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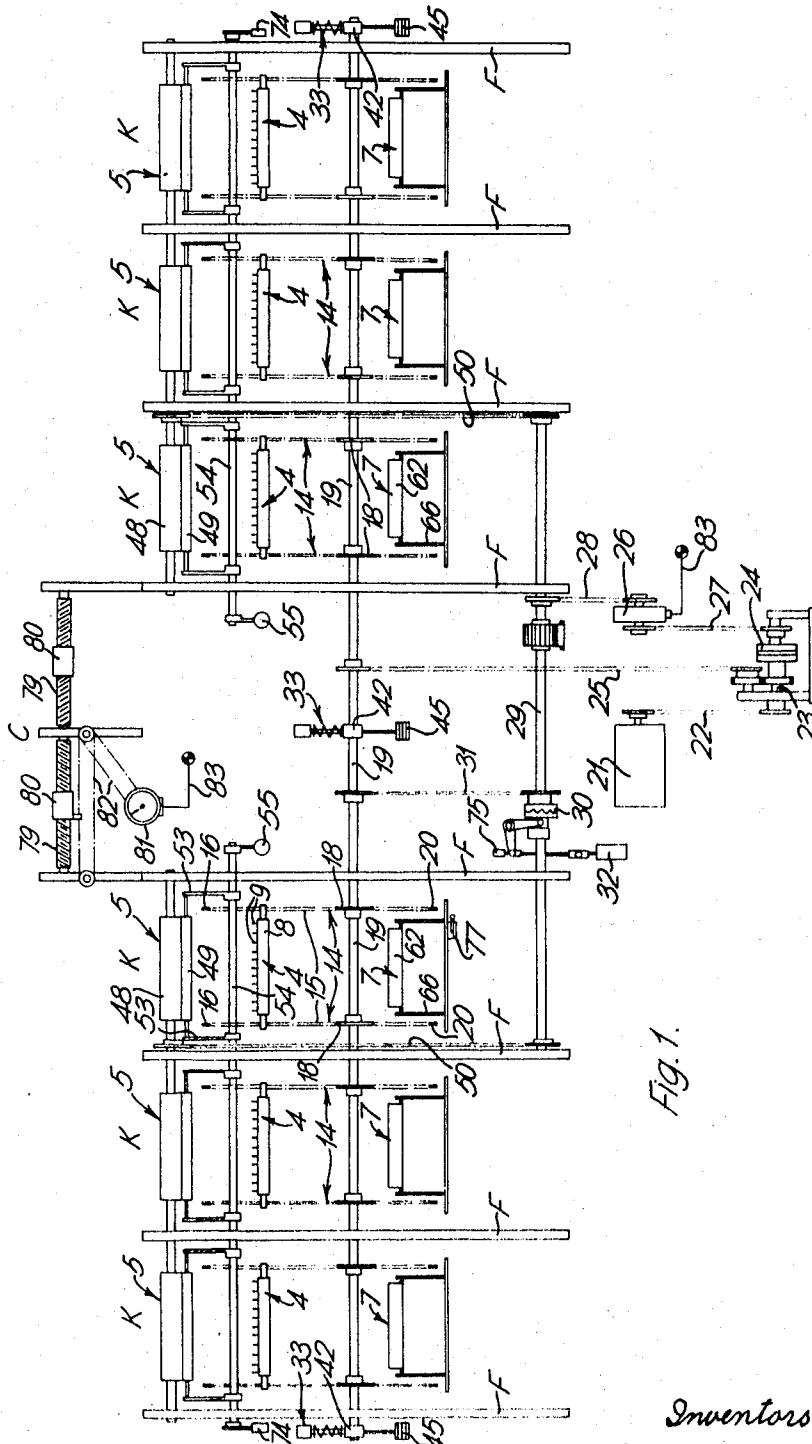
F. R. CHALLENGER ET AL

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METHOD AND MEANS FOR EFFECTING WORK TAKE-OFF IN
FLAT BED AND STRAIGHT BAR KNITTING MACHINES

