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(54) **DEVICE FOR VERTICAL STRETCHING OF FABRIC IN AN AUTOMATIC KNITTING MACHINE, IN PARTICULAR A FLAT-BED KNITTING MACHINE**

VORRICHTUNG ZUM VERTIKALEN SPANNEN VOM GESTRICK AN EINER AUTOMATISCHEN STRICKMASCHINE, INSBESONDERE AN EINER FLACHSTRICKMASCHINE

DISPOSITIF D'ETIRAGE VERTICAL DE TISSU DANS UNE MACHINE A TRICOTER AUTOMATIQUE, EN PARTICULIER DANS UNE MACHINE A TRICOTER RECTILIGNE

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Description

TECHNICAL FIELD

[0001] The present invention relates to manufacturing of automatic knitting machines, in particular flat-bed knitting machines.

BACKGROUND ART

[0002] It is known that flat-bed knitting machines are usually equipped with a couple of needle beds, along which a carriage moves longitudinally with alternate motion.

[0003] The carriage bears suitable actuator units that move selectively, according to a prefixed programme, needles which are introduced inside transversal slits made at regular distances along the needle beds.

[0004] The above mentioned actuator units actuate the needles in succession, according to the commands provided by an electronic control unit, programmed with a suitable knitting programme, so as to achieve formation, in succession, of a series of so-called fabric rows.

[0005] There are known machines, so-called with multiple operation machines, in which several fabric rows are formed during a single carriage stroke.

[0006] Knitting machines need to stretch vertically the fabric being formed. The traditional devices used for this purpose generally include one or more rollers placed below the needle beds and parallel thereto. These rollers are designed to clamp and pull the fabric while being formed.

[0007] A known device of this type provides a couple of rollers tangent to each other and rotated in opposite directions, for a preset time interval, at the end of each carriage stroke.

[0008] These known devices generally produce an uneven stretching in the various machine working areas, giving unsatisfactory results in the fabric weave. Another problem that is encountered with the traditional knitting machines concerns the different tension in different parts of fabric, in particular of different length.

[0009] The US Patent N. 5.271.250, belonging to the same applicant, describes a device that obtains a uniform vertical stretching of adjacent portions of fabric even in the presence of areas of different lengths. This device provides a series of clamping members for the fabric, situated below the needle beds, regularly spaced out, and including each one a couple of jaws articulated to supporting element integral with slides, operated vertically with reciprocating intermittent motion, from a raised position, in which the fabric is clamped, to a lowered position, in which the fabric is released.

[0010] Suitable cams are designed to close the clamping members in suitable phase relation with formation of the fabric rows, when the slide is in the raised position. Therefore, these clamping members cyclically clamp the fabric, perform a pulling stroke, and then release the fabric.

[0011] In the above mentioned device the stroke of the holding parts can be varied from a maximum to a minimum, relative to the desired stretching degree that depends on the knitting type and the number of fabric forming operation that can- be obtained with a single stroke of the carriage. In particular, the possibility to increase the stretching is limited to the maximum stroke that can be imparted to the holding parts.

[0012] It is also to be specified that increase of the holding parts useful stroke beyond a certain value does not allow the fabric stretching to increase in the same proportion, since, due to the fabric elasticity, the stretching of the rows being formed becomes less and less effective in relation to increase of the distance between the rows and the point, in which the clamping members hold the fabric.

[0013] In the mentioned solution, gripper elements, cooperating with the clamping members, hold the fabric when the clamping members are open and return to the raised position.

[0014] In spite of this fact, a part of stretching obtained by the clamping members is lost when the fabric is released by them.

[0015] Therefore, part of the subsequent stroke of the carriage is necessary for recovering the previously lost stretching. In fact, the above mentioned device performs an effective stretching action when the manufacturing is of the type including one or at most two fabric forming operations for each stroke of the carriage.

[0016] Beyond this limit, the amount of fabric produced during each carriage stroke is too big to allow good stretching.

DISCLOSURE OF THE INVENTION

[0017] The object of the present invention is to propose an improved device that performs a uniform vertical stretching of fabric in knitting machines, in particular that varies the stretching in accordance with the kind of manufacturing technique and the number of fabric forming operation per carriage stroke.

[0018] The above mentioned object is obtained in accordance with the invention, by means of a device for the vertical stretching of fabric in an automatic knitting machine, in particular a flat-bed knitting machine, which includes two longitudinal needle beds below which the fabric being formed exits, and that further includes a series of clamping members for the fabric, arranged below the needle beds regularly spaced apart, and respectively consisting of oscillating claws, articulated to a supporting element along a longitudinal axis extending parallel to the needle beds, a stationary abutment plate cooperating with the claws, and presser plates articulated to the claws along a longitudinal axis and designed for pressing fabric on a longitudinal roller arranged below the abutment plate and driven to rotate with a continuous motion according to a direction in agreement with

the descent of the fabric being formed.

[0019] A slide element is connected to the supporting element and is actuated so as to slide vertically stepwise with a reciprocating motion, between a raised position, in which the fabric is clamped and a lowered position, in which the fabric is released.

[0020] Cam means are provided for rotation of the claws to close the clamping elements, in suitable phase relation with formation of the rows of the fabric, when the slides are located in the raised position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The characteristic features of the present invention are pointed out in the following description with reference to the enclosed drawings, in which:

- Fig. 1 shows a cross-section view of the stretching device being the subject of the present invention;
- Figs. 2, 3, 4, and 5 show cross-section views of the subject device in subsequent working steps;
- Fig. 6 is a perspective detailed view of fabric gripping members of the subject device.

BEST MODE OF CARRYING OUT THE INVENTION

[0022] With reference to the above figures, the two needle beds of a flat-bed automatic knitting machine are indicated with 1 and 2, and a portion of a knitted fabric being formed is indicated with 3.

[0023] The needle beds 1 and 2 feature regularly spaced apart transverse slits, well known in the art, in which the needles 4 are inserted and actuated by respective operative systems.

