United States Patent

Findewirth et al.

[15] **3,651,669**

[45] **Mar. 28, 1972**

[54] FABRIC TAKEUP FOR FLAT KNITTING MACHINES

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[22] Filed: **Oct. 28, 1970**

[21] Appl. No.: **84,694**

[52] **U.S. Cl.** **66/149**

[51] **Int. Cl.** **D04b 15/88**

[58] **Field of Search** 66/147, 149, 150, 152; 242/55; 139/304, 307, 305

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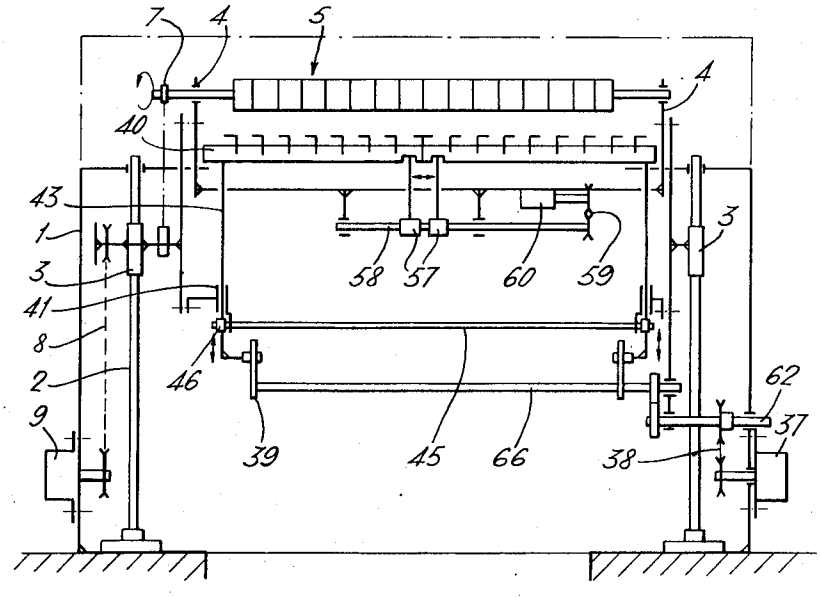
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[57] **ABSTRACT**

Fabric takeup mechanism for flat knitting machines for knitting fabrics of variable width, comprising a hook takeup including means carrying a row of hooks in a line parallel to the front edge of the fabric being knit, the hooks including a first set arranged on the left-hand side of the carrying means and a second set arranged on the right-hand side of the carrying means, the free end of each of the hooks of the first set pointing toward the left-hand edge of the fabric and the free end of each of the hooks of the second set pointing toward the right-hand edge of the fabric, means for bringing the row of hooks into engagement with the front edge of the fabric at the beginning of a knitting operation, a set of a plurality of coaxial takeup rolls and a set of a like plurality of coaxial pressure rolls each cooperating with a respective takeup roll to define a nip, the sets of rolls being positioned relative to the row of hooks to receive in the nips from the row of hooks the front edge of the fabric, and means for disengaging the row of hooks from the front edge of the fabric after the front edge of the fabric has been received in the nips.

7 Claims, 10 Drawing Figures



PATENTED MAR 28 1972

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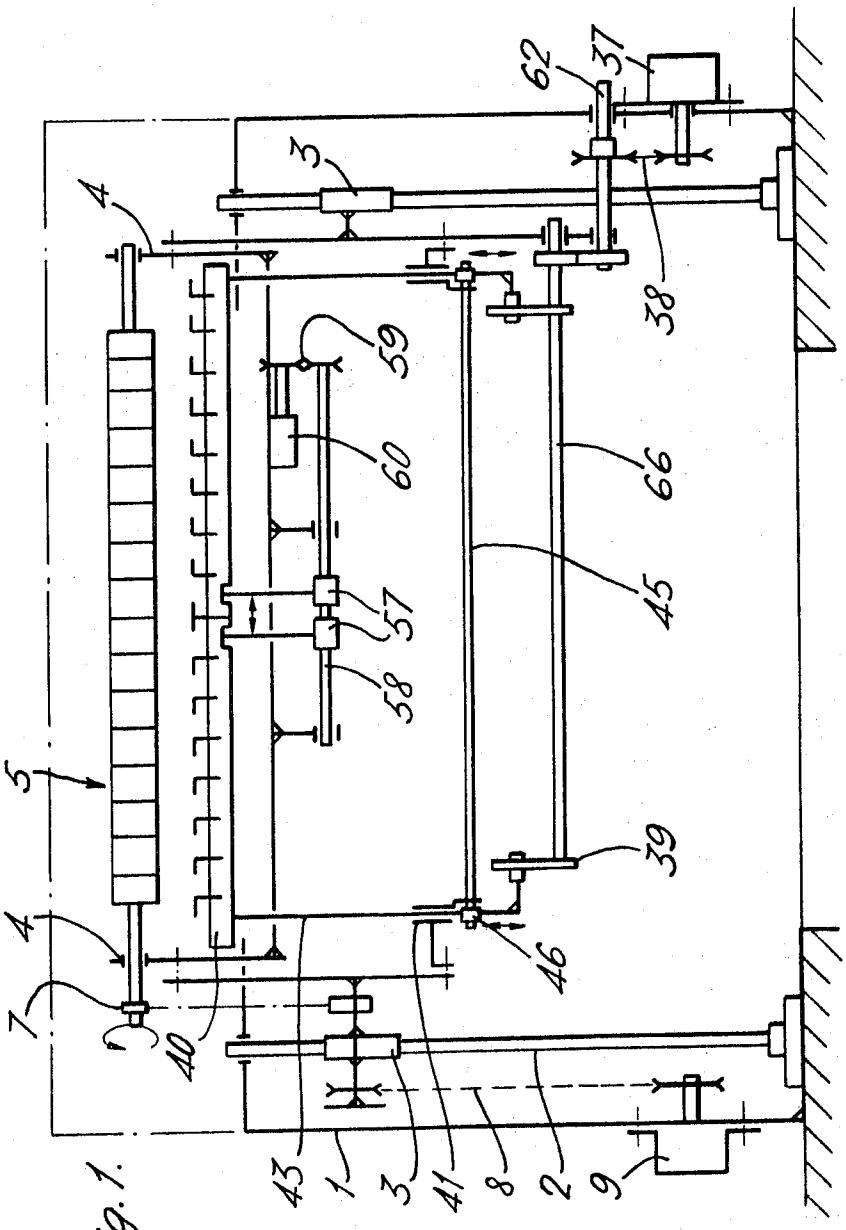