Filed Nov. 28, 1969

7 Sheets-Sheet 1



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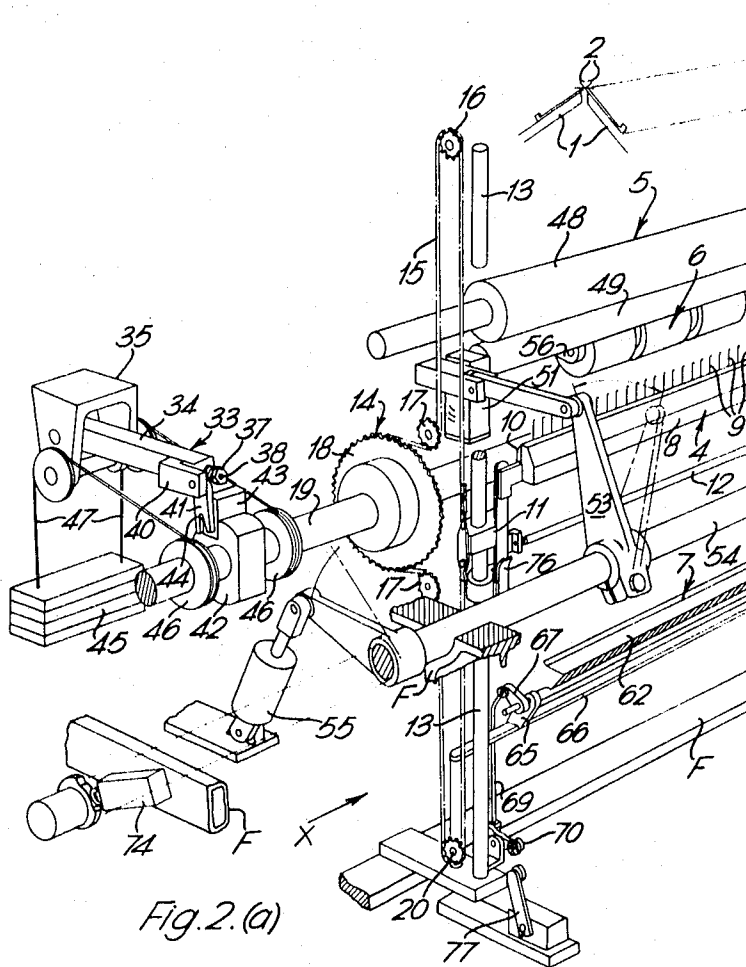
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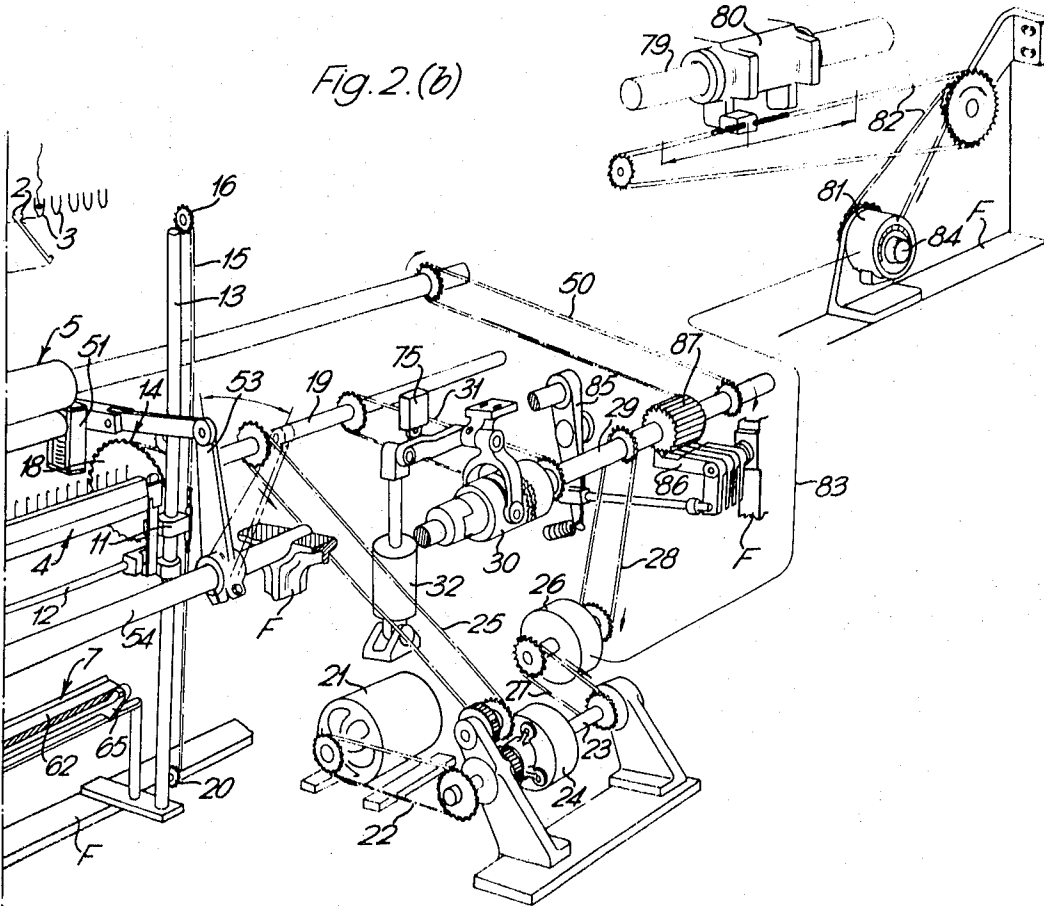
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Fig. 2.(b)



