serial No. 135,386
In Czechoslovakia December 30, 1948

8 Claims. (Cl. 66—96)

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In a recent design of flat weft knitting frames as hitherto known the stockings are drawn off during the knitting operation in extended condition by means of rods inserted into the double welts, the rods being taken along by hooks attached to the drawing-off belts. These drawing off hooks are moving first from their operative position in horizontal direction towards the fabric rolls and then from the latter in a downward direction. In the lowermost position of the hooks, the corresponding welt rods fall out of them as soon as the last course of loops of the stocking has been struck off from the needles. Together with the welt rods the finished stockings fall into containers arranged at a lower level above the level above the floor of the factory. The drawing off belts are driven by a shaft which controls at the same time the movement of the welt bars and is rotated alternatingly by two falling weights of different size. The lighter weight causes the welt bars and the rods to be drawn off until the finished set of stockings fall down into the containers and the heavier weight brings the drawing-off hooks into their starting position and lift the lighter weight to its highest position.

The above described method for drawing off finished stockings in extended condition shows first of all the disadvantage that the goods which are drawn off conceal the front part of the frame so that the visibility is impaired. Moreover, when the non-working threads of the discharged stockings are to be severed by hand, the attendant must take each stocking in hand as otherwise the goods would fall outside of the container and become soiled; the same danger arises also in frames in which the non-working threads are severed automatically. Also the location of the containers adjacent to the floor is not convenient for the attendants. Finally the outlined constructional arrangement of the frames referred to has considerable drawbacks. Thus, especially the use of weights for driving requires complex winding-up and safety devices. Moreover, the use of a single driving shaft for the above mentioned operations does not allow a simultaneous and automatic control of the corresponding devices, as is usual with the modern frames of this type.

Some of the above disadvantages do not appear in the more recent designs of knitting frames which, when still making use of weights for driving the drawing-off means, have a special shaft for controlling the cover plates and a separate shaft for reeling up the goods being drawn off. In such designs the double welt of a stocking together with the welt rod are reeled up on the

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second shaft referred to, but only during the knitting operation. When the knitting operation is terminated, the attendant seizes the instep of the stocking which has been thrown off from the needles and lies between the latter and the fabric roll shaft, and by pulling on the stocking unwinds it by hand and puts it aside after the welt rod has been withdrawn. As far as the constructional arrangement is concerned, in this case the two shafts which rotate constantly in one direction, are driven each by its proper weight, the weight which drives the cover plate controlling shaft being operative up to the moment only when the withdrawing of the welt rods is initiated and the other weight begins to rotate the shaft for reeling up the goods, which operation lasts up to the end of the knitting.

The main drawback of this second method for discharging the finished stockings resides in the necessity for a permanent co-operation of the attendant. The constructional arrangement referred to shows also the disadvantage that the two shafts can be rotated only successively and not simultaneously and always in one direction, so that simultaneous movement of the corresponding devices, which would be advantageous, is not possible. Moreover, with this arrangement it is necessary that after the knitting of the double welt has been terminated and the welt rods have been inserted, the attendant should each time relieve by hand the shaft for controlling the welt bars, by allowing the corresponding weight to drop on to the floor to its inoperative position. This requires special care on the part of the attendant. In this case the disadvantages inherent to the use of weights for the drive are substantially the same as those described hereinbefore.

The method for drawing off and discharging finished stockings in flat weft knitting frames in accordance with the invention as described hereinafter eliminates all the disadvantages of the prior arrangements. The invention resides substantially in that the stocking is completely reeled up on the fabric roll not only during the knitting operation but also after it has been struck off from the needles and then is automatically unreeled by rotation of the roll in the opposite direction and is received into a discharge container located adjacent to the fabric roll.

In accordance with a further feature of the invention, concurrently with the reeling up on the fabric rolls of the knitted stockings still connected to the frame needles, the welt bars are moved by their associated mechanism out of their position of rest into a preparatory position. When

the finished stocking has been struck off from the frame needles, the stocking is completely reeled up on the fabric roll referred to, while the welt bars draw off from the frame needles the initial courses of loops of the next set of hosiery articles. When the stockings have been completely reeled up on the fabric rolls, the rotation of the latter is automatically reversed and the stockings are unreeled and received in the discharge containers, as it has been mentioned hereinbefore.

The present invention relates further to a flat weft knitting frame provided with a device for carrying out the above described method for discharging finished hosiery articles. For this purpose mainly such flat weft knitting frames are convenient which are provided with a separate shaft for controlling the welt bars and with another shaft, the so called fabric roll shaft, for reeling up the hosiery goods. In such flat weft knitting frames the welt bars are moving horizontally and the goods are drawn off by means of pull members, such as belts and hooks for the welt rods, the said hooks being adapted to return automatically to their basic position when the set of knitted articles has been struck off.

