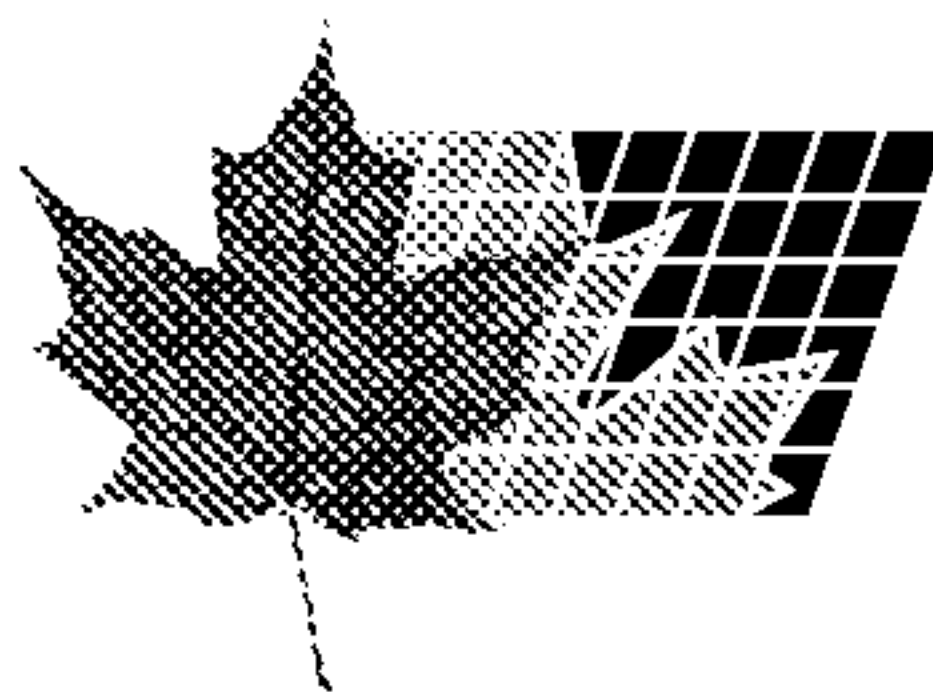




(72) SCHULTES, ROBERT, DE

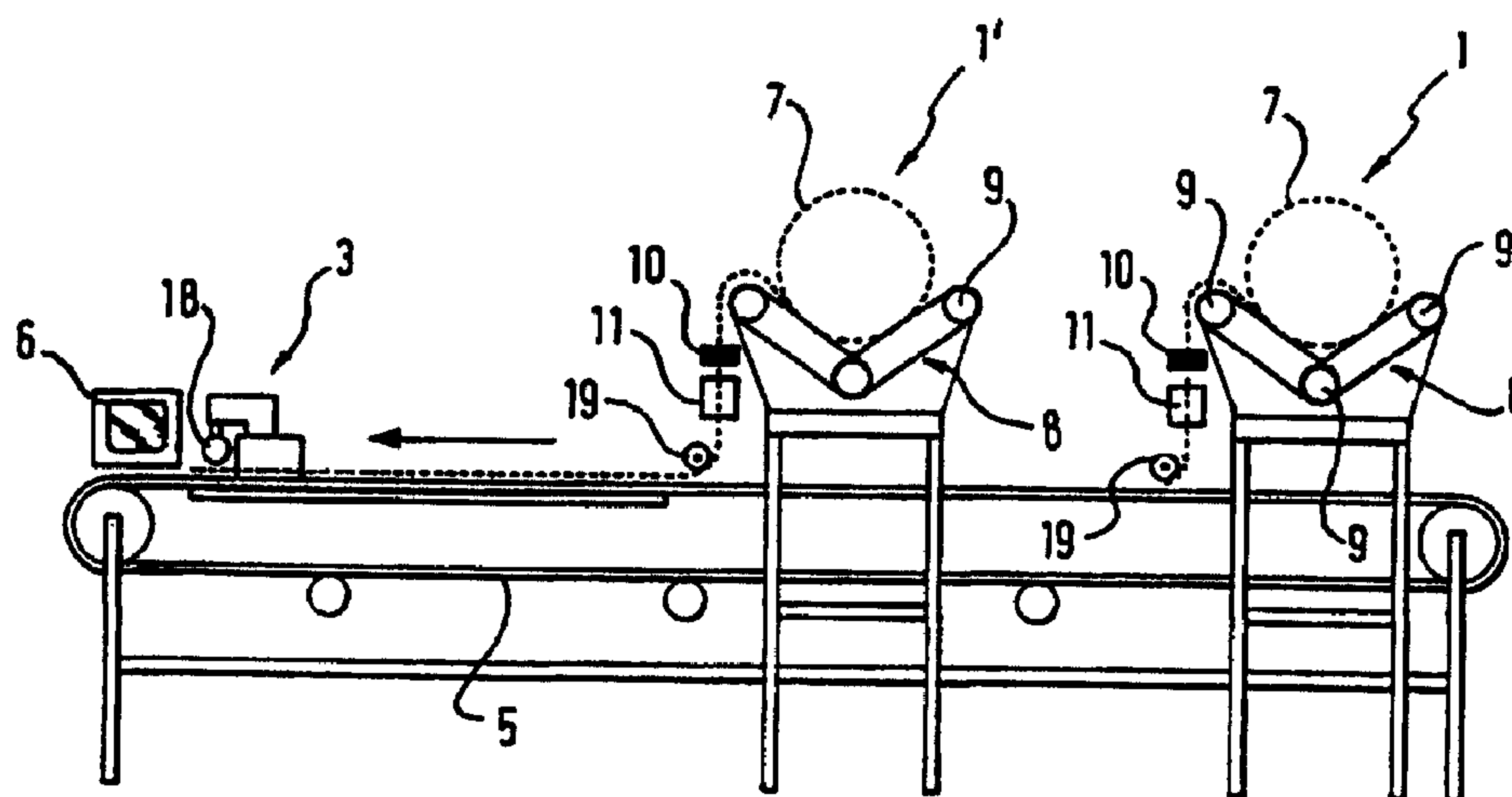
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(54) **INSTALLATION DE DECOUPAGE D'ETOFFE, INSTALLATION
D'ALIMENTATION EN ETOFFE, ET PROCEDE DE
DECOUPAGE D'ETOFFE**

(54) **FACILITY FOR CUTTING FABRIC, FACILITY FOR FEEDING
FABRIC AND METHOD FOR CUTTING FABRIC**



(57) L'invention concerne un installation de découpage d'étoffe comportant au moins un dispositif de déroulement d'étoffe (1, 1') destiné à un rouleau d'étoffe (7), une bande transporteuse (5) qui sert au transport de l'étoffe déroulée, et un dispositif de découpage (3) qui découpe un morceau d'une certaine forme à partir de la bande d'étoffe appliquée sur la bande transporteuse (5). Cette bande transporteuse (5) s'étend, sans interruption, au moins à partir du point où l'étoffe est déposée par le dispositif de déroulement (1, 1') jusqu'à la zone de travail du dispositif de découpage (3). Le dispositif de déroulement (1, 1') applique directement la bande d'étoffe sur la bande convoyeuse (5) ou bien sur une ou plusieurs bandes d'étoffe déjà appliquées sur ladite bande transporteuse. L'invention concerne également une installation d'alimentation en étoffe ainsi qu'un procédé de découpage d'étoffe sur une installation de découpage.

(57) The invention relates to a facility for cutting fabric comprising at least one fabric wind-off device (1, 1') for one fabric bolt (7), a conveyor belt (5) for conveying the unwound fabric, and a cutting device (3) which cuts a piece of fabric of a given shape from the length of fabric deposited on the conveyor belt (5). Said conveyor belt (5) extends without interruption from at least that point where the fabric is deposited by the wind-off device (1, 1') to the working area of the cutting device (3). The wind-off device (1, 1') places the length of fabric directly onto the conveyor belt (5) or onto one or more lengths of fabric already deposited on said conveyor belt. The invention further relates to a facility for feeding fabric and a method for cutting fabric on a cutting facility.