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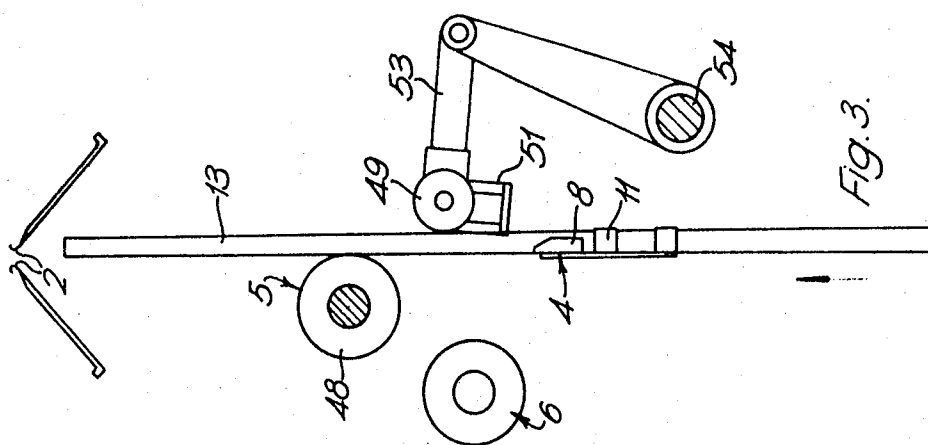
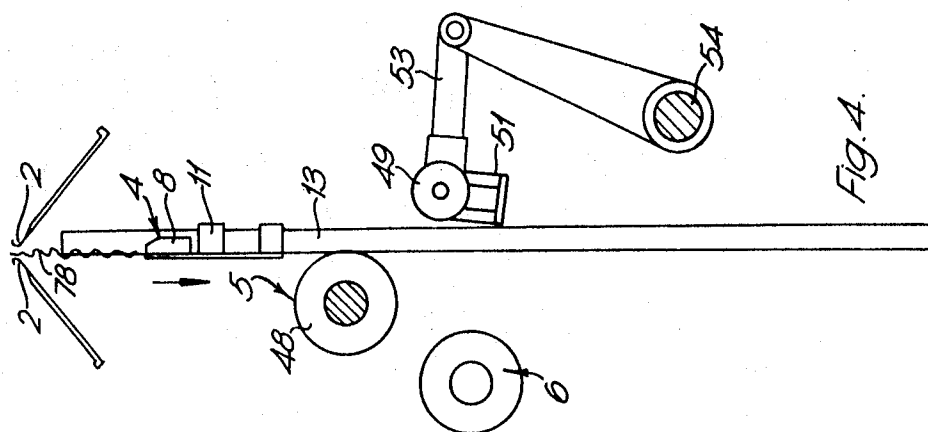
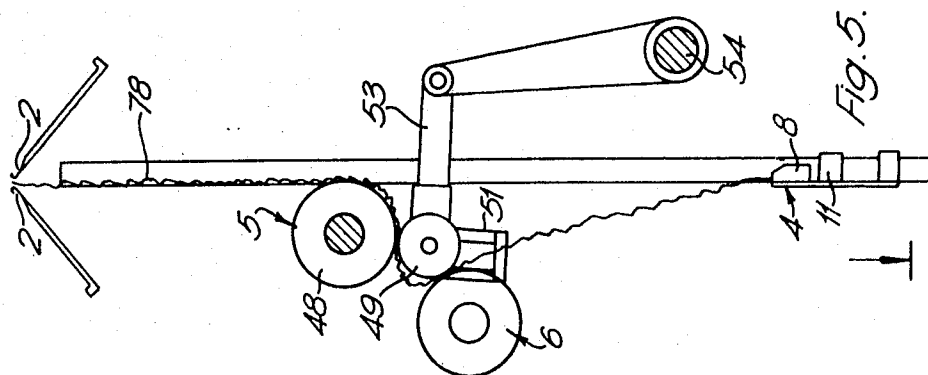
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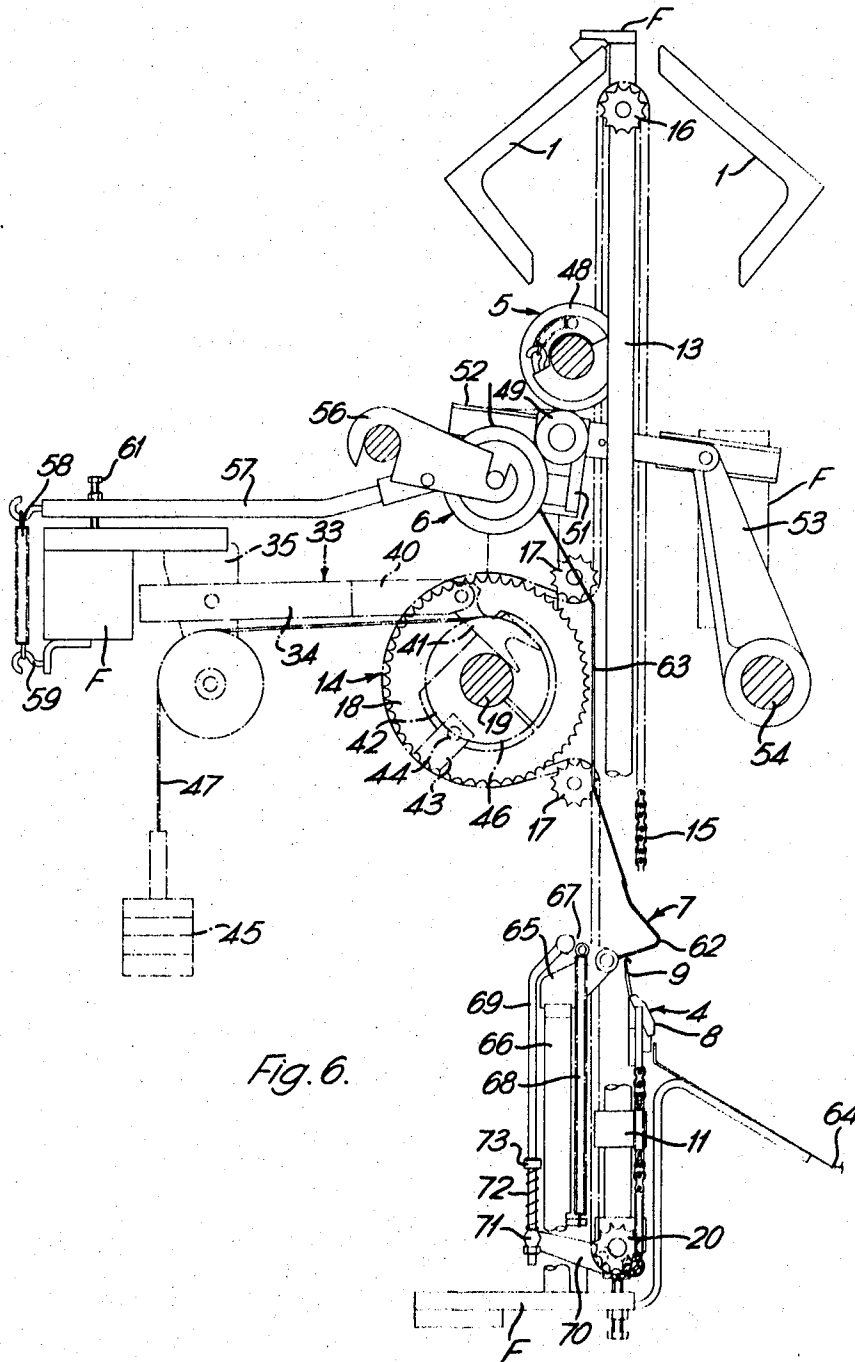
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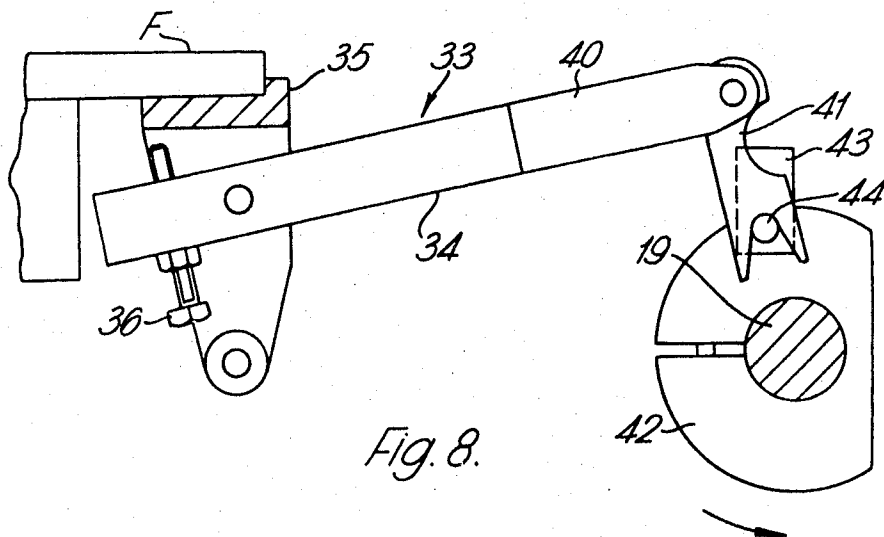
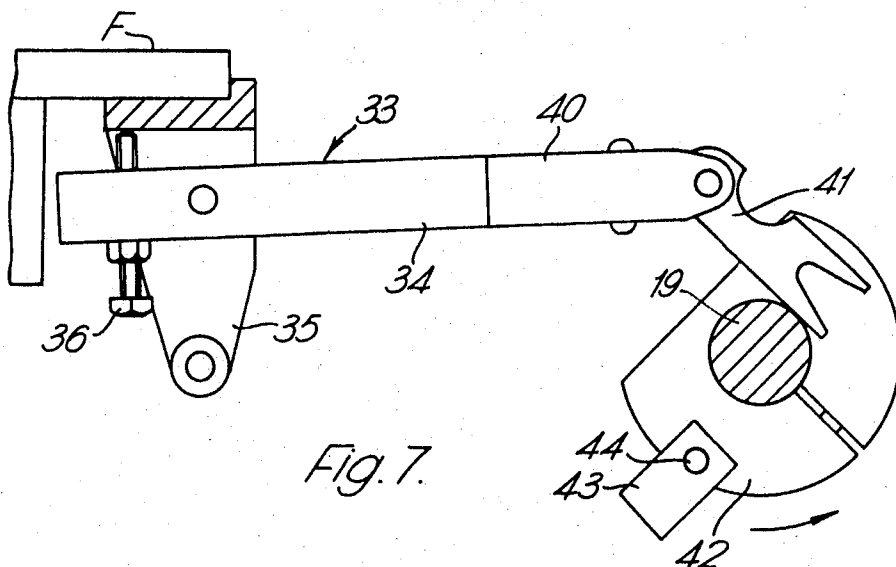
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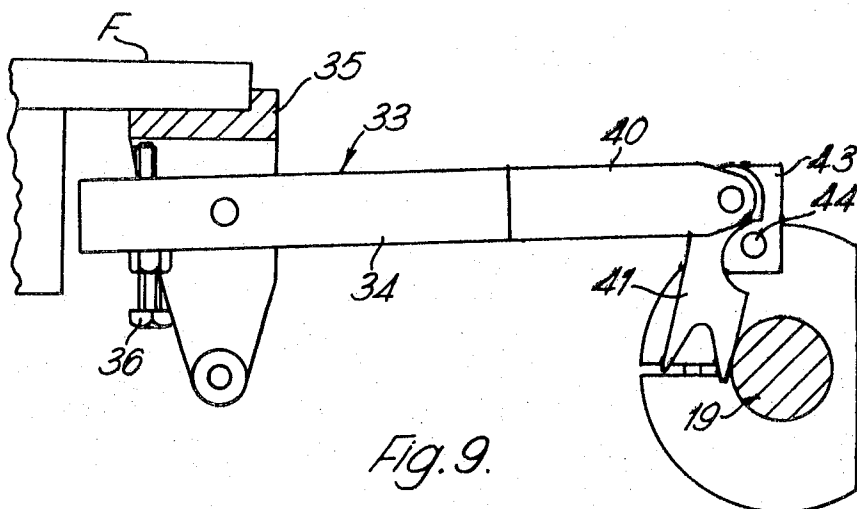