As it has been stated in the preceding paragraph, the flat weft knitting frame in accordance with the present invention comprises an independent shaft for controlling the welt bars and a fabric roll shaft for reeling up, unreeling and discharging the sets of hosiery articles into containers arranged underneath the fabric rolls and for simultaneously returning the drawing-off hooks to their basic position, the two shafts being arranged to operate automatically and quite independently from each other.

In accordance with the invention, each of the shafts referred to is rotated by an automatic and independent drive, the operation of the two drives being derived from a common driving mechanism and controlled by a pattern drum or chain, known per se.

According to the invention, the two drives may be of the pawl and ratchet type and their common driving mechanism may be actuated by the main cam shaft.

The flat weft knitting frames in accordance with the present invention have a higher efficiency than the prior machines of this type and their use reduces substantially the production cost. A single attendant may take care of a larger number of frames since the work to be performed does not require special skill and is confined to subsidiary operation only, such as pulling out the double welt rods and taking the set of finished hosiery articles out of the containers etc.

Further advantages and features of the invention will appear from the example described hereinafter of the construction and operation of a flat weft knitting frame provided with the device of the invention for drawing off and discharging the finished hosiery articles. The accompanying drawings show those parts only of a flat weft knitting frame which are necessary for the understanding of the invention. In the drawings:

Figure 1 is a perspective view of a part of the working system of a flat weft knitting frame having a pawl and ratchet drive A for the shaft controlling the welt bars, and a pawl and ratchet drive B for the shaft for reeling up and unreeling the hosiery articles;

Figure 2 is a vertical section on a larger scale through both shafts along the line *a*—*a* of Figure 1, and a view of the two pawl and ratchet drives A and B in the direction of the shafts;

Figure 3 is a section along the line *b*—*b* of Figure 2;

Figure 4 is a section through the pawl and ratchet drive A along the line *c*—*c* of Figure 2;

Figure 5 is a section through the pawl and ratchet drive B along the line *d*—*d* of Figure 2; and

Figures 6 to 15 are vertical sections through both shafts and the parts associated therewith along the line *e*—*e* of Figure 1, during the various working phases, as is described with greater detail hereinafter.

Of the usual knitting elements for producing the loops, Figure 1 shows only the frame needles 1 and their co-operating bearded needles 2 of a welt bar 3. The welt bar is moved horizontally in a manner known per se in the guides 4 by the rotation of a transverse shaft 5 and of pulleys 6 fixed on the latter, each pulley 6 being embraced by a spring 7 the two free ends of which are anchored in the welt bar 3. The drawing-off hooks 8 which are fastened to the drawing-off belts 9 and serve to draw off the knitted fabric, are wound up or unwound in common on a fabric roll 10 during the knitting operation due to the rotation of the transverse fabric roll shaft 11. The two transverse shafts 5 and 11, which are mounted for free rotation in the side walls 12 of the frame, are adapted to be driven at any desired time independently of each other and in the desired direction of rotation by means of pawl and ratchet drives A and B of which the drive A is adapted to move the welt bars 3 in a manner known per se out of their position of rest I into their preparatory position II (see also Figure 6) and out of their operative position III into their position of rest I (see Figures 7 and 15).

The pawl and ratchet drive A consists, as will be seen from Figures 2, 3 and 4, of two ratchet wheels 13, 14 designed for oppositely directed engagement, which are mounted at the end of the cover plate shaft 5 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 cover plate shaft 5. Around the ratchet wheels 13 and 14 is fixed on a toothed pinion 18, which turns loosely on the fixed pin 19 of the side wall 12, a circular case 20 with apertures 21, 22 (see more particularly Fig. 4). The position at any time of the apertures 21, 22 determines which of the two pawls 23, 24 is to engage in the teeth of the associated ratchet wheel 13 or 14 and thereby the direction of rotation of the welt bar shaft 5. The pawl 23 and the associated ratchet wheel 13 are the means for turning the welt bar shaft 5 in the clockwise sense, as seen in Fig. 2, that is for horizontally displacing the welt bars 3 out of their position of rest I into the preparatory position II (see Fig. 6), and the pawl 24 with its associated ratchet wheel 14 for turning the welt bar shaft 5 in the opposite sense, that is for withdrawing the welt bars 3 out of their operative position III (Fig. 7) into the position of rest I (Fig. 15).