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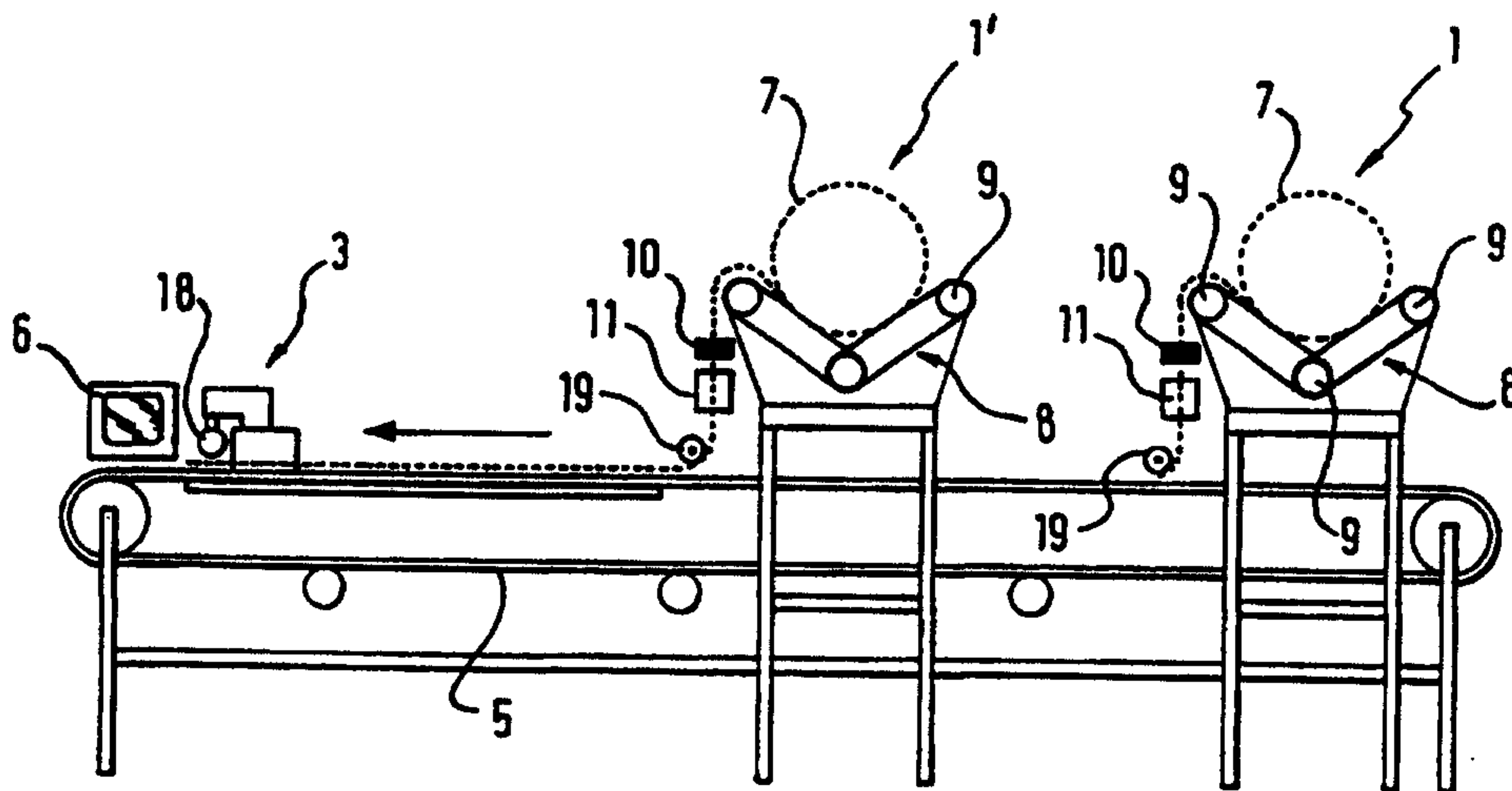
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(54) Bezeichnung: STOFFZUSCHNEIDEANLAGE, STOFFZUFÜHRANLAGE UND VERFAHREN ZUM ZUSCHNEIDEN VON STOFF

(57) Abstract

The invention relates to a facility for cutting fabric comprising at least one fabric wind-off device (1, 1') for one fabric bolt (7), a conveyor belt (5) for conveying the unwound fabric, and a cutting device (3) which cuts a piece of fabric of a given shape from the length of fabric deposited on the conveyor belt (5). Said conveyor belt (5) extends without interruption from at least that point where the fabric is deposited by the wind-off device (1, 1') to the working area of the cutting device (3). The wind-off device (1, 1') places the length of fabric directly onto the conveyor belt (5) or onto one or more lengths of fabric already deposited on said conveyor belt. The invention further relates to a facility for feeding fabric and a method for cutting fabric on a cutting facility.



PCT/EP97/06500**Apparatus for Custom Fabric Cutting
and Device for Fabric Feed
and Process for use of Same**

Description

The invention concerns a custom cutting apparatus for cutting fabric, a device for feeding said fabric to cutting apparatus and a process for the use of such equipment.

A device for the feed of fabric to a textile machine has been disclosed by EP-A-0 589 089. The device is designed as a trough with a driven surface, so that fabric rolls lying in the trough are set into rotation by friction and thereby unwind themselves. The so unwound fabric length is laid upon a conveyor belt assigned to said unwinder and by means of this conveyor belt is transferred to another additional and separate conveyor belt which is dedicated to feeding a cutting machine. These operations, taken all together, provide the assembly with the name of a feeding device.

Conventional equipment of this kind has not proven itself as optimal, since it is difficult for such equipment to bring out a fold-free, straight line issue of the fabric. Furthermore, the exactness with which the custom cutting of said fabric is carried out is limited.

The purpose of the present invention is to make available a custom cutting apparatus, which overcomes the above named deficiencies of the existing state of the technology. This purpose includes the formulation of a process for said custom cutting, corresponding to the operation of said feeder and cutting apparatus. The invention should further provide an improved fabric feeding device.

This purpose will be achieved by a custom cutting apparatus which exhibits the following:

- at least one fabric unwinding device for a fabric roll,
- a conveyor belt for the transport of the unwound fabric,

- a custom cutting apparatus which cuts the fabric while said fabric is still on the transport band, whereby the transport band extends at least from the position where the fabric is deposited by the unwinder device up to the operational area of the custom cutter and
- the fabric band lies directly on the conveyor belt or on one or more thereupon lying fabric bands.

Because of the use of the conveyor belt, with a through movement, the control of the fabric custom cutting apparatus has available very precise data in regard to the position of the fabric in the operational zone of the custom cutter. In addition, this movement eases the issuing of fold-free and straight line character of the fabric. Consequently, the pattern can be more exactly positioned in relation to the material, so that the custom cutting can be done with greater precision.

The subordinate claims explained in the following possess advantageous embodiments of the invention.

While, in the state of the technology up to now, the cutting off of the fabric at the end of a pattern or at the fabric roll end, is, in general, done by the said cutting apparatus. In the embodiment in accord with Claim 2, the fabric unwinder device is equipped with a fabric cut-off device. In the case of several unwinding devices, these are advantageously and respectively equipped with a fabric cut-off device. These measures, on the basis of the increased precision of the conveying belt position, enable the cut-off operations at the pattern, or end of a fabric roll, to be carried out at the respective unwinding device. This increases the operational speed, since it makes possible the relieving of the custom-cutting apparatus from the cutoff operation, and provides a faster change of the fabric roll. The custom cutting apparatus permits a simple removal of fabric ends, although not cut off at the custom cutter, but at the unwinding device.

Fundamentally, these remainder pieces can also run on with the conveyor belt. The cutoff fabric remainders have, usually, a length of 0.2 m to 1 m and can be rolled up and discarded by an operating person or by the custom cutter apparatus (see below).

In accord with Claim 3, the fabric unwind device is equipped with fabric stretch loading apparatus, which holds the fabric firmly upon cutoff with the fabric cutoff device.