Fig. 9.

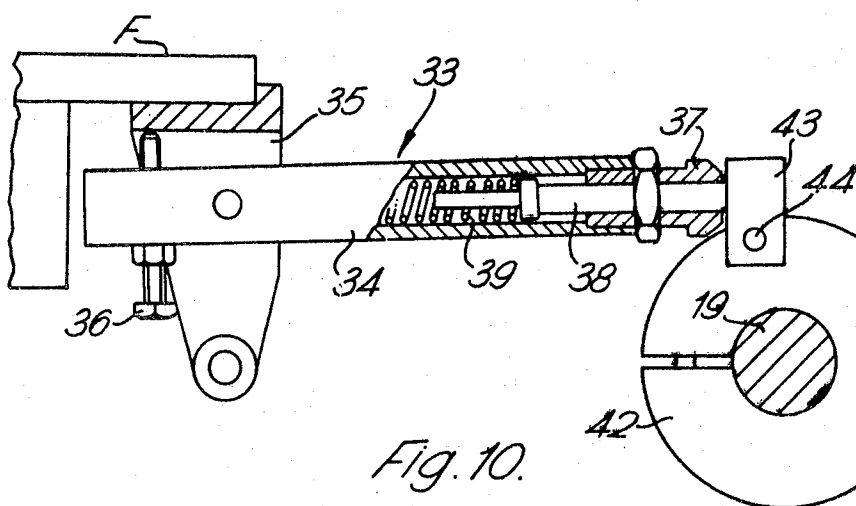


Fig. 10.