The setting of the rotatable case 20 and its apertures 21 and 22 in one direction or the other is effected by means of a rack bar 25 which meshes with the toothed pinion 18 (Figs. 2, 3 and 4). The rack bar 25 is fixed to a pull rod 26, the vertical motion of which is derived by means of a pull rod system 27, 28, 29 and 30 (Fig. 1) from the pattern drum 31, on the surface

of which are fastened segments 32 and 33 having two steps of different height adapted to coact at certain times with the end of a lever 30 mounted for free rotation on a supporting pin 34 fixed in the side wall 12. The two steps of different height of the segments 32 and 33 determine the position of the case 20 (Fig. 2) and thereby the functioning of the pawl and ratchet drive A. Thus, for instance, any lower segment 32 effects the setting of the case 20 into a neutral position and any of the higher segments 33 the turning of the case 20 into a position corresponding to the withdrawing of the cover plates 3 in the direction away from the frame needles 1 (Figs. 8, 9 and 10).

The pawls 23 and 24 are mounted rotatably on the pin 35 of a one-armed lever 36 (Figs. 2 and 4) which is mounted for rocking movement about a pin 19 fixed in the side wall 12. A coiled spring 37 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 case 20. A tension spring 40 which is hooked at one end into the eye 38 of the lever 36 and at the other end into the holder 39 (Fig. 1) fixed to the side walls returns the pawls 23 and 24 after each feed back into their original position, thus causing, for instance, the welt bar shaft 5 to turn to the extent required for withdrawing the welt bars 3.

The pawl and ratchet drive B comprises, similarly as the pawl and ratchet drive A, two ratchet wheels 41 and 42, as shown in Figures 2, 3 and 5, arranged for opposite sense of engagement and which are mounted side by side at the end of the fabric roll shaft 11 and fastened to the hub 43 by means of screws 44. The hub 43 itself is fastened on the fabric roll shaft 11 by means of a securing screw 45. On a pinion 45, freely rotatable about a pin 47 fixed in the side wall 12, is secured around the ratchet wheels 41 and 42 a circular case 48 having apertures 49 and 50 (see more particularly Fig. 5). The position of these apertures at any time determines which of the two pawls 51 and 52 will mesh with the teeth of the corresponding ratchet wheels 41 and 42, whereby the direction of rotation of the fabric roll shaft 11 is determined. The pawl 51 and its associated ratchet wheel 41 serve for turning the fabric roll shaft 11 clockwise as seen in Fig. 2, that is to say for moving the drawing-off hooks 8 horizontally into their basic position (see Figs. 9 and 10), and the pawl 52 and its associated ratchet wheel 42 serve for turning the fabric roll shaft 11 in the opposite direction, that is to say for reeling up the hosiery articles on the fabric rolls 10 (see Figs. 6, 7, 8, 11, 12, 14 and 15).

The adjustment of the rotatable case 48 and of its apertures 49 and 50 in the one direction or the other is effected by a rack bar 53, a toothed segment 54 and a pinion 46 (Figs. 2 and 3). The segment 54 which has two diametrically opposite rows of teeth for engagement on the one side with the rack bar 53 and on the other side with the pinion 46 is mounted for free rotation about a pin 55 screwed into the protecting cover 56. The rack bar 53 is connected to a pull rod 57 to which vertical motion is imparted by means of a pull rod system 58, 59, 60 and 61 (Fig. 1) from the pattern drum 31. On the surface of the drum are fastened segments 62 and 63 having two steps of different height adapted to coact at certain times with the end of a lever 61 mounted for free rotation on the supporting pin 34 fixed in the side wall 12. The two steps of different height of the segments 62 and 63 determine the position of the case 48 (Fig. 2) and thereby control the operation of the pawl and ratchet drive B. Any of the lower segments 62 causes the case 48 to be adjusted to its neutral position and any of the higher segments 63 causes the case 48 to be turned to a position corresponding to the return of the drawing-off hooks 8 to their basic position (see Figs. 9 and 10). Levers 58 and 59 (Fig. 1) are secured on either end of a hollow shaft mounted for free rotation in a bearing 64 fastened to a rod 65 of rectangular cross-section fixed to the side wall 12. In the hollow shaft is mounted for free rotation a shaft 66 and at the projecting ends of the latter are fastened the levers 27 and 28 already referred to.

The pawls 51 and 52 are mounted rotatably on the pin 67 of a one-armed lever 68 (Figs. 2 and 5) which is mounted for rocking movement on a pin 47 fixed in the side wall 12. A coiled spring 69 arranged between the pawls 51 and 52 keeps the latter either in engagement with the associated ratchet wheels 41 and 42 or against the surface of the case 48. In an eye 70 of the lever 68 and in the end of the pull rod 71 of the rod and lever system 72, 73 and 74 (Fig. 1) are hooked the ends of a tension spring 75, the adjustable length of which determines the amplitude of the rocking movement of the lever 68 and of its pawls 51 and 52. The automatic length adjustment of the spring 75 is effected in a manner known per se by a periodically rotating cam 76 (Fig. 1) arranged on a shaft 77 of rectangular cross-section which is mounted in the side wall 12. The amplitude of the rocking movement of the lever 72 pivoted at one end on a spacer member 79 on the side wall 12 is exactly adjustable by means of a screw 80 mounted eccentrically in the lever 72. A tension spring 81 hooked with its one end on a pin 82 of the pull rod 73 and with its other end on a pin 83 fixed in the side wall 12 urges the arm end of a lever 74 rotatably mounted on a short shaft 84 against the circumference of the cam 76.