Fig. 1.

WOLFGANG FINDEWIRTH
HELMUT IRMSCHER
GÜNTHER KESSLER
GÜNTHER LEUBNER
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Fig. 2.

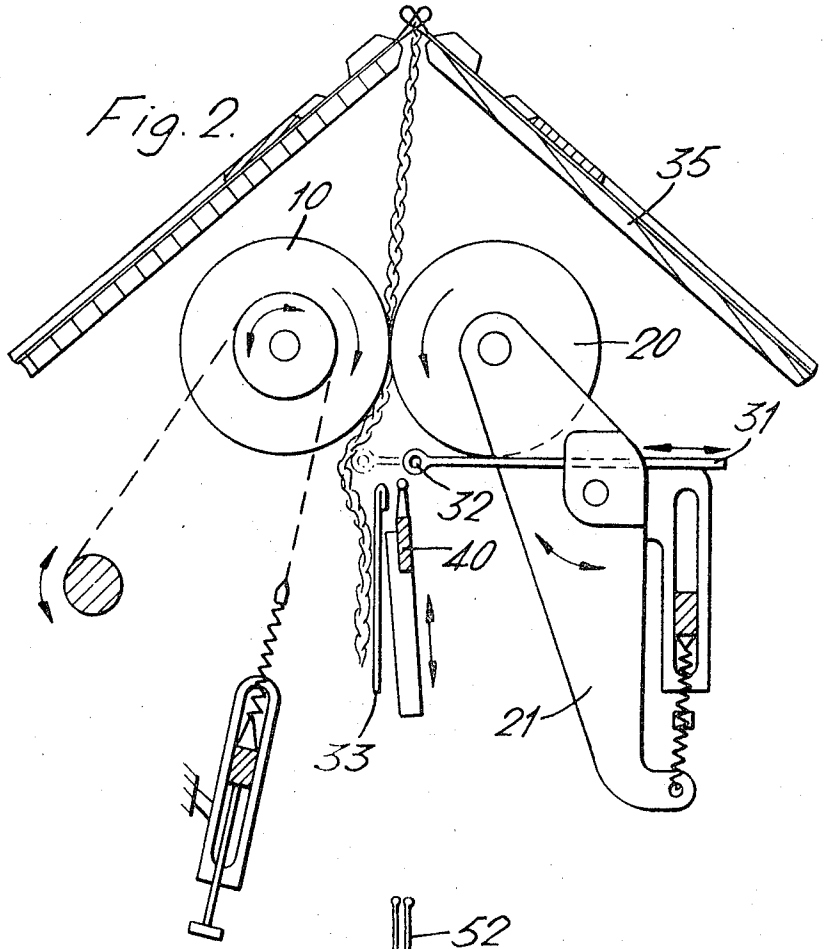
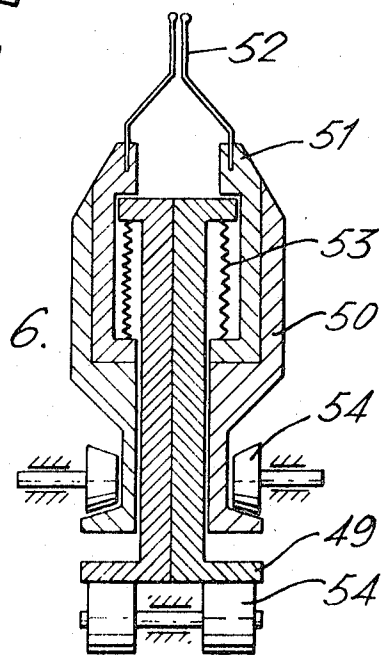


Fig. 6.