[0024] The needle beds 1 and 2 are supported by a stationary frame that includes a couple of platforms 5 situated respectively below the needle beds 1 and 2; the platforms 5 are fixed to the needle beds 1,2 surfaces with interposition of a plurality of spacer elements 6. A cross-member 7, that defines a vertical surface extending lengthwise along the needle beds 1, 2, is fixed to a first of the platforms 5.

[0025] A connection plate 8 is fixed to the second platform 5, adjacent thereto, forms a vertical wall extending lengthwise along the machine, below the top of the first needle bed 1, and supports an abutment plate 9.

[0026] The connection plate 8 bears also a rotating knurled roller 10 (see also Fig. 6), arranged below the abutment plate 9 and operated, by suitable motor means, with a continuous motion at low speed, according to a rotation direction in agreement with the descent of the fabric being formed.

[0027] A vertically sliding angular element 11 is fitted alongside the cross-member 7. Suitable pads 12 made of antifriction material, designed to reduce the sliding friction, are placed between the angular element 11 and the cross-member 7.

[0028] The pads 12 are inserted in corresponding openings made on the angular element 11 and are blocked by a plate 13 placed longitudinal to the same angular element 11.

[0029] A series of prongs 15, suitably spaced out, are articulated to the angular element 11 by related hinges 14. The prongs 15 have an upper portion 15a, designed to face the cross-member 7, and a lower portion 15b facing downwards; the downward facing portion 15b is located below the angular element 11.

[0030] As described in detail in the mentioned US Patent No. 5.271.250, for each prong 15 there is a lever 16 connected therewith and subjected to the action of a cam 17, so that the same prong 15 is made to oscillate; this cam 17 is made up of a cam shaft rotating about a horizontal axis longitudinal to the machine.

[0031] More precisely, the hinge 14 features two seats for receiving of respective pins 18 and 19 for the pivotal connection to the angular element 11 and the lever 16; the pins 18,19 have horizontal axes that are parallel to the machine.

[0032] The lever 16 protrudes over the cam shaft 17 in a kind of beak 16a. The lever 16 normally rests against the downward facing part 15b of the prong 15 being held in position by elastic action of a spring 20 fitted in a housing made in the same lever 16.

[0033] The spring 20 is retained by a knob 21 inserted in the above mentioned housing of the lever 16; the head of this knob 21 rests against the lower surface of the downwards facing portion 15b of the prong 15.

[0034] At the top of the upper part 15a of each prong 15 there is situated a clamping member 22, aimed at cooperating with the stationary abutment plate 9 for holding the fabric 3 to be stretched.

[0035] As shown in Fig. 6, the clamping member 22 includes a claw 23 equipped with couples of teeth 23a arranged along the upper edge.

[0036] Presser plates 25, constituted by a kind of scoop, are articulated to the claws 23 by means of hinges 24 with a horizontal longitudinal axis.

[0037] The presser plates 25 push lightly the roller 10, due to the elastic action exerted by a spring 26, that urges the prong 15.

[0038] On their surface turned toward the roller 10, the presser plates 25 feature a series of vertical grooves 27; these grooves 27 are designed to receive the threads that separate the rows of the fabric 3 being formed, extended in known way in direction parallel to the same fabric.

[0039] Moreover, along their lower edge, the presser plates 25 have a section 25a bent toward the prong 15. In correspondence with the ends of the needle beds 1,2, there is a pair of symmetrical slides 28, only one of which can be seen in the drawing; the slides 28 are fitted in known way to the angular element 11.

[0040] Each slide 28 has a rack profile 29 that meshes with a pinion 30, supported rotatably by the stationary frame 31 of the machine and designed to be stepwise operated by related drive parts.

[0041] On the side opposite to the rack 29, the slide 28 is guided by a counter-roller 32, also supported rotatably by the stationary frame 31 of the machine. The action of the rack 29 is also balanced by a spring 33 suspended vertically on the frame 31 and hooked to a pin 34 protruding transversally to the lower end of the slide 28.

[0042] The operation of the described device is now illustrated beginning from the step, in which the gripper members 22 are opened in a raised position with respect to the stationary abutment plate 9 (Fig. 1). In this position the aforementioned clamping members 22 are in their topmost position, therefore very close to the area where the so-called rows of fabric 3 are formed, in the region of the needle beds 1,2.

[0043] In suitable phase relation with the formation of these rows, the rotation of the cam shaft 17, acting on the levers 16, determines the oscillation of the prongs 15. Therefore, the claws 23 carried by the prongs 15 approach the stationary abutment plate 9, clamping the fabric 3 between the teeth 23a and the same abutment plate 9.

[0044] Further rotation of the cam shaft 17 determines subsequently the oscillation of the levers 16 with respect to the relative prongs 15, loading the springs 20 (Fig. 2).

[0045] In this manner an ideal fabric 3 holding tension is obtained, that can be appropriately adjusted by means of the knob 21 holding the same springs 20.

[0046] Once the fabric 3 hold has been established, the command is given for downward sliding of the slides 28, which are connected with the angular element 11 that act as support for the prongs 15, so as to cause the stretching of the same fabric (Fig. 3. This sliding is obtained by stepwise rotation of the pinions 30 that are engaged with racks 29 of the slides 28.

[0047] It is to be noted that till this step the knurled roller 10 exerts only the friction action on the fabric 3, kept in touch with the roller 10 by the presser plates 25 that are subject to the elastic action of the springs 26.

[0048] Obviously, the presser plates 25 follow the downward movement imposed to the claws 23 by the slides 28. Due to reciprocal adaptations, the lowering of the claws 23 determines also rotation of the presser plates 25 with the roller 10 acting as a pin.

[0049] This rotaticn carries the bent section 25a of the presser plates 25 to strike against the prongs 15, so as to form with the latters one rigid body capable of clamping with force the fabric to the rotating knurled roller 10 (Fig. 4).