The position of the mutually connected ratchet wheels 13 and 14 or 41 and 42 after each complete feed in the one direction or the other is insured by detents 85—88 or 89—92 (Figs. 2, 3 and 5) of which each group of four are mounted side by side for free rotation about a pivot pin 93 fastened in the wall of the protecting cover 56 (Figs. 4 and 5). The coiled springs 94 mounted on a pin 95 keep two adjacent detents 85—86, 87—88 or 89—90, 91—92 constantly in engagement with the associated ratchet wheels 13 and 14 or 41 and 42. In order that the end position of the ratchet wheels may be invariably fixed even at the smallest feed, the lengths of the two detents, for instance 87 and 88 (Fig. 2), which engage with one and the same ratchet wheel, differ from each other by half the pitch of the ratchet wheel teeth. To allow the simultaneous engagement of two adjacent detents with their associated ratchet wheel, the circular cases 20 and 48 are provided with apertures 96, 97 and 98, 99, respectively.

The engagement of the pawls 23 and 24 or 51 and 52 and of the detents 85—88 or 89—92 with their associated ratchet wheels 13 and 14 or 41 and 42 is controlled manually by an independent trip device (Figs. 2, 4 and 5) associated with each of the pawl and ratchet drives A and B. The two trip devices are identical and comprise a tripping member 100 having its shank 101 (see more particularly Fig. 5) vertically slidable in

the protecting cover 56. On the shank 101 is threaded a coiled spring 102, and a press button 104 is fastened on the shouldered end of the shank by means of a screw 103. A longitudinal groove 105 provided in the shank 101 and in which engages the cylindrical end 106 of a screw 107 arranged in the protecting cover 56 serves to limit the vertical displacement of the trip member 100 and to keep the latter in its correct position. Two fingers 108 and 109 (see more particularly Figs. 2 and 3), fastened on a flattened portion of the trip member 100, are arranged so as to lie with their bent ends over the shorter arms of the detents 85—88 or 88—92. The circularly curved flat portion of the trip members 100, which are in the form of arcs coaxial with the welt bar shaft 5 and fabric roll shaft 11, respectively are arranged with outer periphery above the stop pins 110 fixed in the pawls 23, 24, 51 and 52. By depressing the press button 104 of the drive A or B (Fig. 2) the bent ends of the fingers 108 and 109 are pressed against the shorter arms of the detents, while the circular outer periphery of the curved trip member 100 is pressed against the pins 110 of the associated pawls, whereby the engagement of the pawls and detents with their associated ratchet wheels is interrupted so that the welt bar shaft 5 or the fabric roll shaft 11 may be rotated by hand in the desired direction, which is of importance especially in assembling the apparatus.

A pin 111 (Fig. 4) mounted rotatably in the one armed lever 36 is conected with the one end of a pull rod 112, the other end of which is rigidly connected to a pin abutment 113 (Fig. 1) which is mounted rotatably in the arm 114 of a double-armed lever 115. A pin abutment 116 (Fig. 5) rotatably mounted in the one-armed lever 68 is connected to the one end of a pull rod 117 the other end of which is rigidly connected to a pin 118 (Fig. 1) mounted rotatably in the arm 114 of the double-armed lever 115. On one end of each of the pull rods 112 and 117 is threaded a compression spring 119 and 120, respectively, which bears against an abutment 113 and 118 and an adjusting ring 121 and 121', respectively. The double-armed lever 115 is mounted to rock about a supporting pin 122 which is fastened in the side wall 12 of the knitting frame. The end of the other arm 123 of this lever is pulled by a spring 124 into the path of rollers 125 mounted rotatably about pins 126 screwed in a stirrup 127. The stirrup 127 is keyed on the shouldered end of a short shaft 128 which is mounted for free rotation in a bearing 129 screwed to the side wall 12 of the knitting frame. On the other shouldered end of the shaft 128 is keyed a large gear 130 meshing with a smaller gear 131 having half the number of teeth of the large gear and fastened on the main cam shaft 132 of the knitting frame. A tension spring 124 anchored with its one end on a small pin 133 provided on the arm 123 and with its other end on a pin 134 on the side wall of the knitting frame, pulls the extension 135 of the arm 123 against the adjustable stop 136 screwed into a holder 137 fastened on the side wall 12, whereby the angle of rocking of the double-armed lever 115 and as a consequence the extent of the feed of the ratchet wheels 13 and 14 and 41 and 42 is determined. Each feeding step of the ratchet wheels takes place during a revolution of the main cam shaft 132.