In order to attain an especially fast exchange of the fabric to be cut, the fabric unwinding device, of which there may be several, is so designed, that it can, in a self-acting manner, rewind the remainders on the fabric rolls (or on a winding shell). This enables an especially fast change-over to a new fabric roll. The cutoff of the fabric can, as already noted, be exercised for two different reasons. The first possible reason is the reaching of the end of a pattern cut, when the subsequent pattern must cut from a different material, i.e. a different color or a different pattern. The necessary cutoff signal emanates from the control of the fabric feed device, which possesses data on the pattern which is to be used. The second reason lies in the reaching of the end of the material which was originally in the fabric roll.

In accord with Claim 5, the material unwinding device, of which there may be more than one, is equipped with a material end sensor, which detects the approach or the reaching of the fabric end, advantageously upon the sensing of the complete or nearly complete unwinding of the fabric roll. Differently, in accord with Claim 6, the fabric end sensor is designed from a light-relay, through the beam of which the fabric band is run, proximal to the unwinder. Following the features of Claim 7, the control of the cutting is stopped and simultaneously, the unwinding is interrupted as soon as the end of the fabric strip is recognized. With this action cutoff is instituted for the fabric. Because of the traveling conveyor belt, the control senses, with great exactness, the arrival of the fabric end at the custom cutter apparatus and can, therefore, synchronize the cutting operation accordingly.

The advantages of the invention can be especially effectively put to use, when — as expressed in Claim 8, — two or more unwinding devices are provided. This arrangement, achieves, for instance, a substantial reduction of the idle time of the custom cutting apparatus and besides, enables a significant increase of the effective speed of operation is possible. As has been explained above, there is an obvious requirement that a fabric roll must be changed frequently, because of necessary switches in color or pattern specifications.

Claim 9 provides for such changes in the fabric roll, practically without interruption in the operation, since after the cutoff of a fabric with the existing cutoff device for the respective fabric roll, the control of the equipment immediately acts so that the remnant fabric roll is rewound and the unwinding of fabric from other textile rolls is carried out subsequently so that the layout of the material on the transport belt and the conveyance of the "new" fabric to the custom cutting device is immediately effected.

Because of the continuous conveyor belt, the arrival of the fabric band end at the custom cutter can be precisely calculated. Claim 10 permits an interruption of the control of the custom cutter process at the latest, when the calculated arrival of the said fabric band end at the custom cutter takes place and sets the control back in operation by a "Start-again" signal upon the arrival of a subsequent fabric band. The computing of the arrival time is carried out advantageously with reference to the speed of the conveyor belt and the difference in distance between the fabric cutoff device or the fabric-end sensor and the custom cutter. The fabric end sensor can, because of the use of the continuous conveyor belt be disposed proximally to the unwinding device (and not the custom cutter, although this would also be possible and would lead to a self actuating recognition of a fabric end.)

The control can also automatically compute the arrival time of the lead edge of another fabric band at the custom cutter, as outlined in the features of Claim 11, after the said restart of the unwinder. The valid basis for this is again the continuity of the conveyor belt.

Alternatively, the determination of the arrival of a fabric band in the near proximity to the operation area can be done without being on the basis of a computation, but by direct detection of the leading edge of said fabric band. This can be accomplished, for instance, by optical means. For this purpose, the conveyor belt can be made in a specific color, which contrasts itself from the generally used fabric colors. An optical sensor is sensitive to the light reflected from the conveyor belt (which light necessarily has the color of the conveyor belt.) Upon the arrival of the leading edge of the fabric, (which has a different color) the intensity of the detected reflected light is diminished, whereupon

the arrival signal has been received. Another possibility of the recognition of the fabric rests upon an optical difference in distance measurement. The vertical spatial interval between an instrument above the conveyor belt and its visible surface diminishes itself, namely when fabric lies on the conveyor belt. This diminishing of the vertical interval permits the detection of the presence of fabric. The measurement rests, for instance, on the fact that light is focused on the conveyor belt and the reflected light from that surface is detected. The presence of the fabric implies, that the focus point lies under the reflecting surface (here the fabric), which condition manifests itself in an obvious lessening of the detected reflected light intensity. Both measuring methods can be used alternatively or in combination.

In accord with Claim 12, on the basis of this detection, a self actuated zero point reset for the pattern cutter in the moving direction of the fabric band occurs for the next-in-sequence, custom cutting procedure. This zero point lies in the longitudinal direction at a pre-specified distance (for instance, 2 cm) from the fabric band leading edge, and is offset toward the center of the fabric band. Along with the zero-point setting, a restart signal for the cutting procedure could also advantageously be made.

A selvedge for fabric rolls of differing width, found at a right angle, or hereinafter "cross", to the direction of conveyor travel must be considered when setting the zero point,. The selvedge is that fabric edge area , which differs from the remainder of the material in color and/or pattern, More exactly said, the cross zero point must be set at a specified distance from the inner edge of the selvedge toward the center of the fabric band, i.e. remote from the edges. The detection of the inner edge of the selvedge can fundamentally be done automatically by optical means. Preferred is, however, a half-automatic setting of the cross zero point in accord with Claim 13. This is based on an automatic fabric roll follower guide, which compensates for unequal windings of the fabric across the band. At the start of an unwinding for a new roll, an operator defines the position of the cross-zero point relative to the edge of the fabric. If the cross zero point should lie , for example, 1 cm within the inner edge of the selvedge, then the operator, in case of a 2 cm selvedge, sets the cross zero point 3 cm within the actual fabric edge.

The roll follower guide transversely slides the fabric roll automatically during the unwinding in such a manner, that the cross zero point comes to lie at an established cross position of the conveyor belt (the cross-zero point position). In accord with Claim 14, the determination of the fabric band edge position, which is necessary for the described action, is carried out by a fabric band edge sensor with an optical light relay system. Such a system would encompass one or more light sources which directly illuminate the fabric edge after the unrolling and one or more sensors for the spatial detection of the light interrupted by the fabric and/or the light falling on the fabric band.

In the case of the fabric custom cutting, in accord with the invention, the control, because of the positioning of the conveyor belt, can precisely predetermine whether a pattern to be cut exceeds the available length of the remaining fabric. In accord with the embodiment in Claim 15, it is even possible, that the control selects only those patterns for a pattern, which, before running out of fabric, can be completely cut out. The control stores in memory those pattern cutouts, which cannot be completely cutout and then permits, that these cutouts are automatically called back into action after operation begins with new (and sufficient) fabric. Claim 16 demonstrates, from the standpoint of control technology, it is possible, that in case a fabric roll reaches an end at a pattern cutter, this will be cut as determined by the control. Such patterns as could not be cut from said roll completely, are automatically recognized and after automatic recognition of the zero point in the direction of the conveyor belt travel, will be cut out of the next fabric rolls. These measures enable a substantial reduction of the spoilage.

The single cutouts must frequently be provided with additional seams and quilting. This can be the case, for example, in upholstery covering, in which the cover folds are made by the sewing of the single patterns before the complete sewing together of the covering is done. In this case, it is advantageous that the patterns are provided with markings, along which the seam or quilt lines can be set. In order not to have to mark each cutout, these markings were advantageously placed on the not yet cut fabric band. For the later processing of the cut-outs, in general, markings must be made on the fabric. For instance, such markings show where later quilting is to be made.

In accord with Claim 17, for this purpose a marking device has been provided. In the state of the technology, one uses for this purpose a marking head (that is, a spray head) which is installed on the custom cutting apparatus and, indeed more exactly, on the available, bidirectionally movable support which also carries the cutting head of the custom cutting apparatus. The work-up of the fabric is done in the manner of the state of the technology, in general so, that first, by an appropriate procedure of the supports, the necessary markings on the fabric are applied. When that is accomplished, once again, by corresponding movements of the support, the required fabric cutting can proceed.