[0050] The action of the presser plates 25 causes also a limited rotation of the prongs 15 that rotate with respect to the levers 16, kept in contact with the cam shaft 17.

[0051] This rotation determines the return of the claws 23 with the consequent separation of the teeth 23a from the abutment plate 9 and the release of the fabric 3 (see again Fig. 4).

[0052] Thus the continuous rotation of the roller 10 provokes downward sliding of the fabric 3, clamped thereto by the presser plates 25.

[0053] In this manner, the knurled roller 10 can continue the stretching action of the fabric 3, if this is necessary.

[0054] It is clear that the device allows to vary operation in relation with the length of the rows and the number of the fabric forming operations per each carriage stroke.

[0055] In particular, the stretching steps performed by the claws 23, illustrated previously, are sufficient in the machines with one or two fabric forming operations, while further stretching performed by the knurled roller 10, during the descent stroke, is advantageously used in the machines with many fabric forming operations, such as three or four operations.

[0056] It is to be noted that the elastic clamping thrust exerted on the fabric 3, during the descent step, is supplied by the springs 20 carried by the levers 16 and acting on the prongs 15.

[0057] The presser plates 25, in conjunction with the roller 10, can alsc maintain the fabric 3 taut during the subsequent step, in which the slides 28 rise again (Fig. 5). During this rising step, a further rotation of the cam shaft determines the disengagement of the levers 16, that return to form one body with prongs 15.

[0058] It is to be noted that the rise does not bring the teeth 23a of the claws 23 to touch the stationary abutment plate 9, since the springs 26 push elastically the presser plates 25 so as to touch a knurled roller 10, thus allowing a light return rotation of the prongs 15, that keeps the same prongs 15 suitably distanced from the abutment plate 9.

[0059] Obviously, this prevents the teeth 23a from acting on the fabric 3 during the rising step.

[0060] When the slides 28 have completed their rising, the rest condition initially described is restored for another fabric stretching step.

[0061] To summarise, therefore, the device in question involves the creation of a sequence of successive clamping steps for the fabric 3 performed by the claws 23 in conjunction with the abutment plate 9, then descent of these claws 23 for the stretching of the fabric 3, and lastly return of the claws 23 to the raised inoperative position.

[0062] The clamping members 22 are normally activated when the carriage, that slides along the needle beds 1, 2, inverts its stroke.

[0063] When the so-called fabric take-up occurs, or rows of the fabric being formed have limited length, or as has already been said in machines with one or two fabric forming operation per carriage stroke, the stretching of the fabric is performed only by the above mentioned descent of the claws 23.

[0064] During the return stroke of the claws 23 to the raised inoperative position, the fabric 3 is kept taut by the presser plates 25 that clamp it elastically to the knurled roller 10, operated with a continuous motion at a low speed.

[0065] In fact, the roller 10 exerts a constant traction action, preventing the fabric from elastic returning. When the rows of fabric being formed are longer, in machine of multiple fabric forming operations, the rotating knurled roller 10 allows to continue stretching of the fabric.

[0066] Obviously, also in this case, during the return stroke of the claws 23 to the raised position, the fabric 3 is kept taut by the presser plates 25 and the rotating roller 10.

[0067] Therefore, the described device makes it possible to vary the stretching in relation to the number of fabric forming operations and the type of manufacturing.

[0068] In particular, in the machines with multiple fabric forming operations, it is possible to vary the stretching according to the number of needle selecting units which are set into operation, assuring that the fabric is constantly stretched in the desired ways.

[0069] The device is also simple to build, thus reducing considerably the costs of production and maintenance.

[0070] In this description the device, subject of this invention, has been proposed associated with a flat-bed machine, for example for knit-wear.

[0071] This device can be usefully adopted with any kind of machine that produces fabric in an intermittent kind.

Claims

1. Device for the vertical stretching of fabric in an automatic knitting machine which includes two longitudinal needle beds (1,2), below which the fabric (3) being formed exits, said device including:

   a series of regularly spaced apart clamping members (22) for the fabric (3), arranged below said needle beds (1,2), respectively consisting of oscillating claws (23), articulated to a supporting element (11) along a longitudinal axis (18) extending parallel to said needle beds (1,2),
   slide elements (28) connected to said supporting element (11) and actuated so as to slide vertically stepwise with a reciprocating motion, between a raised position, in which said fabric (3) is clamped and a lowered position, in which the fabric (3) is released;
   cam means (17) for providing angular rotation of said claws (23) to close said clamping elements (22), in suitable phase relation with formation of the rows of said fabric (3), when the slides (28) are located in said raised position, characterised by a stationary abutment plate (9) cooperating with said claws (23), and presser plates (25) articulated to said claws (23) along a longitudinal axis (24) for pressing fabric on a longitudinal roller (10), arranged below said abutment plate (9) and driven to rotate with a continuous motion in agreement with the descent of the fabric being formed.

2. Device, according to claim 1, characterised in that said claws (23) are fixed to respective prongs (15) articulated to said supporting element (11), with respective levers (16) also hinged to said prongs (15), and subjected to elastic action of springs (20) held by the same supporting element (11).

3. Device, according to claim 1, characterised in that along their upper edge, said claws (23) feature teeth (23a) for clamping said fabric (3) to the said stationary abutment plate (9).

4. Device, according to claim 1, characterised in that each one of said presser plates (25) is constituted by a kind of scoop hinged in its upper part to the said claws (23) and subjected to the action of spring (26) pushing toward said roller (10) that is suitably knurled.

5. Device, according to claim 1, characterised in that along their lower edge each one of said presser plates (25) features a section (25a) that is bent towards the side opposite to said roller (10) and that rests, when located in an operative position, against a prong (15), fixed to said claws (23).

6. Device, according to claim 1, characterised in that on their surface turned toward said roller (10) each one of the said presser plates (25) features a series of vertical grooves (27) which receive the threads that separate the rows of the fabric (3) being formed.