Figure 10 of the drawings shows the double welt rods 138 which are introduced in the knitted fabric automatically in a manner known per se from a magazine 139. Directly under the shaft 11 for reeling up and unreeling the fabric are arranged containers 140 for receiving the finished set of knitted articles. Figure 1 shows that an intermediate belt 141 which is wound on a pulley 142 arranged between the drawing-off belts 9 which are wound on pulleys 143, is reeled on the fabric roll 10 or unreeled from the latter together with the belts 9 and the hosiery. The shaft 144 on which the pulleys 142 and 143 are arranged is turned by the shaft 11 through the intermediary of a suitable driving device (not shown).

The described arrangement operates in the following manner:

During the knitting of the last courses of loops of the stockings, when all the welt bars 3 are in their position of rest I and the fabric roll shaft 11 with its fabric rolls 10 is rotated by the pawl and ratchet drive B in the direction of the arrow s_1 shown in Figure 6 so as to draw off and reel up the knitted articles 145, the pawl and ratchet drive A is put in operation by an impulse of the pattern drum 31 (see Fig. 1) and causes the welt bar shaft 5 to be rotated in the direction of the arrow s_2 shown in Fig. 6 in a manner known per se so that all the welt bars 3 are shifted horizontally by means of the pulleys 6 and springs 7 in the guides 4 from their position of rest I into a preparatory position II, that is to say in the direction towards the frame needles 1, as shown in Figures 6 and 7.

During this opposite rotation of the two shafts 5 and 11 in the directions of the arrows s_1 and s_2 (Fig. 6) the pattern drum 31 assumes such a position that the ends of the levers 61 and 30 lie against the surface of the drum. Under the action of the lever 61 upon the pull rod system 60, 59, 58 and 57 and further upon the rack bar 53 (Figs. 2 and 3) and toothed segment 54, the pinion 46 and the case 48 connected with the latter are so turned that the aperture 50 of the case 48 will permit the pawl 52 to engage for a time with the teeth of the ratchet wheel 42. Under the action of the lever 30 upon the rod system 29, 28, 27 and 26 and further upon the rack bar 25 (Figs. 2 and 3), the pinion 18 and the case 20 connected therewith are so turned that the aperture 21 of the case 20 will permit the pawl 23 to engage for a time with the teeth of the ratchet wheel 13.

The above described simultaneous feed of the ratchet wheels 42 and 13, and thus the turning movement of the shafts 11 and 5 in opposite directions, is derived by means of the driving mechanism C (Fig. 1) from the main cam shaft 132. To a complete revolution of the main cam shaft 132 and of the small gear wheel 131 corresponds half a revolution of the large gear wheel 130 in the sense of the arrow shown on the same, and of the two rollers 125. The rollers 125 to which circular movement is imparted come to bear successively against one end of the arm 123 of the lever 115 and cause the said arm to rock against the action of the spring 124. The simultaneous rocking of the other arm 114 of the lever in the opposite direction imparts movement to the pull rods 117 and 112 connected to the levers 68 and 36 so that the movement is transmitted from the levers 68 and 36 to their associated pawls, of which the pawls 52 and 23 engage with the ratchet wheels 42 and 13 in the case under consideration.

As soon as the welt bars 3 reach their preparatory position II (Fig. 7), automatic advance of the pattern drum 31 takes place in the direction of the arrow, the end of the lever 30 passing from the surface of the drum 31 on to the sliding face of a lower segment 32, so that the pull rod system 29, 28, 27 and 26, the rack bar 25 and the pinion 18 (Figs. 2 and 3) cause the case 20 to turn to its neutral position. Thereby further engagement of the pawl 23 with its associated ratchet wheel 13 is prevented so that during the following operation of the frame the welt bars 3 remain in the aforesaid preparatory position II, and the pawl and ratchet drive A is for the time being inactive. The same location of the welt bars 3 in the preparatory position in all cases is insured by a gap 148 (Figs. 2 and 3) in the teeth of the ratchet wheel 13 at a point corresponding to this position. The gap 148, which has a length equal to three tooth spaces and half the thickness of the ratchet wheel, permits to a locking detent 86 to engage with the teeth of the ratchet wheel also upon a further rotation of the welt bar shaft 5 whereby it is insured that the ratchet wheel 13 will attain always the same end position corresponding to the aforesaid position II of the welt bars and will remain in such end position.