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METHOD AND MEANS FOR EFFECTING WORK TAKE-OFF IN FLAT BED AND STRAIGHT BAR KNITTING MACHINES**Frederick Raymond Challenger, Loughborough, and John Harry Cuthbertson, Skegby, England, assignors to S. A. Monk (Sutton-in-Ashfield) Limited, Sutton-in-Ashfield, Nottinghamshire, England****Filed Nov. 28, 1969, Ser. No. 880,559****Claims priority, application Great Britain, Dec. 6, 1968, 58,061/68****Int. Cl. D04b 15/88****U.S. Cl. 66—149****15 Claims****ABSTRACT OF THE DISCLOSURE**

Method and means for effecting work take-off in V bed knitting machines, in which initial tension is applied to the fabric being knitted by a hook-up bar, said tension then being taken up by a drawing-off roller assembly, auxiliary means being provided to engage the fabric issuing from said drawing-off roller assembly and to cause said fabric to follow a pre-determined path.

This invention relates to a method and means for effecting work take-off in V bed knitting machines of the single and multi-head type.

A known work take-off mechanism for this purpose comprises a hook-up bar which is adapted to engage the first course of knitting and initially to apply tension to the workpiece, a drawing-off roller and a pressure roller associated therewith for applying tension to the workpiece after it reaches a predetermined length, and press-off means for disengaging the workpiece from the hook-up bar when tension is taken over by the drawing-off roller.

This arrangement has been found to have several disadvantages amongst which are that, on being pressed off the hook-up bar, the workpiece has a tendency to wrap round the drawing-off and pressure rollers, and that, particularly where the workpiece is fashioned, there is a tendency for the selvages to curl inwards.

It is among the objects of the present invention to provide an improved method and means which overcomes, or substantially reduces, the above mentioned and other inherent disadvantages of the type of work take-off mechanism hereinbefore described.

According to the present invention, there is provided a method of effecting work take-off in V bed knitting machines which comprises initially applying tension to a workpiece by means of a hook-up bar, subsequently applying tension to the workpiece by means of a drawing-off roller assembly, and finally disengaging the workpiece from the hook-up bar wherein, prior to the step of disengaging the workpiece from the hook-up bar, an auxiliary roller is caused to engage the workpiece at a position between the drawing-off roller assembly and the hook-up bar.

According to the invention furthermore, a work take-off mechanism for V bed knitting machines comprises a hook-up bar arranged to engage and to apply tension to a workpiece, a drawing-off roller assembly for applying tension to the workpiece after it has reached a predetermined length, press-off means for disengaging the workpiece from the hook-up bar when tension is taken up by the drawing-off roller assembly, and an auxiliary roller adapted to engage the workpiece at a position between the drawing-off roller assembly and the hook-up bar.

Preferably, the drawing-off roller assembly comprises

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a stationary drawing-off roller and a tension roller which is movable into and out of an operative position adjacent the drawing-off roller. Preferably also, the auxiliary roller is in the form of an idler roller which effects positive displacement of the knitted fabric issuing from the drawing-off roller assembly.

The invention is illustrated by way of example in the accompanying drawings in which:

FIG. 1 is a schematic elevation of a multi-head V bed knitting machine.

FIGS. 2a and b are perspective views of part of a V bed knitting machine showing one knitting head and those parts of a control division necessary to provide an understanding of the invention, and incorporating a take-off mechanism according to the invention,

FIGS. 3 to 5 are schematic side elevations showing the take-off assembly in different operative positions,

FIG. 6 is a side elevation in the direction of the arrow X of FIG. 2, and

FIGS. 7 to 10 are sectional elevations showing different operational positions of a hook-up bar stop mechanism.

Referring particularly to FIG. 1 of the drawings, there is shown a multi-head V bed knitting machine comprising six knitting heads K and a central control division C.

FIG. 1 also shows, generally indicated at F, parts of the main supporting framework of the machine, some of which parts are also shown in the other figures of the drawings.

In the following description reference will be made generally to one knitting head K only, but it will be understood that the construction and operation of the work take-off mechanism in all the heads K will be the same.

Referring to the drawings generally, there is shown a pair of co-operating needle beds 1 each having a set of individually slidable needles 2 operated by cam boxes (not shown). Operatively associated with the needle beds 1 are a plurality of yarn carriers 3.

The work table-off mechanism comprises generally a hook-up bar assembly 4, a drawing-off roller assembly 5, an auxiliary roller 6 and a press-off assembly 7.

The hook-up bar or hook-up bar assembly 4 comprises a tric-cut bar 8 having a series of hooks 9 which are spaced at a pitch similar to that of the needles 2 and are retained in position by a clamp bar 10. The hook-up bar is supported at its ends on slide assemblies 11 which are braced by a tie bar 12, the connection between the bar and the slide assemblies being such as to permit of horizontal and vertical adjustment of the hook-up bar so that the hooks 9 will be presented in the correct position relative the needles 2. The slide assemblies 11 are slidably mounted on vertically disposed guide rods 13 supported on the frame F and movement in a vertical direction is imparted to said assemblies by means of chain and sprocket assemblies 14.

Each chain and sprocket assembly 14 consists of a chain 15 which is attached at its ends to top and bottom lugs provided on the slide 11, the chain passing round an upper sprocket 16, idler sprockets 17, a drive sprocket 18 fixed to a driven shaft 19, and a lower tensioning sprocket 20.

The driven shaft 19 is rotated by a motor 21 which operates continuously whilst the machine is switched on. The motor 21 is coupled, via gearing 22, to a lay shaft 23 which incorporates an electro-magnetic clutch 24. The lay shaft 23 is further coupled, by gearing 25, to the driven shaft 19. In addition, a magnetic particles clutch 26 is coupled, via gearing 27 to the lay shaft 23, and via gearing 28, to a second lay shaft 29. The shaft 29 is coupled, via a dog clutch 30 and gearing 31, to the driven shaft 19, the dog clutch 30 being operated by a hydraulic ram 32 which is controlled from the main machine control unit, for example a punched tape mechanism.