7. Device, according to claim 1, characterised in that said abutment plate (9) includes a vertical wall, that extends longitudinally below the top of a first needle bed (1), in front of said claws (23).

Patentansprüche

1. Vorrichtung zum vertikalen Spannen eines Gestrikkes in einer automatischen Strickmaschine, die zwei längsverlaufende Nadelbetten (1, 2) hat, unter denen das entstehende Gestrick (3) austritt, wobei die Vorrichtung aufweist:

   eine Reihe gleichmäßig beabstandeter Spannglieder (22) für das Gestrick (3), die unterhalb der Nadelbetten (1, 2) angeordnet und jeweils aus schwingenden Spannbacken (23) bestehen, die an einem Trägerelement (11) um eine parallel zu den Nadelbetten (1, 2) verlaufende

Längsachse (18) angelenkt sind,
Schieber (28), die mit dem Trägerelement (11) verbunden und so betätigbar sind, daß sie in vertikaler Richtung in Form einer hin- und hergehenden Bewegung schrittweise gleitend verschoben werden, und zwar zwischen einer oberen Stellung, in der das Gestrick (3) eingespannt ist, und einer unteren Stellung, in der das Gestrick (3) freigegeben ist,
Nockenmittel (17), die eine Winkeldrehung der Spannbacken (23) hervorrufen, um die Spannglieder (22) in geeigneter Phasenbeziehung zur Reihenbildung des Gestrickes (3) zu schließen, wenn sich die Schieber (28) in der oberen Stellung befinden,

gekennzeichnet durch

eine stationäre Anschlagplatte (9), die mit den Spannbacken (23) zusammenwirkt, und Andrückplatten (25), die an den Spannbacken (23) entlang einer Längsachse (24) angelenkt sind, um das Gestrick gegen eine längs verlaufende Rolle (10) anzudrücken, die unterhalb der Anschlagplatte (9) angeordnet ist und so angetrieben wird, daß sie sich in Übereinstimmung mit der Abwärtsbewegung des entstehenden Gestricks kontinuierlich dreht.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Spannbacken (23) an entsprechenden gabelartigen Zinken (15) befestigt sind, die an dem Trägerelement (11) angelenkt sind, wobei entsprechende Hebel (16) ebenfalls mit den gabelartigen Zinken (15) gelenkig verbunden und einer elastischen Wirkung von Federn (20) ausgesetzt sind, die von dem selben Trägerelement (11) gehalten werden.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Spannbacken (23) an ihrem oberen Rand Zähne (23) haben, um das Gestrick (3) mit der stationären Anschlagplatte (9) zu verspannen.

4. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß jede der Andrückplatten (25) aus einer Art Schaufel besteht, die mit ihrem oberen Keil an den Spannbacken (23) angelenkt ist und der Wirkung einer Feder (26) untersteht, die eine Kraft in Richtung auf die mit einer Rändelung versehene Rolle (10) ausübt.

5. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß eine der Andrückplatten (25) an ihrem unteren Rand einen Abschnitt (25a) aufweist, der in Richtung auf die der Rolle (10) gegenüberliegende Seite gebogen ist und der, wenn er sich in einer Betriebsstellung befindet, an einem an den Spannbacken (23) befestigten gabelartigen Zinken (15) ruht.

6. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß jede der Andrückplatten (25) auf ihrer der Rolle (10) zugewandten Oberfläche eine Reihe von vertikalen Nuten (27) hat, welche die Fäden aufnimmt, die die Reihen des entstehenden Gestrickes (3) trennen.

7. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Anschlagplatte (9) eine vertikale Wand hat, die in Längsrichtung unterhalb der Oberseite eines ersten Nadelbettes (1) vor den Spannbacken (23) verläuft.

Revendications

1. Dispositif pour l'étirage vertical d'un tissu dans un métier à tisser automatique qui comprend deux fontures longitudinales (1, 2) sous lesquelles le tissu (3) exécuté sort, ledit dispositif comprenant :

- une série d'éléments de prise (22) du tissu (3), régulièrement disposés sous lesdites fontures (1, 2) et consistant respectivement en des griffes oscillantes (23), articulées à un élément de support (11) suivant un axe longitudinal (18) qui est parallèle aux fontures (1, 2) en question ;
- des éléments coulissants (28) reliés à l'élément de support (11) susmentionné et actionnés de façon à coulisser verticalement, par paliers et avec un mouvement réciproque, entre une position haute dans laquelle ledit tissu (3) est bloqué, et une position basse dans laquelle le tissu (3) est relâché ;
- des moyens à came (17) destinés à mettre- en rotation angulaire lesdites griffes (23) pour fermer lesdits éléments de prise (22), en synchronisation avec la formation des rangs du tissu (3), quand les éléments coulissants (28) sont dans ladite position haute,

caractérisé en ce qu'il comprend aussi

- une plaque de butée fixe (9) opérant avec lesdites griffes (23), et des plaques de pression (25) articulées à ces mêmes griffes (23) suivant un axe longitudinal (24) et destinées à presser le tissu sur un rouleau longitudinal (10), placé sous ladite plaque de butée (9) et entraîné en rotation continue en synchronisation avec la descente du tissu exécuté.

2. Dispositif selon la revendication 1, caractérisé en ce que lesdites griffes (23) sont fixées à des bras

respectifs (15) articulés à l'élément de support (11) susmentionné, avec des leviers (16) respectifs également articulés aux bras (15) en question, et soumis à l'action élastique de ressorts (20) supportés par ce même élément de support (11).