Before the sinking of the loops of the initial course a further advance of the pattern drum 31 takes place in the direction of the arrow whereby a cam drive as shown in Fig. 8 of the copending application of Jaroslav Václavik, Ser. No. 99,781, filed June 17, 1949 is put into operation which after the completed sinking of the first course of loops and during their distribution causes the welt bar shaft 5 to make a single revolution in the direction of the arrow s_2 shown in Figure 7, and all the welt bars 3 to move from their preparatory position II into their operative position III in which the bearded needles 2 of the welt bars 3 will take over the loops of the initial course while the pawl and ratchet drive B still operates in the original direction shown by the arrow s_1 in Fig. 7, the set of discharged hosiery articles 145 being reeled up on the drawing-off rolls 10.

When the first courses of loops of the next set of hosiery articles 146 have been taken over, a further advance of the pattern drum 31 takes place in the direction of the arrow shown, whereby the pawl and ratchet drive A and thus also the welt bar shaft 5 are rotated in the direction of the arrow s_2 shown in Figure 8 to withdraw the welt bars 3 from the range of the frame needles 1 in a direction towards the position of rest I. For this purpose the end of the lever 30 leaves the sliding face of a lower segment 32 and passes on to the sliding face of a higher segment 33. The end of the lever 30, which thus moves upwards, imparts movement to the pull rod system 29, 28, 27 and 26 (Figs. 2 and 3) and to the rack bar 25 and pinion 18 as well, whereby the case 20 is turned to such an extent that its aperture 22 permits to the pawl 24 to engage for a time with the ratchet wheel 14. This feed of the ratchet wheel 14 and also of the welt bar shaft 5 in the aforesaid direction, and the simultaneous feed of the ratchet wheel 42 and of the fabric roll shaft 11 in the same direction are derived again from the main cam shaft 132 through the intermediary of the means described hereinbefore.

When the drawing-off belts 9 with the drawing-off hooks 8, the intermediate belts 141 and the finished stockings 145 have been reeled up on the fabric rolls 10, a further advance of the pattern drum 31 takes place in the direction shown by the arrow, whereby the rotation of the pawl and ratchet drive B and also that of the fabric roll shaft 11 is automatically reversed, the fabric roll shaft beginning to rotate in the direction of the arrow s_1, shown in Fig. 9. Thereby the drawing-off belts 9, the intermediate belts 141 and the hosiery articles 145 are unreeled and the latter finally fall down together with the welt rods 138 into the containers 140 (Fig. 9), so that the attendant only has to withdraw at any desired moment the welt rods from the goods and introduce them into a magazine 139 (Fig. 10). The object of the intermediate belts 141 which are reeled up on to the fabric rolls 10 together with the hosiery articles 145 is to insure the reliable unwinding of the goods from the fabric rolls into the containers 140.

The change in the sense of rotation of the pawl and ratchet drive B to the direction of the arrow s_1 shown in Fig. 9 takes place due to the fact that the end of the lever 61 (Fig. 1), which prior to this stage was in contact with the surface of the drum 31, passes on to the sliding face of one of the higher segments 63. The lever 61 which is lifted thereby transmits its movement to the lever system 60, 59, 58 and 57, rack bar 53 (Figs. 2 and 3) and toothed segment 54 which causes the pinion 46 and the case 48 to turn in such a way that the aperture 49 of the case 48 permits the pawl 51 to engage for a time with the teeth of the ratchet wheel 41.

During the rotation of the two shafts 5 and 11 in opposite directions, as shown by the arrows s_1 and s_2 in Fig. 9, the pattern drum 31 assumes a position in which the ends of the levers 61 and 30 rest on the sliding faces of the higher segments 63 and 33, respectively. As soon as the drawing-off hooks 8 have reached their basic position shown in Fig. 10 in which they remain until the lowermost welt rod 138 from the magazines 139 has been inserted in the knitted fabric 145, the operation of the pawl and ratchet drive B in the direction s_1 shown in Fig. 9 is terminated by a further advance of the pattern drum 31. The invariable location of the drawing-off hooks 8 in their basic position is insured by means of a simple device (not shown) whereby the hitherto unavoidable dependency of the drum rotation on the basic position of the hooks is eliminated. During the afore-described advance of the drum 31 in the direction shown by the arrow, the end of the lever 61 slides from the sliding face of a higher segment 63 on to the sliding face of a lower segment 62 so that the lever system 60, 59, 58, 57 and the gear transmission 53, 54 and 46 (Figs. 2 and 3) cause the case 48 to turn to its neutral position whereby the pawls 51 and 52 are prevented from engaging with their associated ratchet wheels 41 and 42 and the shaft 11 with the fabric rolls 10 does not turn.