In order to raise the hook-up bar assembly 4, a signal from the main machine control causes the electro-magnetic clutch 24 to be energized whereby rotation of the driven shaft 19 is effected via the gearing 25. In order to lower the hook-up bar assembly 4, the electro-magnetic clutch 24 is de-energised and the magnetic particle clutch 26 is energised. In addition, the dog clutch 30 is engaged whereby rotation is imparted to the driven shaft 19 in a direction opposite to that previously described.

At spaced positions along the length of the machine, there are provided, for example, three spring loaded stop mechanisms 33 which serve to determine the extent of upward movement of the hook-up bar assembly 4 and, as hereinafter described, to effect tensioning of the first course of loops.

Each stop mechanism 33 comprises a lever 34 which is pivotally mounted on a U-shaped frame member 35, angular adjustment of said lever being provided by a setscrew 36. The end of the lever 34 is provided with an adjustable stop 37, the latter receiving a plunger 38 which acts against a compression spring 39. A projection 40 on one side of the lever 34 supports a pivotally mounted fork-like member 41.

Fixedly mounted on the driven shaft 19 is a boss or cam 42 having secured thereto a stop block 43 which coacts with the stop 37 and the plunger 38, the stop block 43 being provided with a projecting pin 44 which coacts with the fork-like member 41.

Bearing in mind that, in order to move the hook-up bar assembly 4 from its lowermost position to its uppermost or operative position, the driven shaft 19 must be rotated more than once, the reason for and the operation of, the aforementioned stop mechanisms will now be described. Thus, as the hook-up bar 4 is being raised, the shaft 19, and thus also the boss or cam 42, are turning in an anti-clockwise direction with the fork-like member 41 resting on the shaft 19 and the lever 34 in a horizontal or operative position as is seen in FIG. 7. During the first revolution, the pin 44 engages the fork-like member 41 and raises the lever 34 so that the stop block 43 cannot as is shown in FIG. 8 engage the stop 37. Further rotary movement allows the lever 34 to return to its operative position so that, during the second revolution, the stop block 43 enters, as shown in FIGS. 9 and 10, into engagement with the stop 37 which determines the uppermost limit of the movement of the hook-up bar.

When entering into engagement with the stop 37 it will be seen from FIG. 10 that the stop block 43 also engages the plunger 38 against the action of the spring 39. This provides an energy store so that, on changing over from the clutch 24 to the clutch 26 to reverse the direction of movement of the hook-up bar 4, the spring 39 provides an initial thrust in the reverse direction to apply tension to the first course of loops which, by this time, are engaged by the hooks 9 of the hook-up bar 4. This action is facilitated by the provision of weights 45 attached to pulleys 46 fixed to the shaft 19 by means of cables 47, which weights serve to counterbalance the weight of the hook-up bar assembly 4.

It will be obvious that, during downward movement of the hook-up bar 4, the pin 44 will enter into engagement with the fork-like member 41 and return it to the position shown in FIG. 7 in readiness for the next operation.

The drawing-off roller assembly 5 comprises a drawing-off roller 48 and a pressure roller 49. The roller 48 is mounted in fixed bearings in the framework F and is rotated by gearing 50 from the second lay shaft 29 from which downward movement is imparted to the hook-up bar via the shaft 19. In this respect, it will be clear that operation of the roller 48 is only required during a take-down operation and it will therefore remain stationary until the hook-up bar 4 commences to move in a downward direction.

The pressure roller 49 is mounted in spring-loaded housings 51 which are slidable in guide rails 52. The hous-

ings 51 are coupled, via linkages 53, to an operating shaft 54 which is adapted, by the action of a hydraulic ram 55, to be angularly turned so as to move the pressure roller 49 towards and away from a position adjacent the drawing-off roller 48.

The auxiliary roller 6 is mounted at its ends on hinged supported brackets 56 which are biased in an upward direction by means of spring biased levers 57. As can be seen in FIG. 6, the ends of the levers 57 are connected to tension springs 58 which are anchored at 59 to the supporting frame F. Adjustable set screws 61 are provided between the frame F and the levers 57 to adjust the angular position of the latter. Thus, it will be appreciated that the auxiliary roller is very lightly sprung so that, in use, when the pressure roller 49 is moved into its operative position between the drawing-off roller 48 and the auxiliary roller 6 as shown in FIG. 5, the auxiliary roller 6 will be slightly pushed down against the action of the spring 58.

The press-off assembly 7 comprises a press-off plate 62 which extends the full width of the knitting head and projects into a gap provided between a knitted garment piece guide plate 63 and a work receiving tray 64. The press-off plate 62 is pivotally mounted on brackets 65 secured to a supporting frame 66 and is fixed to one end of a lever arm 67. A tension spring 68 is provided between the lever arm 67 and an anchorage point on the frame 66, the other end of the lever arm 67 being connected to an actuating rod 69. A pivotally mounted roller lever 70 is mounted adjacent the base of one of the guide rods 13, a roller on one end of the lever 70 being positioned to be engaged by the correspondingly positioned slide 11 of the hook-up bar assembly 4, and the other end of the lever 70 being provided with a sleeve 71 which is slidably mounted on the lower end of the actuating rod 69. A compression spring 72 is positioned on the rod 69 between the sleeve 71 and a stop collar 73. Thus, as the hook-up bar moves into its lowermost position as shown in FIGS. 5 and 6, the aforementioned slide 11 will engage the roller lever 70 and cause the press-off plate 62, against the action of the springs 68 and 72, to tilt forward as shown in FIG. 6 in order to press the knitted fabric off the hooks 9 of the hook-up bar. However, this does not effect immediate release of the fabric since the springs are designed so that the plate 62 will not effect press-off whilst the fabric is under tension between the hook-up bar and the rollers 6, 48 and 49. Thus, initially, the plate 62 merely deflects the fabric forward of the hooks 9, and when sufficient fabric is knitted, the weight of the fabric, plus the pressure applied by the plate 62, disengages it from the hooks 9 without difficulty.