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Fig. 3.

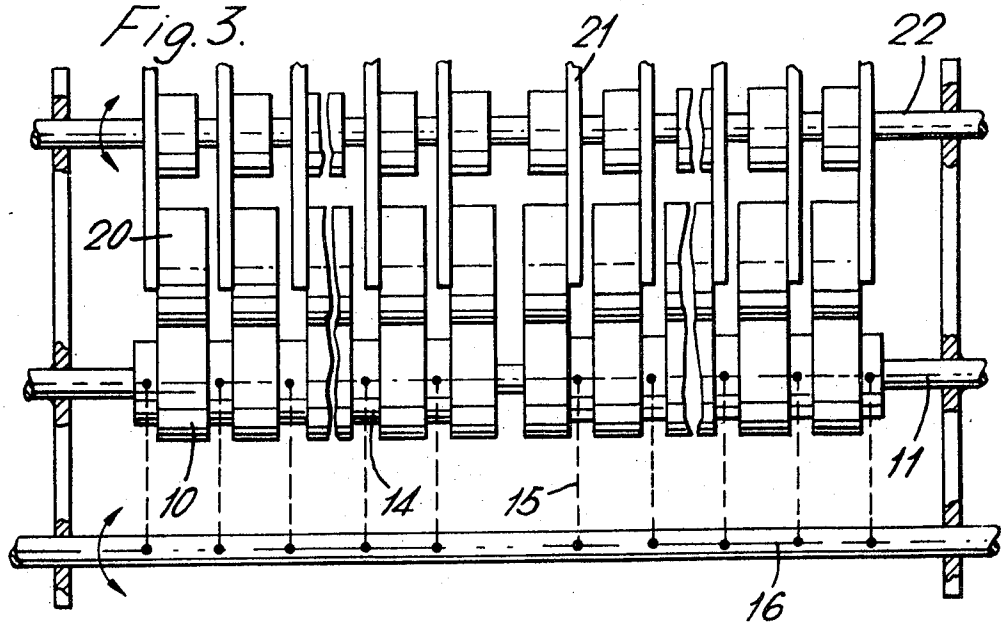
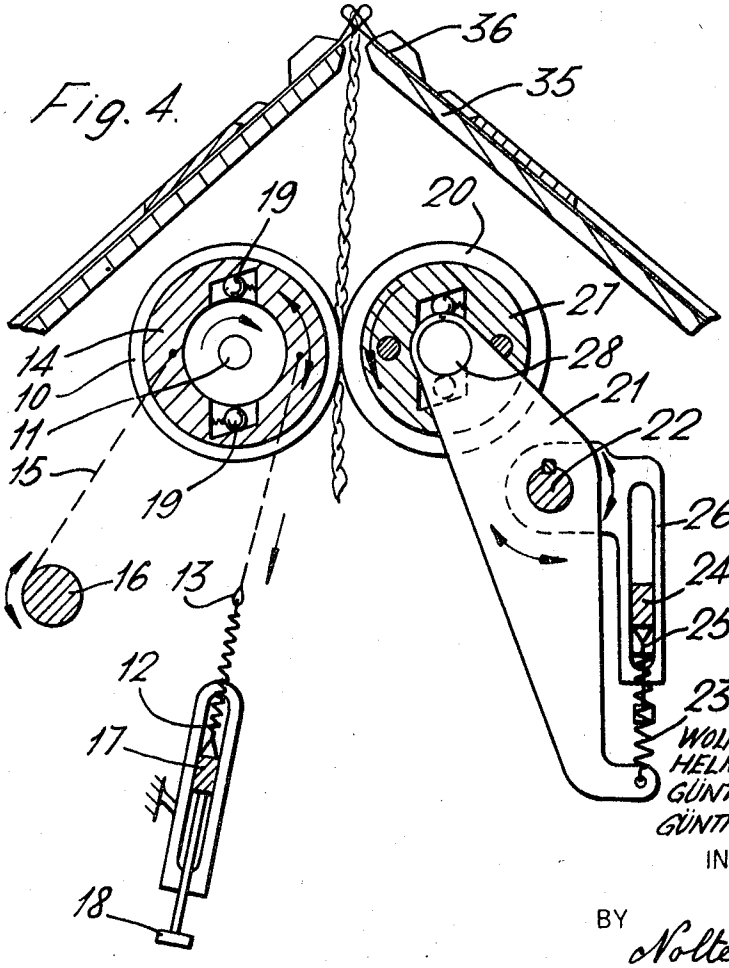


Fig. 4.