Alternatively, the formulation in accord with Claim 18 proposes, that there be provided a controllable marking apparatus, separately placed away from the custom cutting apparatus and independent thereof, and that the cutting and the marking are executed simultaneously. Advantageously, the marking apparatus is located between the unwinding device and the cutting apparatus. By marking the fabric directly after the unwinding from the fabric rolls, the fabric bands come to the cutting apparatus in a prepared state. Since the cutting apparatus now serves only the one cutting function, the operational speed is increased by a factor of 2.

In a case of disturbance with the cutting apparatus or the marking apparatus, a custom cutting machine of the state of the technology must, in general, be brought to a stand still, until the difficulty is corrected. In order to avoid production down-time of this kind, by means of an improvement of the above described system, in accord with Claim 19, the marking apparatus is equipped with a custom cutting means (for example) a cutting head, and/or the custom cutting apparatus is provided with a means for marking (for instance, a marking head). The control of the equipment is so designed, that at an emergency-run operation — at what would be a shut down for conventionally operating cutting or marking means — in accord with the present invention, custom cutting is possible with the cutting means placed on the marking equipment, or, in reverse, marking continues with the marking means located on the cutting apparatus. Further, roll exchange can be carried out simultaneously. In the case of a complete breakdown of either of the two apparatuses, a more extensive emergency-run operation is foreseen, in

which both functions are taken over by the non-disabled apparatus (i.e. custom cutting and marking). In the first mentioned case there is effected a continuation of operation with simultaneous cutting and marking without loss of time. In the second case, what occurs is a non-simultaneous cutting and marking, which allows continued operation at perhaps half the speed of the normal operating rate.

The unwinding of the fabric and the its conveyance on the conveyor belt can be done continuously or discontinuously. In the first case, the fabric is drawn from the roll without interruption or delay and during its movement, is cut and, if necessary, marked. Control-wise, however, a forward impulse movement is simpler, in which the unwinding device and the conveyor belt are at times held back for a cutting of a "cutting window" and, if necessary, for the marking of a "marking window".

In accord with Claim 19, the fabric custom cutting apparatus exhibits a marking head, which is movable in the transport direction of the conveyor belt or at right angles thereto. This marking head can be outfitted with a spray device, which applies line-like markings on the fabric band. In this way, dry powder can be ejected thereon, which, after the further work-up of the material can be brushed away. The spray, or ejected substance can also be of a retentive nature, such as a dye, which, without the aid of technical means (fluorescent lamps), is invisible. In the case of another preferred embodiment, the marking apparatus is formed from a marking head, which, in similar manner to a plotter, applies the markings by means of a movable vertical rod moving along the lines to be marked. The rods can be chalk pieces or other customary marking means. In this way, a single rod can be employed. Even a supply magazine can be provided, out of which the marking head can select a rod. The latter form has the advantage, that, first, the rods are exchangeable upon wear without long resetting periods, and second, several rods for varied colored markings are immediately accessible to the marking head. The movement of the marking head is, advantageously, regulated by a control unit which possesses a microprocessor. This control can be, for instance, from a tool machine issue such as the well known CNC or DNC Control units.

The input quantity of the control includes the placement of the markings to be made on the individual patterns as well as the arrangement of the pattern. In order to be able to load in these data, the said control possesses an interface, to which is connected either:

- a central control unit for the regulation of the fabric guidance formed from the unwinding device and the conveyor belt and the custom cutting apparatus, or
- by means of which central control the data from another computer could be taken over, for instance, the control of the cutter apparatus.

Compatible data formats are preferred, such as in textile work, the customary formats, *.DXF AAMA or formats such as ISO 6983, wherein the data, in general, are produced with the aid of CAD-systems. A matching to each optional data format is possible. The control of the equipment can be the proprietary format of another machine manufacturer, such as, the proprietary format of the French firm "Lectra Systems", which can be installed and worked with. The program for the control of the marking head can either be input through the interface for the location data of the markings, or be input to a stable memory, for instance and EPROM or even to an electrical erasable and rewriteable EEPROM.

In accord with Claim 21, the custom cutting apparatus exhibits a cutting head, which is movable in the cross direction and, if required, in the direction of conveyor belt travel and the position of which as well as the cutting activity is contrallable from the control of the general equipment. The cutting head control is advantageously designed in the same way as the above described marking head control. The two controls can use one and the same or separate microprocessors. Further the two head control components can be the control of the entire fabric cutting equipment, which possesses a single common microprocessor.

The cutting head can possess a cutting knife, which, for instance, is designed as an electronically driven circular knife. In other embodiments, the cutting knife is designed as a pinion cutter, which advantageously is activated supersonically, whereby the assurance is given that even in the case of fast forward movement, the cutting force is vertical to the fabric band. The cutting head can also be built as a die, which stamps the patterns out of the fabric band.

In a preferred embodiment, the cutting head is a laser beam cutting head. This type of cutting head possesses a laser beam source and a corresponding focusing optical system, which focuses the laser beam on the fabric band. To avoid undesirable oxidation, an additional protective glass jet can be provided, which pushes away from the cutting position the oxygen containing air by means of inert gases, i.e. nitrogen or other inactive gases. Especially, where artificial fiber containing textiles are concerned, a fume removal system can be provided, which, during the cutting, sucks away the vaporized substances in order to uphold the required working place environmental regulations (MAK-values). Finally, the cutting head can also fulfill its function as a water stream, which exhibits a water jet, from which a high pressure water stream issues for cutting the fabric. In this case, the custom cutting apparatus possesses on the side remote from the cutting head, an appropriate collection system for the cutting water stream. An advantageous arrangement is one of the above mentioned mechanical cutting or stamping methods combined with a laser beam cutting device or with a high pressure water jet custom cutting apparatus.

In order to cut out several similar patterns in a single work operation, it is known in the state of the technology to lay several layers of fabric bands, one on top of the other. These laminated arrangements of fabric are brought to the cutting apparatus, and with one penetrating cut, are all custom cut together (see the EP-A-0 589 091) mentioned in the introduction). With the conventional marking apparatuses (see DE-U-295 03 230) only the top layer of this multiple layered fabric structure can be so marked.

In the embodiment as described in Claim 22, the fabric cutting apparatus is so designed, that on the conveyor belt, two or more layers of fabric can be laid out on top of one another. For this purpose, a corresponding number of fabric unwinding devices are used. Because of the continuously moving conveyor belt, the fabric bands can be very precisely positioned over one another.

In accord with Claim 23, each of the unwinding devices is provided with a marking device

The marking apparatuses are so arranged, that they are able, respectively, before the deposition of a further fabric band layer, to apply a marking on the existing band. The marking apparatuses are controllable in respect to time and position in such a way, that the markings of the finally stacked fabric layers are positioned congruently, one on the other. This pre-customized, multiple layered fabric band is then conducted to the cutting apparatus. On the now cutout patterns, the marking guides are still in alignment. The last marking apparatus (if there are more than one) is advantageously located between the last unwinding device and the custom cutting apparatus. It marks respectively the unwound fabric band layer from the assigned unwinding device before the next layer can be placed by the adjacently located unwinding device.

After the stacking and so that the markings of the individual layers are congruently aligned, the marking apparatuses and the withdrawal speed of the individual unwinders are time synchronized and controlled. Preferably, all marking apparatuses operate simultaneously, wherein each handles one window in the timely sequence of the fabric output. The marking windows can belong to one or to various cutout patterns. After the work-up of respectively one marking window, the fabric band is moved forward, so that the respective marking window next in line is presented. In regard to control, the marking windows are so synchronized, that in the finished, custom cut packet the markings lie congruently, one under the other. In the case of a discontinuous operation, the second marking apparatus carries onto the second layer of fabric exactly the same marking pattern, which, in a previous step, the first marking apparatus applied on the first fabric layer. The markings of the first and second material layers, lie congruent, one on top of the other. Alternatively, a continuous forward movement is possible. The fabric bands were, during the marking, pulled under the marking apparatuses.

Advantageously, the fabric custom cutting equipment is equipped with at least one coating material dispensing device placed after the unwinding device, which lays down a top layer on the fabric band. In this way, on the uppermost fabric band layer, a covering material is laid for the formation of a vacuum sealing means.