In operation, in order to effect work take-off, the hook-up bar assembly 4 is in its lowermost position, the pressure roller 49 is in its inoperative position as shown in FIGS. 3 and 4, the motor 21 is running with the clutches 24, 26 and 30 disengaged, the hook-up bar stop mechanism 33 is in the inoperative position shown in FIG. 7 and the press-off assembly 7 is in its retracted position. In this respect, it will be understood that various electrical interlocks well known in the art must, at this stage, be in their correct positions to ensure clear passage of the working parts. The most significant of these are switches 74 which indicate the angular position of the pressure roller actuating shaft 54.

With the interlock switches in the correct positions, a signal is passed from the main machine control which causes energisation of the clutch 24 and thus upward movement of the hook-up bar 4. During this upward movement the operation of the stop mechanism 33 is as hereinbefore described with reference to FIGS. 7 to 10.

On reaching the uppermost position as determined by the stop mechanism 33, the hooks 9 of the hook-up bar 4 are positioned between the two needle beds 1 and one of the yarn carriers 3 is operated to lay the yarn, which is usually a draw thread, for the first course. The main

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machine control then calls for a work take-down operation. This de-energises the clutch 24 and energises the clutch 26 so that, through the dog clutch 30 the position of which is indicated by a switch 75, the driven shaft 19 is turned in the reverse direction to move the hook-up bar, with the hooks 9 engaged in the first course of knitting, downwardly. In this respect, as hereinbefore indicated, release of the clutch 24 allows the plunger 38 under the action of the spring 39 to turn the shaft 19 sufficient to apply tension to the first course.

Assuming the fabric being knitted is to be of constant width, the hook-up bar 4 is moved downwardly in increments under the action of the clutch 26 and the dog clutch 30.

When the hook-up bar assembly 4 reaches its lowermost position, a cam 76 on one of the slides 11 trips a switch 77 which disengages the dog clutch 30 thereby completing controlled downward movement of the hook-up bar 4. In this position the knitted fabric indicated at 78 in FIGS. 4 and 5 extends in a taut condition directly between the needles 2 and the needles 9 of the hook-up bar 4. Operation of the switch 77 also causes actuation of the hydraulic ram 55 to move the pressure roller 49 into its operative position as shown in FIG. 5. This causes the knitted fabric to be wrapped more than a quarter turn round the drawing-off roller 48, which is being rotated via the clutch 26, the gearing 28, the shaft 29 and the gearing 50, and also brings into operation the auxiliary roller 6 which ensures that the fabric follows its correct course and is not wrapped round the pressure roller 49 or round the drawing-off roller 48. Thus, thereafter tensioning of the fabric will be effected by the rollers 48, 49 and 6.

Movement of the hook-up bar assembly 4 into its lowermost position also causes actuation of the roller lever 70 to operate the press-off plate 62 in the manner hereinbefore described. In this latter respect, the press-off plate 62 will not press-off the fabric whilst it is in a taut condition, and in fact, when the pressure roller 49 is moved into its operative position, it will be seen that the hook-up bar 4 will be lifted slightly to allow for the fabric to be wrapped round the rollers. However, during continued knitting of the fabric 78, the hook-up bar 4 will return to its lowermost position and subsequently that part of the knitted fabric extending between the rollers and the hook-up bar 4 will become slack. At this stage, the weight of the fabric, plus the action of the press-off plate 62, will cause disengagement of the fabric from the hooks 9.

On completion of the knitted garment piece, the main machine control signals the yarn carriers to finish their movement at the end of their stroke, and also signals a press-off operation whereby the garment piece is released from the needles 2 in known manner. At the same time, the electrical circuit to the magnetic particle clutch 26 is put through a time sequence which is operative to cause continued rotation, for a set period of time, of the drawing-off roller assembly 5 to release the fabric piece and allow it to drop into the receiving tray 64.

Where the machine is fitted with fashioning mechanisms, the fashioning screws and nut housing of which are shown respectively at 79 and 80, means are provided for varying the tension applied to the fabric according to its knitting width.

For this purpose a variable ratio transformer 81 is coupled, via gearing 82, to one of the nut housings 80 which control the knitting width of the fabric. The transformer 81 is also connected electrically via line 83 to the magnetic particle clutch 26 which operates on the principle that, the greater the voltage applied thereto the greater will be the torque transmitted thereby. Thus, operating on this principle, when the screws 79 are operated to reduce the fabric width, the voltage applied to the clutch 26 is gradually reduced and thus the torque output thereof is lowered. Similarly, when the fabric width is

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increased, the voltage and thus also the torque output are increased. By using a variety of sprocket sizes for the gearing 82, a large range of torque can be applied to the hook-up bar assembly 4 and to the drawing-off roller assembly 5.

If at any time the operator finds it necessary to ease the load applied by the hook-up bar assembly 4 or the drawing-off roller assembly 5, this can be effected manually by means of a manual control switch indicated at 84. This easing of the load is also effected automatically during a fashioning cycle. Thus, when the main machine control signals a fashioning operation, the main cam shaft (not shown) of the machine operates a linkage 85 which releases anti run-back pawls 86 from a ratchet wheel 87 on the lay shaft 29. This pawl and ratchet mechanism is well known in the art and serves to prevent the tension of the fabric from pulling or turning the shaft 29 in the wrong direction. This also applies when the traverse of the machine is stopped by turning the power control rod to the "off" position.

It will be understood that the various operations described are effected by selective operation of the clutches 24, 26 and 30. Thus, the operation is generally as follows:

(1) The clutch 24 is engaged, with the motor 21 continuously turning, to turn the driven shaft 19 thereby raising the hook-up bar up to the limit of its stroke as determined by the stop mechanism 33.

(2) The yarn carrier 3 is operated to draw the first course and the clutch 24 is de-energised whilst at the same time the clutch 26 is energised.