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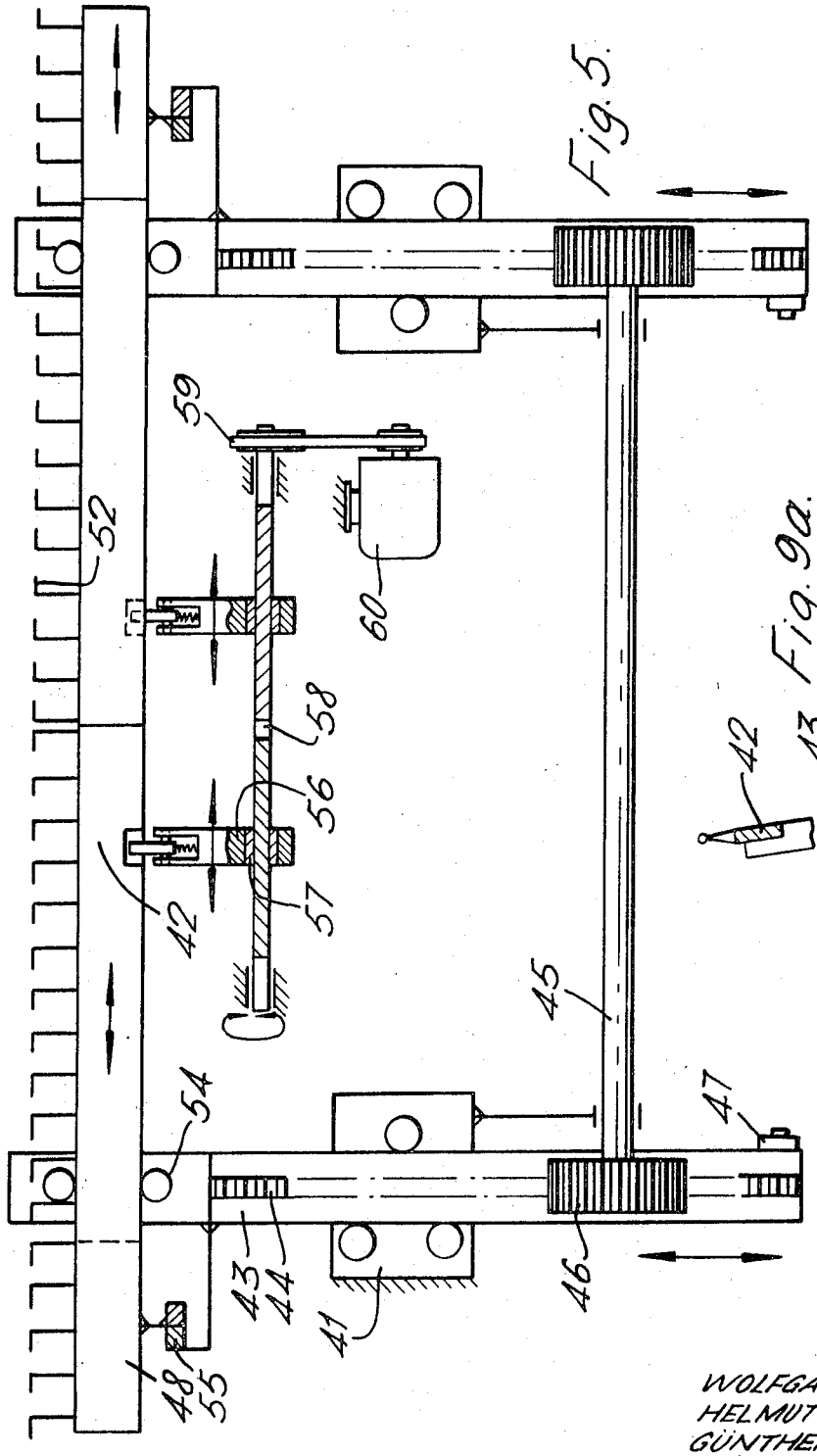


Fig. 5.

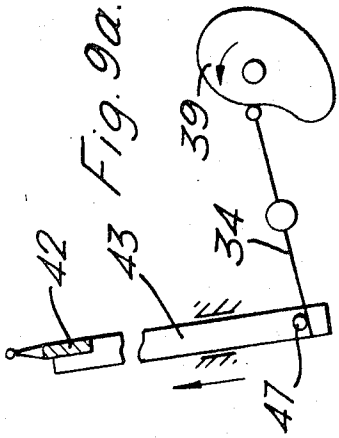


Fig. 9a.

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Fig. 7.