A fabric band with such a covering coating as described, upon later cutting, can, because of low pressure at the conveyor belt, be so pressed against the said conveyor belt, that the risk of a relative slipping of the single fabric band layers during the cutting is lessened. An appropriate covering material can be a plastic foil, a paper layer, or another foil-like material. The permeability to air of the covering material is advantageously less than that of the fabric band layers, so that a sufficient anchorage due to the vacuum formation is made. In the case of other embodiments, the suction is effected without a cover on the top fabric layer. A sufficient suction can be achieved by the relatively small air permeability of the fabric band layers to be cut.

In the case of more simple and more economical embodiments in accord with Claim 25, the conveyor belt is provided with a rough and/or adhesive coating, which, without the vacuum effect is enabled to hold the fabric band(s) securely. This is accomplished advantageously by a felt coating. This obviates first, the relatively expensive suction arrangement and second, makes the coating of the fabric band obsolete.

In order to cut with greater precision and to hold the scrap rate to a minimum, there are various measures for freedom from folding in the depositing of the fabric on the conveyor belt or on other fabric layers. Thus, in accord with Claim 25, the progressive movement of the unwinding device or the fabric tension loading apparatus (which can be multiple) is somewhat slower than the forward motion of the conveyor belt. This causes the fabric to be laid on the conveyor belt with a certain degree of tension. In accord with Claim 26 the fabric band is subjected to pressure, namely by a pressure roll which presses the band against the conveyor belt.

In the state of the technology, where custom cutting was involved, frequently in the edge areas of the pattern, so-called "clipping" was observed. What was involved here were three cornered cutouts, which indicated to the sewing person during the subsequent sewing of the fabric pattern, where the seams which were to be installed began or ended. In order to shorten the fabric work-up time even more, Claim 27 proposes that the recognizable characteristic mark for seam ends or seam beginnings, instead of being marked with cutout "clips", to apply such guiding markings in the form of (colored)

marking on the material itself. This is done advantageously by the above mentioned marking apparatus, which operates simultaneously with the custom cutting apparatus. Since the custom cutting apparatus is more heavily loaded than the marking apparatus, the substitution of the cutout clippings (optically recognizable) by markings would bring with it a more well balanced loading and therewith as a whole, an increase of profitable working time.

The marking system(s) can, advantageously, also be employed for other markings on the fabric pieces. Such markings, for instance, can be symbols assigning different fabric pieces to a specific, for instance, furniture piece. This is particularly valuable, when the fabric pieces belonging to a specific furniture piece come from different patterns. This would be the case if the furniture piece was to have a multicolored covering. Further such marking would be helpful if the fabric, because of roll end changes, was cut from an old and a new fabric roll. In accord with Claim 28, this assignment information, or other information can be carried out with the marking apparatus on an separate piece for sew-on addition. In this case a fabric piece is involved which is to be sewed on at a later time. The information can be presented in coded or uncoded form.

The fabric cutting equipment — alternatively or additionally — can possess a label application device, which provides the individual cutouts of a pattern or different patterns with labels, so that the cutouts, by further working, can be properly assembled together. The label application device can, for this service, be located either before or after the cutting apparatus and can be controlled by the complete system controller.

The unwinding device is advantageously designed as a rodless device, wherein the fabric rolls are found upon an underlying support, and for the unwinding of the fabric are set into rotation by a tangential motion imparted against their outer surface.

The fabric custom cutting apparatus can also possess a take-away belt, which transports the already cut and possibly marked cutouts to various assigned receiving baskets. The take-away belts can also be located as an extension of the main conveyor belt.

Advantageously, the said fabric custom cutting apparatus also has a monitor, upon which the cutting design and/or the markings to be made are visible.

As mentioned in the introduction, in accord with the state of the technology, one employs separate equipment for the fabric feed and the custom cutting, which are assembled at the operating site. The above described arrangement of the fabric cutting apparatuses are also advantageous for such separate equipment, even if thereby, at least partially full optimal results are not achieved, which optimal results would be expected of a fabric cutting apparatus designed as a unified entity. Existing in the textile working countries are a large number of such installations assembled from various parts and these are capable of useful production for many years to come. In order to allow these existing installations to enjoy the profitability of the invented designs, it is proposed that the custom cutting apparatus be retained, but to replace the feeding apparatus with a fabric forwarding feed system in accord with one or more of the above assemblies. In accord with Claim 29, following this idea, such a fabric feeding device and system is proposed with at least one fabric unwinding device (1, 1') for a fabric roll (7), one belt conveyor (5) for the transport of the unwound fabric, wherein the unwound apparatus (1, 1') lays the fabric band directly on the conveyor belt (5) or upon one or more fabric bands already thereon, whereby the fabric feed equipment possesses one or more of the features of the Claims 2 to 20, 22 to 28 of this present patent. Insofar as, in these Claims, a fabric custom cutting apparatus is mentioned, the separate custom cutter component is meant. In some cases, the separate custom cutter component can be controllably coupled with the fabric feed equipment of the invention, so that, for instance, the object of the Claim 15 (defining and operations on the cut out patterns prior to the end of the fabric roll) is advantageous to the highest degree with the feed apparatus of the invention along with an existing, conventional custom cutting apparatus. Particularly advantageous is also an embodiment in accord with Claim 23, according to which a multi-layered marking is made possible. From this, the existing cutting system can profit in the greatest measure

if it is operated together with a feed system as outlined above.

Finally, the invention presents in accord with Claim 30 a procedure for custom cutting of fabric, which advantageously and in accord with one or more of the above formulations, can be developed and extended (Claim 31). In regard to the details reference is made to explanations for fabric cutting and fabric transport, which give attention to the process and its embodiments.

The invention will now be explained in even greater detail by reference to other embodiments and the following schematic drawings. There is shown in:

- Fig. 1 a side view of a fabric custom cutting apparatus with two unwinding devices, however, without a marking apparatus,
- Fig. 2 a plan view of the cutting apparatus of Fig. 1,
- Fig. 3 a side view of a fabric custom cutting apparatus, similar to Fig. 1, however with the additional equipment of two marking apparatuses and a removal belt,
- Fig. 4 a plan view of the fabric cutting apparatus shown in Fig. 3,
- Fig. 5 a schematic presentation of a fabric band with pattern cutouts and blanks to be cut,
- Fig. 6 a schematic cutout, the patterns for which were divided onto two separate fabric bands,
- Fig. 7 a side view of a fabric custom cutter apparatus which is similar to Fig. 1, which is made secure against down time due to loss of the cutting facility and the marking apparatus and
- Fig. 8 a side view of a fabric unwinding device, which is similar to that of Fig. 3, however, not equipped with a custom cutting apparatus.

In the drawings, the same reference number is given to components with identical functions or definitions.

The fabric custom cutting apparatus, as shown in Figs. 1, 2, exhibit two unwinding devices 1, 1'. Respectively, a fabric roll 7 lies in a V-notch shaped, belt arrangement 8 of the unwinding device, which latter has three rolls 9. The belts are driven preferably by means of the center roll 9. The traveling force of the said belt arrangement 8 is communicated by friction to the fabric rolls 7, which are thereby rotated and unwind themselves.

The fabric custom cutting apparatus is equipped with a conveyor belt 5, which extends itself from the position where the fabric from the first unwinding device 1 is laid down to the operational area of the custom cutter 3. As to the term "first unwinding device", that unwinding device is to be understood which is most remote from the said custom cutting apparatus 3. The fabric band is laid down from the unwinding devices 1, 1' directly upon the conveyor belt 5. The direction of travel of the progressing conveyor belt is characterized in the drawing(s) by an arrow.

In accord with the presentation in Fig. 1, the second unwinding device 1' is active. The first unwinding device is idle. . The custom cutting apparatus 3, accordingly, cuts fabric which is respectively discontinuous by the length of a cutting window as drawn from the fabric roll 7 of the second unwinding device 1'.