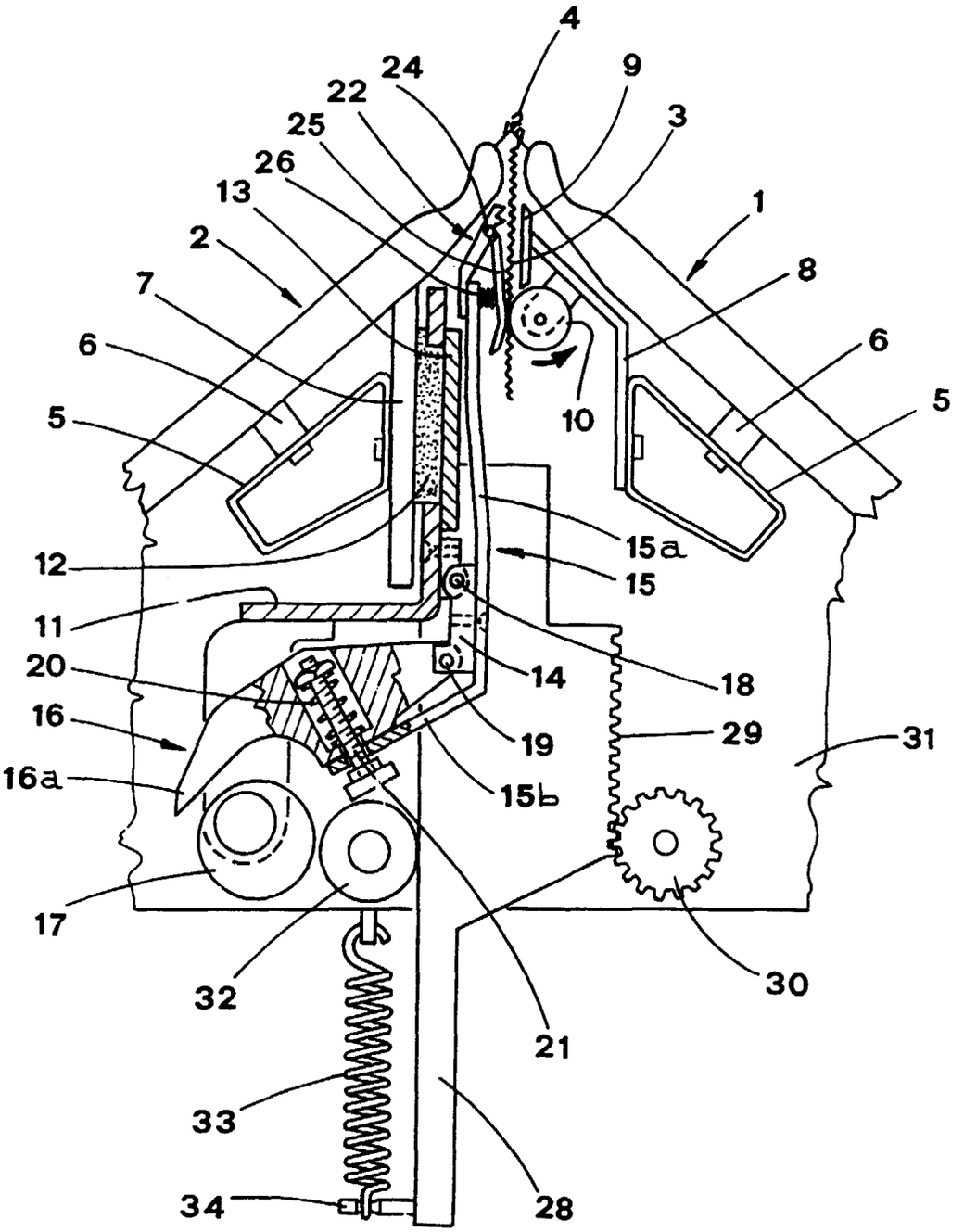
3. Dispositif selon la revendication 1, caractérisé en ce que lesdites griffes (23) présentent, le long de leur bord supérieur, des dents (23a) pour bloquer ledit tissu (3) contre la plaque de butée fixe (9).

4. Dispositif selon la revendication 1, caractérisé en ce que chacune des plaques de pression (25) susmentionnées consiste en une sorte de cuiller articulée dans sa partie supérieure aux griffes (23) susmentionnées et soumise à l'action du ressort (26) qui pousse vers cette dernière ledit rouleau (10) qui est adéquatement moleté.

5. Dispositif selon la revendication 1, caractérisé en ce que chacune des plaques de pression (25) susmentionnées présente, le long de leur bord inférieur, une section (25a) qui est pliée à l'opposé du rouleau (10) susmentionné et qui repose, dans sa position opérationnelle, contre un bras (15) fixé aux griffes (23) susmentionnées.

6. Dispositif selon la revendication 1, caractérisé en ce que chacune des plaques de pression (25) susmentionnées présente, sur leur surface orientée vers ledit rouleau (10), une série de rainures verticales (27) destinées à recevoir les fils séparant les rangs du tissu (3) exécuté.

7. Dispositif selon la revendication 1, caractérisé en ce que ladite plaque de butée (9) comprend une paroi verticale qui s'étend longitudinalement sous la partie supérieure d'une première fonture (1), en face des griffes (23) susmentionnées.