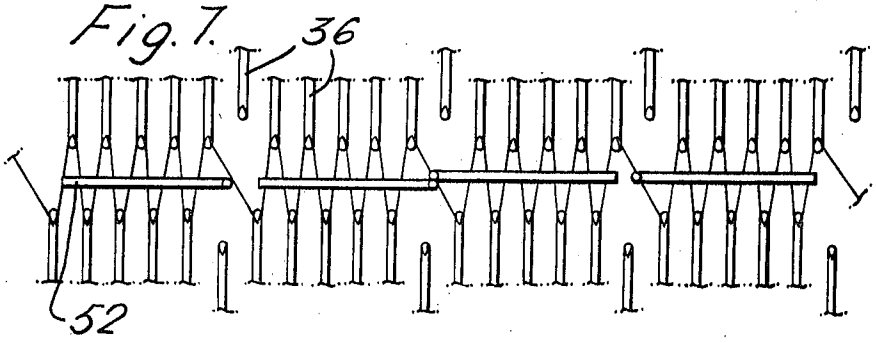
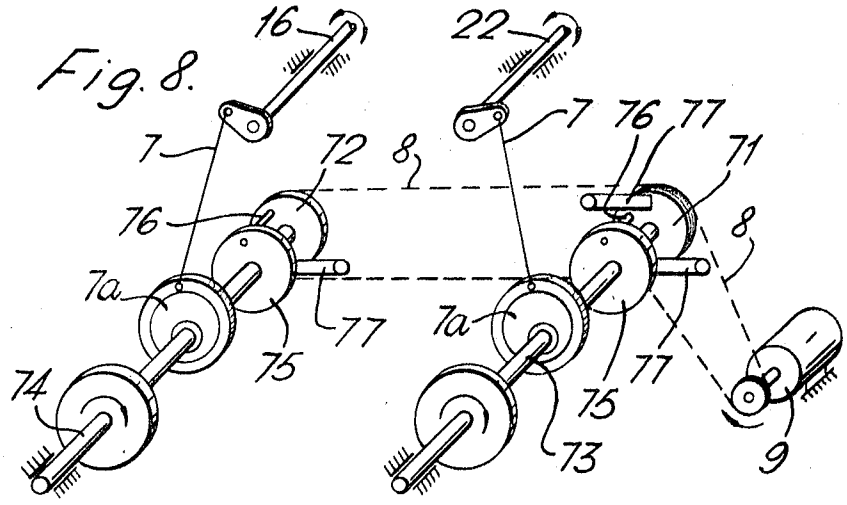


Fig. 8.



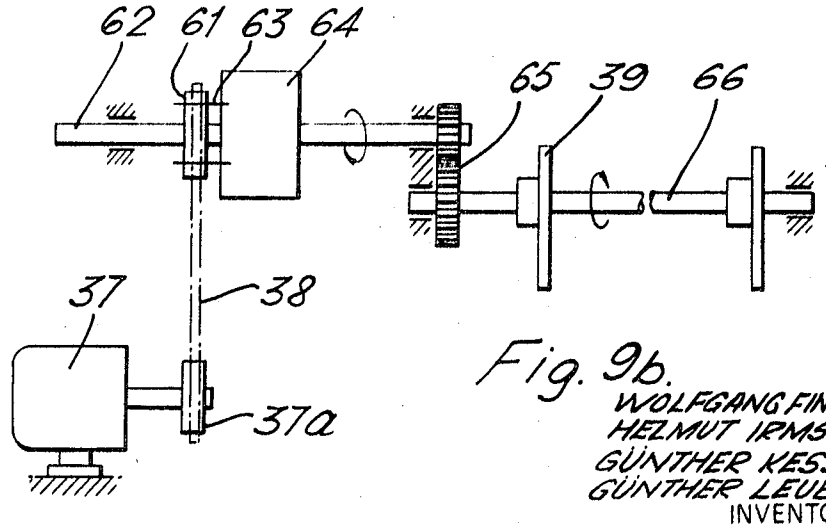


Fig. 9b.

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FABRIC TAKEUP FOR FLAT KNITTING MACHINES

The invention relates to a fabric takeup for flat knitting machines for knitting fabrics of variable width, consisting of a combination of a hook takeup with a roll takeup.

Fabric takeup devices are already known where the knitting head and smaller knitted pieces are taken up by a takeup comb alone and larger knitted pieces by takeup rolls. The takeup comb consists of a row of hooks which project at the start of the knitting beyond the takeup combs of the needle bed and which have wrapped around them a separating yarn. After the knit fabric is completed or after it has been transferred to the roll takeup, it is cast off the hooks of the comb by means of a mechanically operated ejector. The ejector consists of a plate extending over the entire working width of the knitting machine and having a bent edge which reaches over the row of hooks so that it drops the knitting from the hooks when it turns toward the takeup comb. In the case of long pieces of knit fabric, the fabric is taken up by the roll takeup, the back pressure rolls being displaced toward the continuous takeup roll and the knitted part being wound about one-quarter of the circumference of the takeup roll.

This fabric takeup device has the disadvantage, however, that the roll takeup is arranged relatively low, so that large parts of the knitting are taken up by the comb. This has the result that the knitted fabric is distorted, due to the constant takeup force, particularly when reduction has already started. Besides, with these lengths, the knitted fabric already shrinks considerably. Special fabric width retaining means would thus have to be provided. The dropping of the knitting from the hooks by the ejector likewise does not always ensure a 100 percent release, due, among other things, to the form of the hooks, which may lead to distortion and damage in the knitted fabric.