The unwinding devices 1, 1' are respectively equipped with a (not shown) fabric-end sensor. This is comprised, for example, of a light emitter/receiver unit and a reflector. This light relay unit can be so arranged, that the light beam runs over the two outer rolls 9 of the belt arrangement 8, so that the fabric rolls interrupt the light path of the light relay. When the diameter of the fabric roll, on the other hand, reduces itself below a given threshold, the light beam passes freely to the receiver, thus making a fabric end signal to a control instrument (not shown). This signal initiates a cutoff of the fabric band already

on the conveyor from the remainder wound on the fabric roll 7. At this point, the fabric band is retained by a tensioner apparatus 10 and is cut off by a subsequently placed fabric cutoff apparatus 12. Both the tensioner 10 and the cutoff apparatus 12 are installed on the unwinding device 1,1' in an area in which the already unwound fabric has not yet reached the conveyor belt 5. After the cutoff, the fabric remainder on the second fabric roll 1' (the active roll) is rewound thereon.

Although the end of the fabric band, now laid upon the conveyor belt 5, is to be cut by the custom cutting apparatus 3, the first unwinding device 1 is already unloading onto the same conveyor belt 5. With a doubled belt advancement, the fabric from the first unwinding device 1 is already within the operational area of the custom cutting apparatus 3, so that a fabric roll switch is achieved with only a small break in the continuous operation. The operating person can now remove the fabric roll from the second unwinding device 1' and replace it with a new fabric roll.

For the continuing of the cutting procedure with the new material, a zero point positioning is required. In the progressive direction of the conveyor belt, this zero-point setting is fully automatic since a travel-direction, zero point sensor 11 detects the forward edge of the fabric in the operational area of the custom cutting apparatus. The detection is based on an optical recognition of the color of the fabric which differs from the color of the conveyor belt and/or by means of an optical detection of a spatial difference between fabric bands. In the cross direction, the zero point setting occurs half-automatically. And indeed, the unwinding devices 1, 1' are slidable at right angles to direction of belt travel by means of a (not shown) cross directed drive. This cross drive is equipped with a subsequent signal controller, which, acting upon a signal from the optical fabric band edge sensor, moves the unwinding roll laterally so that the unwound fabric band edge comes to a constant cross position on the conveyor belt. This avoids that an uneven unwinding of the fabric leads to angled pushing of the laid down fabric band on the conveyor belt. The position of the unwound fabric located across the belt, which was automatically set by the follow-up control, can be adjusted in individual cases by an operating person as fabric rolls are changed. This is necessary, since the breadth of the so

called fabric band edge 13, does not coincide from side to side. For this adjustment there serves a determinable cross directional zone (14), i.e. selvedge, free of zero point.

The cross directional zero point adjustment also encompasses the fact that the operating person, after the insertion of a new roll of fabric, sets the zero point at a specified spatial offset (for instance 1 cm) inside of the inner selvedge limit. By this means, assurance is given, that the cross directional drive automatically controls the position of the unwinding devices 1, 1' in such a manner, that the adjusted cross zero point is always laid at the same cross position of the conveyor belt.

This cross zero point adjustment can be undertaken previous to the actual start of operations of a unwinding device and so would engender no interruption in the continuity of work.

The custom cutting apparatus 3 encompassed a sliding support 16, movable parallel to the the conveyor belt, possessing a cross-traverse 17 upon which a cutting head 18 is movable. Where the cutting head 18 is concerned, this could be, among other choices, a laser-cutting head.

The (not shown) control equipment has stored in memory, the patterns to be cut. On a monitor 6, (among other things) these patterns are presentable in virtual cutouts. Using these the stored patterns as a basis, the control equipment controls:

- the remnants from the unwinding devices 1, 1',
- the automatic relocation of the zero points in belt travel direction,
- the motion of the cutting head 18 in belt travel and cross directions,
- the cutting activity of said cutting head 18,
- the cutoff of the fabric at approaching roll end, and
- the exchange from one unwinding device to the other because of input from the cutting specification for a change in from one fabric to another or because of an approaching end of a fabric band.

More detail on this will be provided below in connection with Figs. 5, 6.

A fold-free lay-out of the fabric on the conveyor belt 5 is to be achieved, first, in that the tensioning device 10 for stretching the fabric permits only a somewhat lesser

forward motion of the fabric in comparison to that of the conveyor belt 5. Thereby, the fabric is under a certain tension when laid down on the conveyor belt 5.

Second, proximal to each unwinding device, 1, 1', a pressure rider roll 19 is provided, which presses the fabric against the conveyor belt 5.

The said conveyor band 5 is provided with a felt like surface. The fabric clings to the material of this surface so well, that it does not slide even during the cutting process.

The fabric custom cutting in accordance with Figs 3, 4 permit the marking and the cutting of multi-layer fabric bands. The above detailed explanations for the Figs. 1 and 2 are also valid for such multi-layer bands in the same custom cutting apparatuses.

Additionally, on the cutting apparatus, after each unwinding device 1, 1' is found respectively, a marking apparatus 2, 2' which applies on the just unwound fabric band, line markings for quilting or sewing to be carried out later. The marking are comprised, for instance of a self volatilizing substance, which can only be seen in ultraviolet or infrared spectrums. The marking apparatuses 2, 2', correspond in construction to the above described custom cutting apparatus 3, and indeed, they exhibit a support 16, slidably movable parallel to the conveyor belt carrying a traverse bar 17 and a marking head 20 thereon. The latter is, for instance, a spray head which ejects the marking substance in the course of the spray head movement and thereby applies line-like markings of optional line form in the fabric.

After the first layer of the fabric band is laid down after the first unwinding device 1, has been marked by the first marking apparatus, and has been transported further by the conveyor belt 5, then the second unwinding device 1' lays down a second layer of fabric. This will be marked by the second marking apparatus 2'. The marking procedure is so controlled, that at the end of the marking, the markings on successive layers of fabric band are congruent. The conveyor belt transports the ready-to-cut, multilayer fabric band to the custom cutter apparatus 3, where the collected layers are cut in a common operation.

A vacuum box 21 in the operational area of the custom cutting apparatus 3, located underneath upper strand of the endless conveyor belt sucks air through the conveyor belt

and the superimposed fabric bands. This causes a sufficient compression of the fabric bands onto the conveyor band to exclude any slippage of same during the cutting operation.

On the monitor 6, in this embodiment, not only the virtual cutout lines are visible, but also the marking lines.

Behind the custom cutting apparatus 3 — "downstream", relative to the belt travel — is appended a removal belt 22, which is formed from an extended portion of the conveyor belt 5. By means of said removal belt 22, either the finished cut out fabric pieces can be sorted by the operational persons, or an automatic arrange and sort system can be added. Also, at this point, error cuts can be sorted out.

Fig. 5 shows a fabric band ahead of the custom cutting. On the longitudinal edge, is found the selvedge 14, which normally has a width of 2 cm, The (virtual) zero point 23 finds itself in a cross direction, somewhat inside of the inner edge of said selvedge 14 (about 0.2 mm), as well as in the direction of travel of inside of the forward fabric edge (for instance, about 1 cm). On the fabric are seen the cutting lines of the patterns 24 yet to be cut out. This presentation of the lines serves only for information, because in reality, the lines are virtual, and exist only in the data memory of the cutter control. Along these virtual cutting lines, is moved the marking head 20 of the custom cutting apparatus 3, so that said custom cutting apparatus 3 excise the presented cutouts. Likewise, marking lines 25 are drawn in. These are first likewise in the memory of the control equipment, but after the application of the markings, however, they become visible on the fabric in the here presented form. In the area of the cutting lines, also triangular markings 26 are to be seen. These are likewise applied by the marking apparatus 2, 2'. The triangular marking serve for the later work-up of the fabric as recognition signals for seam ends or seam beginnings. Finally, the marking apparatus 2, 2' sprays in the specified seam locations of the cutouts 24, data such as commission or cutout number, so that after the cutting, an assignment of the single cutouts to their proper place is made easier.

When the length of a cutting pattern, as is presented, for example, in Fig. 5 exceeds the length of the working range of the custom cutter, 3, then the virtual cutting pattern is

apportioned into several virtual parts, which correspond to the workable lengths. The control of the equipment is so designed, that after a progressive movement of the conveyor belt to the extent of the length of a "cutting window", to allow that the next window to be processed, the result is that the presented cutting pattern shown in Fig. 5 is cut piece-wise.