4
24
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34

FIG. 1

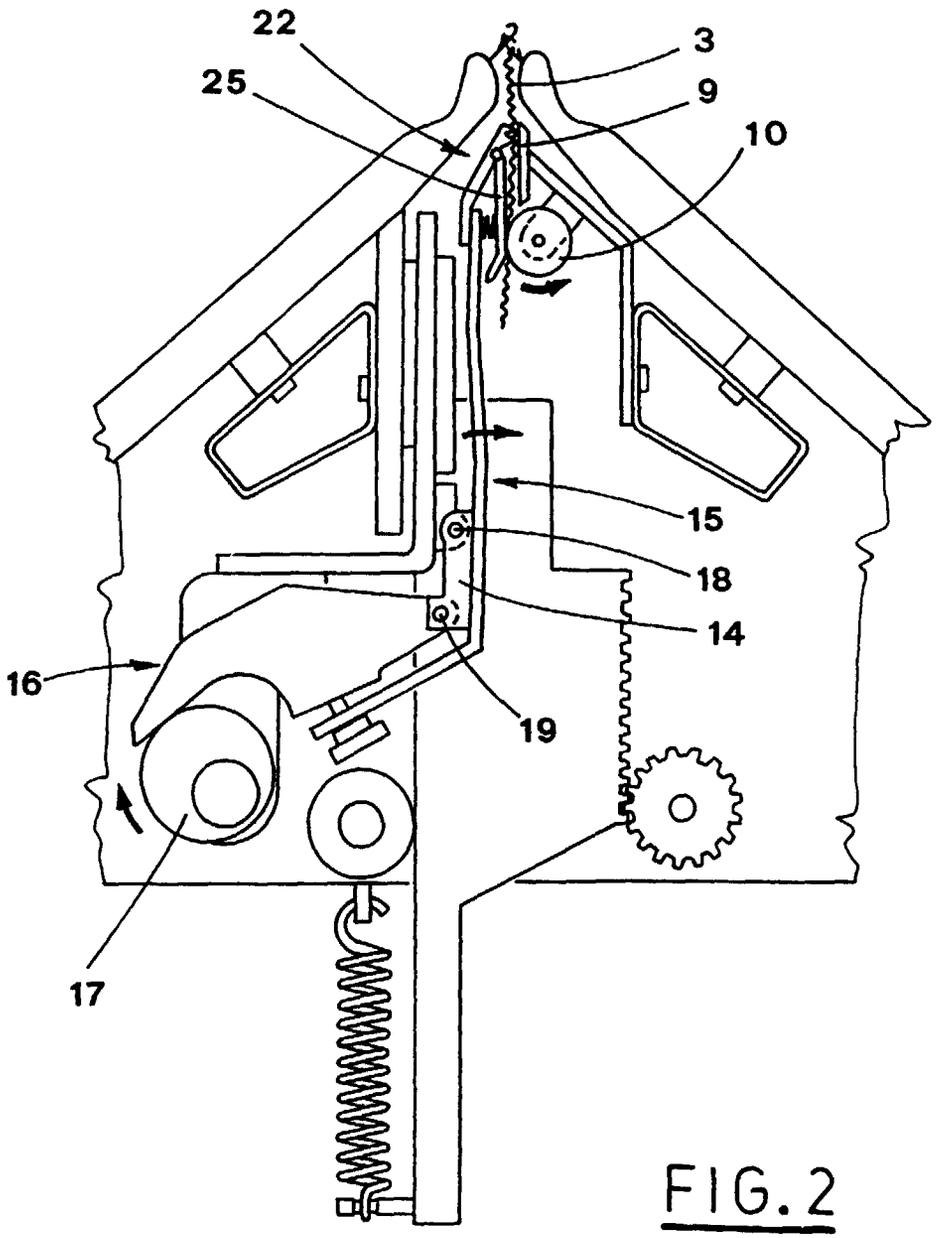