During the rotation of the two shafts 5 and 11 in the same direction (see s_1 and s_2 in Fig. 8), that is to say during the drawing off of the initial courses of loops of the double welts of the next hosiery articles 146 and during the rotation of both shafts 5 and 11 in opposite directions, as shown in Fig. 9, each step of movement of the shaft 11 and thus also of the fabric rolls 10 is larger than, e. g. the double of, each prior step

in the normal drawing off operation shown in Fig. 6. The object of this arrangement is to permit the drawing off hooks 8, which are reeled up on the fabric rolls 10, to return to their basic position shown in Figure 10 before the automatic insertion of the welt rods 139 from the magazines 139 into the knitted goods 146.

The feed amplitude of the pawl and ratchet drive B and thereby the value of the aforesaid speed of rotation of the shaft 11 during the various stages of the knitting operation are determined by the position of a periodically rotating cam 76 (see Fig. 1) provided on its periphery with portions of different height which displace the lever 74 and the lever system 73, 72 and 71 in a direction towards the pawl and ratchet drive B or in the opposite direction.

The varying length and tension of the spring 75 affects the amplitude of the rocking movement of the lever 68 and of its pawls 51, 52. Thus, for instance, the cam 76 assumes during the knitting of the last courses of loops of the stockings 145 such a position that its highest peripheral portion causes the lever 74 and the lever system 73, 72 and 71 to be moved in a direction towards the pawl and ratchet drive "B" so that the contracting, shorter spring 75 practically does not affect the feed of the pawl 52. On the other hand, when the lever arm 74 is sliding along the lowest peripheral portion of the cam 76, the latter causes the spring 75 to be extended and to produce a stronger pull in the direction of the pawl and ratchet drive B so that the feed of the pawl 52 and of the fabric roll shaft 11 is the largest.

After the automatic positioning of the lowermost welt rod 138 in the basic position as shown in Fig. 10, the pawl and ratchet drive B is again put in operation by a pulse from the pattern drum 31 through the afore-described means and causes the fabric roll shaft 11 to rotate in the direction of the arrow s_1 as shown in Fig. 11, while the operation of the pawl and ratchet drive A and the advance of the welt bars 3 resulting therefrom are interrupted for a time. The rotation of the fabric rolls 10 in the direction of the arrow s_1 as shown in Fig. 11 produces a horizontal displacement of the drawing-off hooks 8 in a direction away from the frame needles. Thereby the drawing-off hooks seize in a manner known per se the lowest welt rods 138 which again carry out the drawing off operation of the hosiery articles 146 up to its termination. Meanwhile the welt bars 3 remain inactive, and the leading portion of the knitted fabric 146 held in the bearded needles 2 of the welt bars 3 slides, due to the pull of the rods 8, along the shanks of the needles 2 in the direction towards the welt bars 3 and thus is brought against the back of the bearded needles 2 (see Fig. 12).

Upon termination of the second half of the double welt, the next automatic advance of the pattern drum 31 takes place causing the operation of the pawl and ratchet drive B to be interrupted in the afore-described manner during the change over of the double welt (Fig. 12) so that both pawl and ratchet drives A and B are in their position of rest. The change over of the first courses of loops, which are held in the bearded needles 2 of the welt bars 3, on to the frame needles is effected by a separate drive, not shown, which causes the welt bar shaft 5 to make a revolution in the direction of the arrow s_2 shown in Fig. 13 as soon as the rocking guide 4' for the welt bars 3 is lifted by rotation of the shaft 147.

After the automatic change over of the double welt, the pattern drum 31 is again advanced in the direction of the arrow as shown, whereby the two pawl and ratchet drives A and B and with them the shafts 5 and 11 are caused to rotate in the manner already described in the same direction s_1, s_2, as shown in Fig. 14.

During this period the drawing-off hooks 8 continue to draw off the knitted fabric and the empty welt bars 3 return to their position of rest I. As soon as they reach this position, a further advance of the pattern drum takes place so that the pawl and ratchet drive A is put out of operation by the means described hereinbefore, while the other pawl and ratchet drive B is held in operation up to end of the complete reeling of the finished stockings 146 on the fabric rolls 10, as it has been explained already in connection with the knitting of the preceding set of hosiery articles 145. The described process of knitting, drawing off and discharging the stocking is repeated.

The invention is not confined to the described example but may be carried out with various modifications and is also suitable for other machines with similar working conditions. More particularly, the apparatus for carrying out the invention may differ in its various details from the arrangement shown. Thus, for instance, the drawing-off belts 9 for moving the welt rods may be made of any desired material, more particularly in the shape of tension springs similar to those used hitherto for shifting the welt bars.