Fig. 6 shows a pattern for cutting in an apportionment to demonstrate three cutting windows. In the presented example, the fabric band end comes to lay in the middle of the center cutting window. The control of the equipment determines immediately, which of the virtual proposed cutouts can be made from this cutting window in their entirety, and for which this is not the case. The control then allows the cutting of the partial cutout 24' from the fabric band which is coming to its end, and allows, from the next new fabric band, the excising of the cutout 24" which is now an incomplete but complementary cutout to 24'. Previously, the control had automatically reset the zero point 23 on the new fabric band. This measure allows, that the scrap waste is reduced to the minimum and upon fabric band change work can continue, practically without interruption.

The demonstrated fabric custom cutting equipment is modular in its construction. Thereby, components other than those here presented in example embodiments, may in a simple way, be used in combination with other functional units. Particularly advantageous is, for example, an embodiment for single layer fabric working, similar to Fig. 1, which, however, possesses behind the second unwinding device, 1', a marking apparatus of the kind shown and described in Fig. 3. Such an embodiment is shown in Fig. 7. With this embodiment, single layer marking and custom cutting can be carried out, whereby, because of the doubled unwinding devices available, and the simultaneous carrying out of the marking and cutting, very high speed operation can be achieved. The fabric cutting apparatus of Fig. 7 corresponds to the remaining, not mentioned features in the Figs. 1 to 4.

Other than shown in Figs 3, 4, by an increase in durability and resistance against downtime, the marking apparatus 2 (where more marking apparatuses are present, then as in Figs. 3, 4 — the last marking apparatus) is provided with a cutting head 18'.

Correspondingly, the custom cutting apparatus 3 is equipped with a marking head 20'. Respectively, a vacuum box is found in the working areas of the marking and cutting apparatuses.

In normal operation the additional heads 18 and 20 are not employed. In case of a breakdown of one of the normally used heads 18', 20', then, respectively, one of the additional heads 18', 20' is put to use. Now as to the roll exchange: The custom cutting apparatus 3 takes over the marking operation, the marking apparatus the cutting. In this emergency switching operation, the marking continues after the cutting, the already cutout pieces of fabric are also marked. Because of the before and after simultaneous method of operation, the operational speed can be maintained at its normal level. In the case of a total breakdown, a further emergency run stands available for the custom cutting apparatus 3 and the marking apparatus 2. The emergency operation is as follows:

The still operable apparatus 2 or 3, by the activation of the marking head 20' or the cutting head 18', marking and cutting now are done one after the other. The equipment can then, in spite of total breakdown, still operate, whereby, because of the now no longer simultaneous method of operation, the working speed is diminished.

Fig. 8 shows a fabric feed apparatus, which corresponds to that presented in Fig. 3 with the custom cutting apparatus. The single difference therefrom is that this embodiment has no custom cutting apparatus 3 (and also no subsequent removal area 22). Much more, the conveyor belt 5 ends in this case directly after the last marking apparatus 2'. This depicted arrangement in Fig. 8 is designed to be combined with a separate (partially shown in the Fig. 8) custom cutting apparatus 3', which has its own conveyor belt 5'. Composite embodiments to the Fig. 1 through 7 are adaptable also for this fabric feed equipment. The shown embodiment permits, as does that of Fig. 3, a collection of multilayer, marked fabric windows, before the cutouts are excised in common from the fabric band packet.

**Apparatus for Custom Fabric Cutting,
Device for Fabric Feed
and Process for use of Same**

CLAIMS-II

Claimed is:

1. A fabric custom cutting apparatus with:

- at least two sequentially arranged fabric unwinding devices (1, 1') for a fabric roll (7),
- fabric unwinding devices (1, 1') which are equipped with a fabric cutoff apparatus (11),
- a conveyor belt (5) for transporting the unwound fabric, and
- a custom cutting apparatus (3), which cuts out a pattern figure from the fabric band laid on the said conveyor belt (5),

and wherein the conveyor belt (5) extends continuously, at least from the point of deposition of the fabric from the unwinding devices (1, 1') to the operational area of the custom cutting apparatus (3)

and wherein the unwinding devices (1, 1') lay the fabric band directly on the conveyor belt (5),

and wherein after the cutoff of a fabric with that fabric cutoff apparatus (11) assigned to its respective fabric roll (7), the control of the equipment permits, that the fabric roll (7), where the cutoff was made, rewinds the fabric remnant,

and wherein the unwinding of fabric from another fabric roll (7), the deposition of the same on the conveyor belt (5) and the transport thereof to the operational area of the custom cutting apparatus (3) is immediately carried out without delay, so that a

fabric roll change is achieved without loss of, or only with minimal loss of production time.

2. A fabric custom cutting apparatus in accord with Claim 1, therein characterized, in that the fabric unwinding devices (1, 1') are each equipped with a fabric tensioner apparatus (10), which holds the fabric still for the fabric cutoff apparatus (11).
3. A fabric custom cutting apparatus in accord with Claim 1 or 2, therein characterized, in that the fabric unwinding devices (1, 1') are so designed, that after the cutoff with the cutoff cutter apparatus (11), the said devices can rewind the fabric remnants automatically back on the fabric roll.
4. A fabric custom cutting apparatus in accord with one of the Claims 1 to 3, therein characterized, in that the fabric unwinding apparatuses (1, 1') are equipped with a fabric end sensor, which detects the arrival or the approach of the end of the fabric on the fabric roll (7), this being done advantageously upon the recognition of the complete or nearly complete unwinding of a roll.
5. A fabric custom cutting apparatus in accord with Claim 4, therein characterized, in that the fabric end sensor is comprised of a light-relay through which the fabric band advantageously passes in the area of the unwinding devices (1, 1').
6. A fabric custom cutting apparatus in accord with Claim 4 or 5, therein characterized, in that the detection of the arrival of, or the approach of, the end of the fabric initiates the cutoff of said fabric with the fabric cutoff apparatus (11).
7. A fabric custom cutting apparatus in accord with one of the Claims 2 to 6, therein characterized, in that, after the cutoff of the fabric band or, in the case of absence of

a cutoff apparatus, and the approach of the fabric end has been detected, then, basing its action upon the calculated latest arrival of the lead end of the fabric band at the custom cutting apparatus from data on

- the speed of the conveyor belt (5)
- the spatial interval between fabric cutoff apparatuses (11) with the fabric end sensors and the custom cutting apparatus (3)

the control, interrupts the custom cutting procedure, and upon a reinstatement signal to said custom cutting apparatus (3) after arrival of a new or another fabric band — particularly from another unwinding device (1, 1') — the said control restarts the cutting operation.

8. A fabric custom cutting apparatus in accord with Claim 7, therein characterized, in that the control, after operation of the unwinding devices (1, 1') resumes, defines automatically, for a new or different fabric band, the time for the arrival of the edge of the said new or different fabric band at the custom cutting apparatus (3).
9. A fabric custom cutting apparatus in accord with one of the foregoing Claims, wherein the arrival of the fabric band at a defined point proximal to the operational area of the custom cutting apparatus (3) is automatically detected, preferably in an optical manner, and on the grounds of this detection, a self-acting location of the zero point setting occurs in the travel direction of the fabric band for the ensuing cutting procedure.
10. A fabric custom cutting apparatus in accord with one of the foregoing Claims,
 - which possesses a sensor (13) for the detection of the position of the fabric band edge transverse to the travel direction of said band,
 - in which the fabric roll (7) is transversely slidable by a cross drive, and
 - which is provided with a follow-up device, which automatically slides the fabric rolls (7) transversely to direction of conveyor belt (5) motion in such a

manner, that the unwound fabric band edge is brought to lie in a predetermined transverse position by the operator, so that differently wide selvages (14) as well as irregular unwinding of the fabric can be compensated for as to transverse positioning.