FIG.2

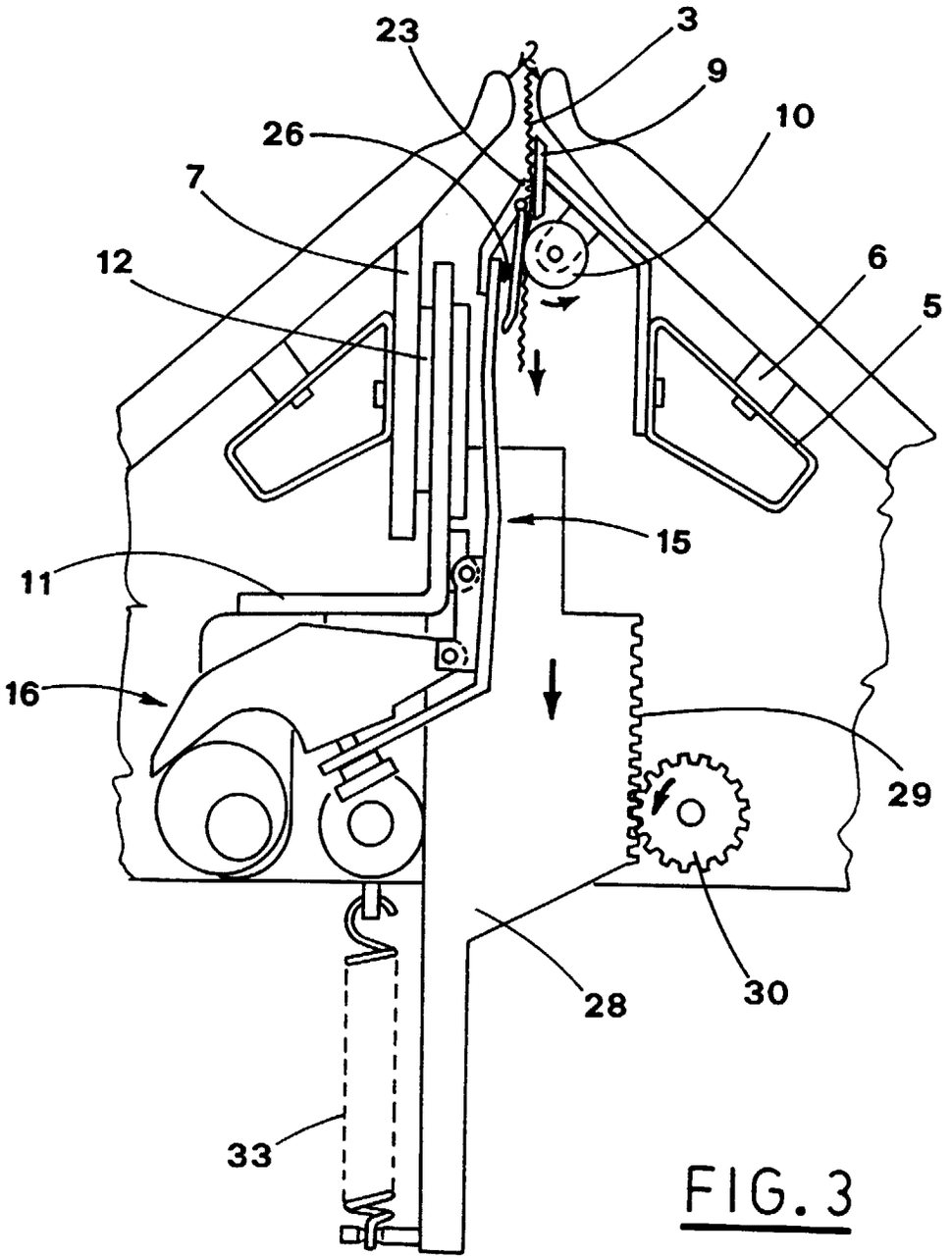

FIG. 3

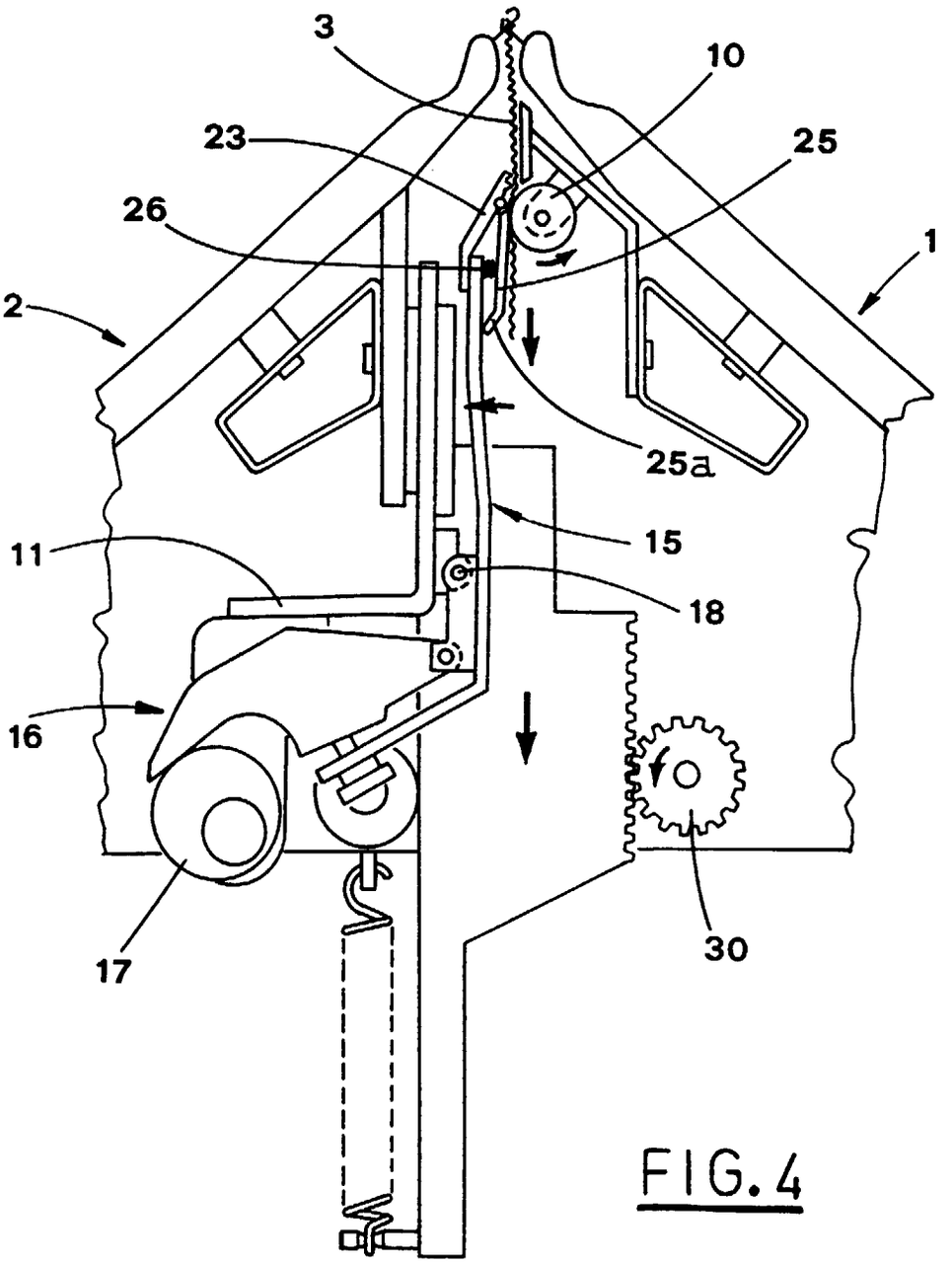