What we claim is:

1. In a method for drawing off and discharging the hosiery in flat weft knitting frames, in which the initial courses of loops of the knitted fabric are drawn off by horizontally moving welt bars and after the double welts have been completely knitted and transferred, the fabric is drawn off by means of double welt rods which are carried along together with the drawing-off hooks by means of pull members, the steps of reeling up the knitted fabric on the fabric rolls together with the said double welt rods also after the fabric has been struck off from the needles and, when the fabric is completely reeled up, unreeling it by rotation of the fabric rolls in the opposite direction to automatically deliver the fabric into discharge containers arranged adjacent to the said fabric rolls, and causing the drawing off hooks to return automatically to their basic position in the range of the automatically controlled double welt rods after completion of the unreeling operation.

2. In a method for drawing off and discharging the hosiery in flat weft knitting frames, in which the initial courses of loops of the knitted fabric are drawn off by horizontally moving welt bars and after the double welts have been completely knitted and transferred, the fabric is drawn off by means of double welt rods which are carried along together with the drawing off hooks by means of pull members, the steps of reeling up the knitted fabric on the fabric rolls together with the said double welt rods also after the fabric has been struck off from the needles and, when the fabric is completely reeled up, unreeling it by rotation of the fabric rolls in the opposite direction to automatically deliver the fabric into discharge containers arranged adjacent to the said fabric rolls, causing the draw-

ing-off hooks to return automatically to their basic position in the range of the automatically controlled double welt rods after completion of the unreeling operation, and moving the welt bars out of their position of rest into a preparatory position adjacent to the frame needles concurrently with the reeling of the fabric on the fabric rolls, the said welt bars, after the fabric has been struck off from the needles and during the final phase of its reeling on the fabric rolls, causing the initial courses of loops of the next set of hosiery articles to be drawn off in the direction away from the frame needles.

3. In a method for drawing off and discharging the hosiery in flat weft knitting frames, in which the initial courses of loops of the knitted fabric are drawn off by horizontally moving welt bars and after the double welts have been completely knitted and transferred, the fabric is drawn off by means of double welt rods which are carried along together with the drawing off hooks by means of pull members, the steps of reeling up the knitted fabric on the fabric rolls together with the said double welt rods also after the fabric has been struck off from the needles and, when the fabric is completely reeled up, unreeling it by rotation of the fabric rolls in the opposite direction to automatically deliver the fabric into discharge containers arranged adjacent to the said fabric rolls, causing the drawing-off hooks to return automatically to their basic position in the range of the automatically controlled double welt rods after completion of the unreeling operation, and moving the welt bars out of their position of rest into a preparatory position adjacent to the frame needles concurrently with the reeling of the fabric on the fabric rolls, the said welt bars, after the fabric has been struck off from the needles and during the final phase of its reeling on the fabric rolls, causing the initial courses of loops of the next set of hosiery articles to be drawn off in the direction away from frame needles, the reeling and unreeling of the knitted fabric from the moment of striking it off from the frame needles up to the return of the drawing off hooks to their basic position being effected at a higher speed than the reeling of the knitted fabric still held on the frame needles.

4. In a flat weft knitting frame including knitting instrumentalities and pattern control mechanism, means for drawing off and discharging the fabric comprising horizontally movable welt bars having welt hooks to receive the initial courses of loops of the fabric, actuating means for said welt bars including a reversible drive shaft, a fabric take-up roll for reeling up the fabric after the same has been struck off from the needles, actuating means for said fabric take-up roll including a reversible drive shaft, separate automatic reversible drives for said shafts, and automatic control mechanism for said reversible drives, responsive to the pattern control mechanism, for controlling actuation of said drive shafts both as to direction and time in relation to each other and to the actuation of the knitting instrumentalities.

5. A flat web knitting frame according to claim 4, and means for varying the speed of rotation of the drive shaft of the fabric take-up roll.

6. A flat web knitting frame according to claim 4 in which each of said automatic reversible drives is a pawl and ratchet wheel mechanism including ratchet wheels mounted on each of said drive shafts, rockable pawl carriers carrying pawls for cooperating with the ratchet wheels and movable selecting elements displaceable to positions to render said pawls ineffective to drive said ratchet wheels or selectively effective to drive the same in either direction.

7. A flat web knitting frame, according to claim 6 in which said rockable pawl carriers are rocked in one direction by driving elements actuated from a moving part of the machine and in the reverse direction by spring means, and in which means are provided for varying the tension on the spring means associated with the pawl carrier of the drive for the fabric take-up roll.

8. A flat web knitting frame according to claim 4 in which drawing off bands carrying hooks for engaging the ends of welt rods are wound on said fabric take-up roll adjacent the ends thereof and an independent web is wound on said roll intermediate the ends thereof between the fabric layers to insure safe unwinding and laying off of the fabric therefrom upon reverse rotation of the take-up roll to discharge the fabric.

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