(3) When the clutch 24 is de-energised, the spring 39 is caused to rotate the shaft 19 in the opposite direction to apply tension to the first course of fabric. In this respect, the hook-up bar assembly 4 is counterbalanced by the weights 45 so that the only tension applied to the first course of the fabric is that applied by the spring 39.

(4) Tension is applied to the knitted fabric through the clutch 26, the dog clutch 30 and the shaft 19 operating the hook-up bar assembly 4.

(5) Knitting continues with the hook-up bar 4 being moved downwardly in increments corresponding to one knitted course, the check pawls 86 serving to prevent the tensioned fabric from pulling the hook-up bar 4 back.

(6) When the hook-up bar reaches its lowermost position, the pressure roller 49 is operated so that tension of the fabric is taken up by the drawing-off roller assembly 5.

(7) On the knitted fabric reaching a certain length the press-off assembly 7 assists in detaching the fabric from the hooks 9 of the hook-up bar 4.

(8) On completion of a knitted fabric piece, pressing off of said piece is effected in a manner well known in the art.

(9) The operation is repeated as from 1 above.

It will be appreciated that, by using the magnetic particle clutch 26, constant and continuous tension is maintained on the knitted fabric, such tension being variable to suit the width of the fabric and/or the particular fabric being knitted.

What we claim is:

1. A method of effecting work take-off in a V bed knitting machine, which comprises initially applying tension to a workpiece being knitted using a hook-up bar which is driven in a downward direction in increments corresponding to a knitted course, subsequently applying tension to the workpiece by means of a drawing-off roller assembly, and finally disengaging the workpiece from the hook-up bar wherein, prior to the step of disengaging the workpiece from the hook-up bar, auxiliary means are caused to grip the workpiece at a position between the drawing-off roller assembly and the hook-up bar so that, on release of the workpiece from the hook-up bar, said auxiliary means cause the knitted fabric issuing from the drawing-off roller assembly to follow a pre-determined path.

2. The method as claimed in claim 1, in which the step of applying tension to the workpiece by means of the drawing-off roller assembly, and the step of gripping the workpiece by the auxiliary means, are effected simultaneously.

3. The method as claimed in claim 2, in which engagement of the workpiece by the hook-up bar is maintained for a pre-determined number of knitted courses after tensioning of the workpiece has been taken up by the drawing-off roller assembly.

4. A work take-off mechanism for a V bed knitting machine comprising a hook-up bar having a series of fixed hook elements for engaging a fabric workpiece being knitted, traction means for moving said hook-up bar in a downward direction to apply tension to said workpiece and move the same along a predetermined path of travel, a drawing-off roller positioned adjacent said traction means, means for rotating said drawing-off roller about its axis in the direction of workpiece movement, means mounting a pressure roller for movement from a first position remote from said drawing-off roller to a second position adjacent thereto, said pressure roller in said first position and said drawing-off roller being on opposite sides of said predetermined path of workpiece travel, means for moving said pressure roller across said predetermined path of workpiece travel from said first position to said second position whereby said workpiece is pressed into engagement with said drawing-off roller, and means for disengaging said workpiece from said hook-up bar after said workpiece has been gripped between said drawing-off roller and said pressure roller.

5. The work take-off mechanism as defined in claim 4 wherein said rotating means rotate said drawing-off roller in increments each corresponding to a course of the fabric workpiece.

6. The work take-off mechanism as defined in claim 4 including an idler auxiliary roller, and means supporting said auxiliary roller in spaced adjacent parallel relationship to said drawing-off roller and on the same side of said predetermined path of workpiece travel whereby upon movement of said pressure roller to said second position said workpiece is also pressed into engagement with said auxiliary roller whereby said workpiece is constrained to pass between a nip of said drawing-off roller and said pressure roller and between a nip of said pressure roller and said auxiliary roller.

7. The work take-off mechanism as defined in claim 4 wherein said rotating means rotate said drawing-off roller in increments each corresponding to a course of the fabric workpiece, an idler auxiliary roller, and means supporting said auxiliary roller in spaced adjacent parallel relationship to said drawing-off roller and on the same side of said predetermined path of workpiece travel whereby upon movement of said pressure roller to said second position said workpiece is also pressed into engagement with said auxiliary roller whereby said workpiece is constrained to pass between a nip of said drawing-off roller and said pressure roller and between a nip of said pressure roller and said auxiliary roller.

8. A work take-off mechanism as defined in claim 7 wherein said traction means includes means (1) for raising the hook-up bar into an operative position, (2) for lowering the hook-up bar in increments corresponding to a knitted course, and (3) for turning the drawing-off roller in increments corresponding to a knitted course.

9. The work take-off mechanism as defined in claim 8 wherein said last-mentioned means comprises three selectively operable clutch mechanisms.

10. The work take-off mechanism as defined in claim 9 wherein said clutch mechanisms include a first clutch powered by a driven shaft to raise the hook-up bar into an operative position, a second clutch driven through a third clutch and said driven shaft to lower said hook-up bar, and said second clutch being further operative to rotate said drawing-off roller.

11. The work take-off mechanism as defined in claim 10 wherein said second clutch is a magnetic particle clutch, and means are provided to vary the torque output thereof to vary the tension applied to the workpiece through said hook-up bar and said drawing-off roller.

12. The work take-off mechanism as defined in claim 7 including a device for applying tension to a first course of knitted loops of said workpiece immediately prior to the engagement of the workpiece by said hook-up bar hook elements.

13. The work take-off mechanism as defined in claim 12 wherein said device comprises spring-loaded plunger means for imparting limited angular rotation of a shaft coupled to said hook-up bar thereby limiting downward movement of said hook-up bar.

14. The work take-off mechanism as defined in claim 7 including a fixed supporting frame for a knitting head, a plate extending lengthwise of said knitting head, a means mounting said plate for angular movement relative to said supporting frame at a position adjacent said hook-up bar in the lowermost position thereof.

15. The work take-off mechanism as defined in claim 14 including spring means resisting the angular movement of said plate, and lever means between said plate and said hook-up bar and operative by the latter to effect angular movement of said plate.

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