FIG. 4

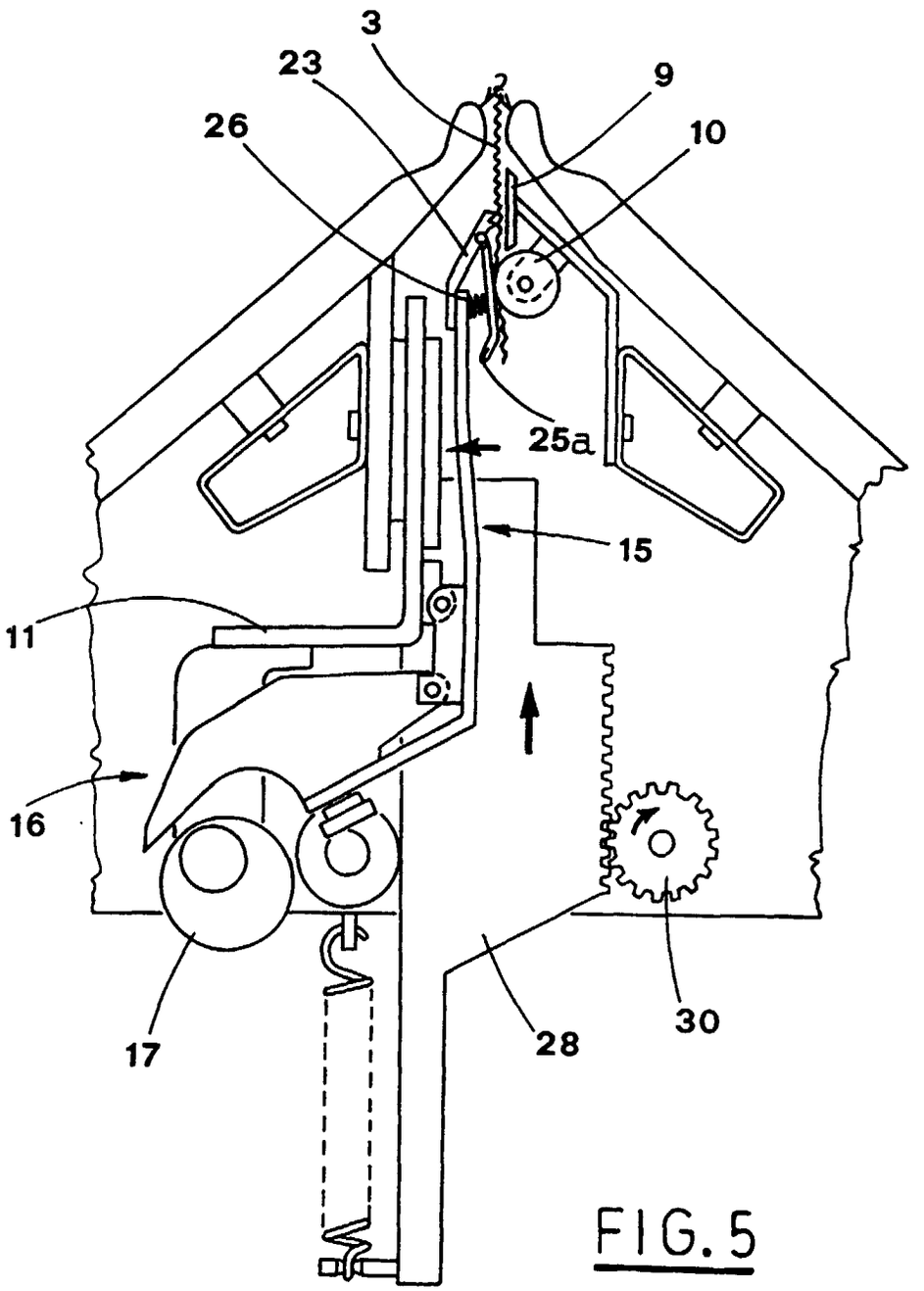

FIG. 5

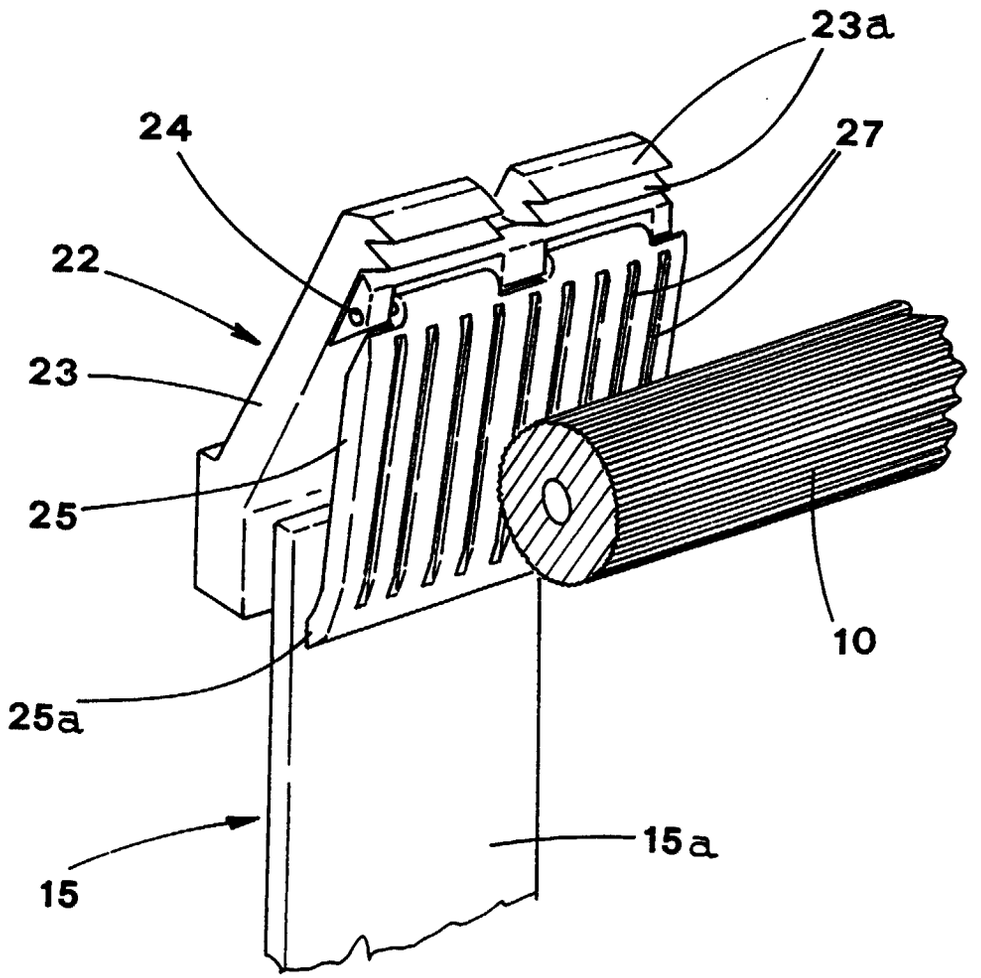

FIG. 6