Furthermore, fabric takeup devices are known in which takeup hooks arranged on bars feed the widening part or the head of a newly started knitted fabric to a takeup roll and to an arcuate guide element cooperating with the latter, which presses the knitted fabric against a part of the circumference of the takeup roll. For the automatic transfer of the knitted fabric from the takeup hooks to the takeup roll and to the arcuate guide element, the latter is in a configuration of a comb in the vicinity of the entrance point of the knitting, the spaces of which are engaged by the takeup hooks. The knitted fabric is deflected arcuately after entering the arcuate guide element and the takeup hooks move linearly. The takeup hooks remain in a position in which the knitting is taken up by the hooks. The takeup roll is driven over a ratchet gear and provides a takeup force that can be adjusted in dependence on the knitting width.

This device has the disadvantage, however, that the number of hooks for engaging the widening part or the head of the knitted fabric would have to be readjusted manually with each lot of new knitted articles or new sizes, or that new bars would have to be used. Besides the roll with the associated arcuate guide is relatively far away from the needle bed, which results in the occurrence of shrinkage. The friction conditions between the roll and the guide are not constant, so that a uniform takeup of the knitted fabric cannot always be ensured. The friction between the knitted fabric and the guide has an adverse effect on the quality of the knitted fabric, the knitted fabric receiving in addition an electrostatic charge. Furthermore, the knitting, particularly its first row, is distorted by the shape of the hooks.

It is the object of the invention to develop a fabric takeup for flat knitting machines with variable fabric width, where a clean loop pattern of the knitted material is maintained and where a minimum expenditure of assembly and attendance is necessary, due to a very simple design.

The fabric takeup provided by this invention does not have the disadvantages found in the prior art. An improved hook-and-roll takeup is provided in which the two systems are arranged in a small space, close together and relatively close underneath the needle bed comb, a constant takeup force per unit knitting width is maintained, the hooks transfer their loops safely and shrinkage of the fabric is avoided without width retaining means.

According to the invention, the hook takeup for taking up the knitting head consists of hooks bent in a right angle, which are so inserted into the fabric that their free ends point in the direction of the knitting edge. The hooks are guided in hook bars. The roll takeup taking over the knitting is formed by a plurality of particularly small takeup and pressure rolls which work independently of each other and cooperate in pairs. The row of hooks of the hook takeup extending over the entire width of the machine is composed of two half rows, each of which is guided in a respective hook bar.

On each side of the machine the two hook bars are guided in a common bearing, each of which in turn is elevationally adjustably mounted on a slide.

The pressure rolls can be turned by means of pressure levers toward the stationary takeup rolls. This pivotal movement is started by actuating a limit switch arranged on the guide of the hook takeup. For release, the hook bars can be displaced from the center horizontally in opposite directions by carriers arranged on a spindle having oppositely directed threads engaging respective base rails of the hook bars.

The takeup roll assemblies are each provided with a carrier plate as well as freely rotatable rollers, and the pressure roll assemblies each with a positively coupled locking plate as well as a stationary bolt serving as a return lock. For driving the takeup rolls the carrier plates are connected over chains provided with springs which are prestressed by a pull-back shaft.

For the adjustment of the takeup force of the takeup rolls all driving springs are secured on a spring tension bar which is infinitely variably displaceable by means of a threaded spindle, and for the adjustment of the pressure of the pressure rolls all springs arranged on the pressure levers are secured on a spring retaining bar which is likewise infinitely variably displaceable by means of a threaded spindle. The adjustment of the threaded spindles causes at the same time the variation of the takeup force of all takeup rolls and of the pressure of all pressure rolls.

This arrangement of the hook and roll takeup permits an early takeover of the fabric by the roll takeup. Shrinkage of the fabric is avoided without width retaining means. The design of the takeup comb including its horizontal drive ensures a safe dropping of the loops; there are no distortions of the fabric. When changing to other articles or sizes, no manual work is required. Besides, a constant takeup force at all points of the knitted fabric is ensured by the special design of the roll takeup including its drive.

The invention will be described more fully below by reference to a specific embodiment as illustrated in the drawings, in which:

FIG. **1** is a front elevation of the roll takeup;

FIG. **2** is a side elevation of the roll takeup;

FIG. **3** is a plan view of the roll takeup;

FIG. **4** is the roll takeup in a cross section;

FIG. **5** is a front elevation of the hook takeup;

FIG. **6** is a cross section of the hook takeup;

FIG. **7** is a plan view of the needles and hooks when laying an intermediate mesh;

FIG. **8** is a schematic diagram of the drive for the rotatory and the pivotal movements of the roll takeup; and

FIGS. **9***a* and **9***b* are schematic diagrams of the drive for the vertical movement of the hook takeup.

In the box legs **1** of the knitting machine are secured columns **2** on which are arranged takeup bearings **3**. The takeup bearings **3** are joined with frame walls **4** by screws. The roll takeup **5** is mounted in these frame walls **4** (FIG. **1**).

The roll takeup **5** consists of a plurality of particularly small takeup rolls **10** and of an equal number of pressure rolls **20** (FIG. **2**). The takeup and pressure rolls **10** and **20** are provided with a high friction coating or cover, such as rubber, so that the coefficient of friction is increased and the pressure between takeup and pressure rolls **10** and **20** remains relatively small. A pair of opposed rolls, viz a takeup roll **10** and a

pressure roll **20**, work together. Due to the division of the roll takeup into many small roll pairs a uniform knitting tension is achieved even with varying knitting width. The takeup rolls **10** run on a shaft **11** (FIG. **2**). The pressure rolls **20** are mounted rotatably on pressure levers **21** on a shaft **22** (FIG. **4**). They are urged by springs **23** against the takeup rolls **10**. The springs **23** are secured on a spring retaining bar **24**, which can be displaced by means of threaded spindles **25**. An infinite variation of the pressure is thus possible. The spring retaining bar **24** and the threaded spindle **25** are positioned in adjusting lever **26** which is fixed to the shaft **22**.

On the last pressure lever **21** on each side of the needle bed **35** are arranged plungers **31** on which is secured a rope **32** extending over the entire takeup width. The plungers **31** move the rope **32** with each reversal of the slide in the direction of the takeup rolls **10**, thus ensuring a good sliding of the knitting over the slide-off plate **33** and avoiding sticking of the knitting due to electrostatic charges.

The drive for the movement of the plungers **31** is derived by means of Bowden cables from a pull-back shaft **16** to be described more fully below.

The drive for the feed and the pivotal movement of the roll takeup is effected by the geared motor **9**, which drives chain wheels **71** and **72** over a chain drive **8** (FIG. **8**). These chain wheels **71** and **72** rotate freely on shafts **73** and **74** when not connected to clutches **75** by driver elements **76**. The shafts **73** and **74** are driven through carriers **76**, dogs **77** and clutches **75** by chain wheels **71** and **72**. The dogs **77** actuate by means of a magnet the clutches **75** which are fixedly mounted on the shafts **73** and **74**. The clutches **75** are thus connected through the driver elements **76** to the chain wheels **71** and **72**. When the shafts **73** and **74** are thus rotated to a position at which the dogs **77** engage the driver elements **76**, the dogs **77** thus disengage the driver elements **76** from the chain wheels **71** and **72** and the sequence is then repeated. These movements of the shafts **73** and **74** are transmitted over linkage **7** including an eccentric **7***a* to the pull-back shaft **16** and likewise to a shaft **22**. The rotation of the shaft **22** effects a pivotal movement of the pressure rolls away from or toward the takeup rolls **10**, and the rotation of the pull-back shaft **16** effects the prestressing of the takeup rolls **10**.

The takeup rolls **10** are driven by springs **12** through chains **13** and carrier plates **14**. The springs **12** tend constantly to turn the takeup rolls **10** in the takeup direction. With each reversal of the slide the springs **12** are prestressed over chains **15** by the pull-back shaft **16**. All the springs **12** are secured on a spring retaining bar **17**. Their takeup force can be varied infinitely by displacing the spring retaining bar **17** by means of a threaded spindle **18**. The takeup force as well as the pressure of all the rolls **10** can be varied only by adjusting the threaded spindles.

The hook takeup **40** is guided in guides **41** connected with the frame walls **4**. It is subdivided into a takeup comb **42** and slide **43** (FIG. **5**). The guides **41** are inclined to the vertical by a few degrees. The takeup comb **42** is formed of two hook bars **48** which consist each of a base rail **49** and counter rail **50** in which segments **51** are guided (FIG. **6**). Into these segments are inserted hooks **52**. The hooks **52** are bent in a right angle and so inserted into the segments **51** that their free ends point from the center in the direction of the knitting edge. Each hook **52** engages a number of loops. Between the segments **51** and the base rails are interposed vertically arranged springs **53**. The hooks **52** effect the takeup of the knitting immediately after the formation of the loops. The base rails **49** run on bearings (rollers) **54** mounted on the slides **43**. The slides **43** have racks **44** which are connected with each other by a differential shaft **45** having gear wheels **46** arranged at its ends (FIG. **5**). The vertical movement of the takeup comb **42** along the racks **44** is effected by a motor **37** through its output sprocket **37***a*, a chain **38** and a sprocket **61** (FIG. **1**). The sprocket **61** is freely rotatably mounted on a shaft **62**. When the chain wheel **61** is rotated, it couples over a carrier **63** with a clutch **64** and thus turns the shaft **62**. A cam shaft **66** and the cams **39** arranged thereon (FIGS. **9***a* and **9***b*) are driven by the shaft **62** through a pair of gears **65**. Each cam **39** engages one end of a respective lever **34** the other end of which engages a roller **47** mounted on a respective rack **44** and thus lifts or lowers the takeup comb **42** into the desired position.

For driving the hook takeup **30** in the horizontal direction, the hook bars **48** are provided with recesses which are engaged by carriers **56** which are mounted by means of nuts **57** on a threaded spindle **58** having an opposite thread (FIG. **5**). The threaded spindle **58** is driven over a belt drive **59** by a motor **60**. During the rotation of the threaded spindle **58** the carriers **56** move toward or away from each other, driving the hook bars **48**.

If the knitting is to be taken up, the takeup comb **42** is lifted into its uppermost position before the first courses are started, the hooks **52** projecting over the needle beds **35**. In order to make sure that the hooks **52** are at the same point each time a knitting is started, the extreme position of the hook bar **48** is limited by permanent magnet stops **55** arranged on the slide **43** (FIG. **5**). Due to the special design of the hooks **52** it is possible to place an intermediate mesh over the entire selected knitting width. Only at the points where the hooks **52** protrude through the needle beds do the needles **36** remain inactive. These inactive needles are taken up by the Jacquard device of the knitting machine. When the intermediate mesh is formed, the takeup comb **42** is lowered so far that the hooks **52** rest on the mesh rows. The knitting is taken up from the takeup comb **42** until the latter releases a limit switch arranged on the slide **43**. After the actuation of this limit switch, the rolls of the roll takeup **5** are swung together by turning the pressure rolls **20** toward the stationary takeup rolls **10**. The feed of the rolls is actuated immediately and the knitting is thus taken over smoothly by the rolls. Subsequently, the hooks **52** of the takeup comb **42** are moved in the direction of the knitting center by moving the hook bars **48** and the knitting is thus released. This movement of the takeup comb **42** takes place only in its bottom position. It remains in this position until a new knitting is started.

When the takeup rolls **10** are driven, they cooperate with the carrier plates **14**. During the takeup of the knitting, the carrier plates **14** are turned clockwise by the springs **12** and drive the takeup rolls **10** through freewheeling rollers **19**. When the springs **12** are tensioned during the reversal of the slide by the pull-back shaft **16**, the carrier plates **14** are turned counterclockwise, the carrier plates **14** turning freely on the takeup rolls **10**. Since the prestressed knitting tends to turn the takeup rolls **10** at this time counterclockwise and the pressure rolls **20** clockwise, the pressure rolls **20** are locked against such return rotation by the locking plates **27** which are positively coupled with the pressure rolls **20**. These locking plates **27** act with running bolts **28** as a return lock.

If another knitting with a wider head is to be taken up immediately, it is necessary to work a few intermediate courses so that, when the takeup comb **42** rises, the knitting is suspended on the needles of the front needle bed **35**. When the takeup comb **42** rises, the pressure rolls **20** are turned away from the takeup rolls **10**.

What is claimed is:

1. Fabric takeup mechanism for flat knitting machines for knitting fabrics of variable width, comprising a hook takeup including means carrying a row of hooks in a line parallel to the front edge of the fabric being knit, the hooks including a first set arranged on the left-hand side of the carrying means and a second set arranged on the right-hand side of the carrying means, the free end of each of the hooks of the first set pointing toward the left-hand edge of the fabric and the free end of each of the hooks of the second set pointing toward the right-hand edge of the fabric, means for bringing the row of hooks into engagement with the front edge of the fabric at the beginning of a knitting operation, a set of a plurality of coaxial takeup rolls and a set of a like plurality of coaxial pressure rolls each cooperating with a respective takeup roll to define a nip, the sets of rolls being positioned relative to the row of

hooks to receive in the nips from the row of hooks the front edge of the fabric, and means for disengaging the row of hooks from the front edge of the fabric after the front edge of the fabric has been received in the nips.

2. Fabric takeup mechanism according to claim 1, in which the carrying means includes two bars, each having mounted thereon a respective one of the sets of hooks.

3. Fabric takeup mechanism according to claim 1, in which the means for engaging and disengaging the hooks includes means for raising and lowering the hook carrying means.

4. Fabric takeup mechanism according to claim 1, in which the means for engaging and disengaging the hooks includes means for reversibly driving the respective bars in mutually opposed directions.

5. Fabric takeup mechanism according to claim 1, further comprising means for adjustment of the takeup force of each of said takeup rolls and means for adjustment of the pressure of each of said pressure rolls.

6. Fabric takeup mechanism according to claim 5, in which said means for adjustment of the takeup force of each of said takeup rolls comprises means for driving the takeup roll including a first spring arranged for biasing of the takeup roll in the takeup direction and means for adjusting the tension of said first spring and said means for adjustment of the pressure of each of said pressure rolls comprises a second spring arranged for biasing of the pressure roll against the respective takeup roll and means for adjusting the tension of said second spring.

7. Fabric takeup mechanism according to claim 6, in which each takeup roll is provided with a carrier plate and free-running rolls and each of the pressure rolls is provided with a locking plate and a running bolt together forming a return lock, and further comprising a first chain fastened at one end to the first spring and at the other end to the carrier plate, a pull-back shaft arranged to bias the carrier plates in the direction opposite the takeup direction of the takeup rolls, and a second chain fastened at one end to the pull-back shaft and at the other end to the carrier plate.

* * * * *