11. A fabric custom cutting apparatus, in accord with Claim 10, therein characterized, in that, the fabric band edge sensor (13) is designed in the manner of a light-relay, being comprised of one or more light sources which illuminate the fabric edge immediately after the unwinding and possessing one or more sensors for spatial detection of the light interrupted by the fabric or randomly falling on the fabric band.
12. A fabric custom cutting apparatus in accord with Claim 1 or 2, therein characterized, in that the control is able to determine, from the speed of the conveyor belt (5) and the point in time of the recognition of the fabric end, those cutouts (24') of the cutting patterns, which can be completely cutout before reaching the end of the fabric length and the control is able to store in memory those space deprived cutouts 24" of the cutout pattern, allowing holding of the cutting out of the said cutouts for another fabric band.
13. A fabric custom cutting apparatus in accord with Claim 12, therein characterized, in that, in case a fabric roll end is reached within a pattern to be cut out, the said pattern is controllably apportioned, since those single cutouts (24") of the pattern, which cannot be completely cut out from fully used fabric rolls (7) are immediately recognized and, advantageously, after an automatic resetting of the zero point in the direction of said belt travel, are assigned to be cut from the next fabric roll.
14. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in that at least one marking apparatus (2, 2') is provided, which applied line-like markings (25) for seams or quilting on the laid out fabric

band from the unwinding device (1, 1') and carried on the conveyor belt (5).

15. A fabric custom cutting apparatus in accord with Claim 14, therein characterized, in that the marking apparatus(es) (2, 2') are located separately from the custom cutting apparatus (3) and are independent of the same as to control, and the custom cutting and the marking are effected simultaneously.
16. A fabric custom cutting apparatus in accord with Claim 15, therein characterized, in that also the marking apparatus (2, 2') is equipped with a custom cutting means and/or the custom cutting apparatus (3) is equipped with a marking means, and the control of the equipment is so designed, that in emergency operation upon a failure of the custom cutting apparatus (3), custom cutting with the help of the custom cutting means on the marking device (2, 2') can be carried out, and/or upon a failure of the marking apparatus (2, 2'), marking with the help of the marking means provided to the custom cutting apparatus (3) can be carried out.
17. A fabric custom cutting apparatus in accord with one of the Claims 14 to 19, therein characterized, in that the marking apparatus (2, 2') possesses a marking head (20) movable in transverse or in travel directions, the position of which and marking activity thereof are controllable by the control of the equipment, the design of which is in particular supported by CAD, especially as CNC or DNC-control.
18. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in that the custom cutting apparatus (3) possesses a cutting head (18), the position of which and cutting activity is controllable from the control of the equipment.

19. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized,
in that the fabric band(s) are placed under suction on the conveyor belt (5), or
in that the said conveyor belt (5), is provided without suction means, and for this reason is supplied with a rough and/or adhesive covering, preferably a felt surface.
20. A fabric custom cutting apparatus in accord with one of the Claims 2 to 19, therein characterized, in that for a fold-free layout of the fabric band, the forward advance of the unwinding devices (1, 1') or, if necessary, the fabric tensioning means (10) is somewhat less than that of the forward advance of the conveyor belt (5).
21. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in that to achieve a fold-free lay out of the fabric band on the conveyor belt (5), the said fabric band is pressed by a pressure device, in particular a pressure roller (19) against the conveyor belt (5).
22. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in which, instead of the conventional clip-outs, recognition symbols (26) for seam ends or seam starts in the form of markings on the fabric are applied, preferably made by the marking apparatus(es) (2, 2').
23. A fabric custom cutting apparatus in accord with one of the foregoing Claims, for the cutting of fabric pieces to achieve a projecting sewed addition, which extends itself from a previous seam, and onto which addition, data (27) can be imparted in

coded or uncoded form.

24. A procedure for the custom cutting of fabric by the following steps:

- laying out at least one layer of a fabric on a conveyor belt (5) by the unwinding of a roll of fabric (7) from one or more unwinding devices (1, 1') and the direct deposition on the continuous or discontinuous movable conveyor belt (5) wherein the fabric unwinding devices (1, 1') are equipped with a fabric cutoff apparatus (11),
- transporting the laid out fabric on the conveyor belt (5) to a custom cutting apparatus (3) wherein the conveyor belt (5) is continuous at least from the point of fabric deposition to the custom cutting apparatus (3) and
- automatic cutting out of a desired pattern form with the said custom cutting apparatus (3),

whereby, after the cutoff of a fabric with the respective fabric cutoff apparatus (11) assigned to the corresponding fabric roll, the control of the equipment permits, that the said fabric roll (7) is rewound and the unwinding of fabric from other fabric rolls (7), the layout of which on the conveyor belt (5) and the transport of which to the operating area of the custom cutting apparatus (3) is subsequently and immediately carried out, so that a fabric roll changeover is achieved without any, or at least little, loss in productive time.

25. A procedure in accord with Claim 24, which exhibits one or more of the features of Claims 2 to 23.

26. A fabric custom cutting apparatus with:

- at least two sequentially arranged fabric unwinding devices (1, 1') for a fabric roll (7),

- a conveyor belt (5) for transporting the unwound fabric, and
- a custom cutting apparatus (3), which cuts out a pattern figure from the fabric band laid on the said conveyor belt (5),

and wherein a conveyor belt (5) extends continuously, at least from the point of deposition of the fabric from the unwinding devices (1, 1') to the operational area of the custom cutting apparatus (3) and the unwinding devices (1, 1') lay the fabric band directly on the conveyor belt (5) or on one or more already deposited fabric bands, wherein, on the conveyor belt (5), two or more layers of fabric lay one on the other and to each of the unwinding devices (1, 1') at least one marking apparatus (2, 2') is assigned, whereby the marking apparatuses (2, 2') are so placed, that they respectively are able to apply markings on one fabric band layer before the deposition of another fabric band thereon and are so controllable as to time and place, that the markings of the final fabric bands laying one over the other are congruent.

27. A fabric custom cutting apparatus in accord with Claim 26, therein characterized, in that the fabric unwinding devices (1, 1') are equipped with a fabric cutoff apparatus (11).
28. A fabric custom cutting apparatus in accord with Claim 27, therein characterized, in that the fabric unwinding devices (1, 1') are each equipped with a fabric tension loading device (10), which holds the fabric firmly upon cutoff with the fabric cutoff apparatus (11).
29. A fabric custom cutting apparatus in accord with Claim 27 or 28, therein characterized, in that the fabric unwinding devices (1, 1') are so designed, that they can automatically cause the rewinding of the remnant fabric on the rolls (7) after

the cutoff with the fabric cutoff apparatus (11).

30. A fabric custom cutting apparatus in accord with one of the Claims 26 to 29, therein characterized, in that the fabric unwinding devices (1, 1') are equipped with a fabric end sensor, which detects the arrival or the approach of the end of the fabric on the fabric rolls (7) advantageously with the aid of recognition of the complete or nearly complete unwinding of the fabric roll (7).
31. A fabric custom cutting apparatus in accord with Claim 30, therein characterized, in that the fabric end sensor is comprised of a light-relay, through which the fabric band passes, in the area of the unwinding device (1, 1').
32. A fabric custom cutting apparatus in accord with Claim 30 or 31, therein characterized, in that the detection, or the arrival, or the approach of the fabric band end initiates the cutoff of the fabric with the fabric cutoff apparatus (11).
33. A fabric custom cutting apparatus in accord with one of the foregoing Claims, wherein the arrival of the fabric band at a specific point proximal to the operational area of the custom cutting apparatus (3) is detected automatically, preferably by optical means, and on the basis of this detection, a self acting zero point setting in the travel direction is effected for the ensuing cutting procedure.
34. A fabric custom cutting apparatus in accord with one of the foregoing Claims,
 - which possesses a sensor (13) for the detection of the position of the fabric band edge transverse to the travel direction of said band,
 - in which the fabric roll (7) is transversely slidable by a cross drive, and

- which is provided with a follow-up device, which automatically slides the fabric rolls (7) transverse to the travel direction of conveyor belt (5) in such a manner, that the unwound fabric band edge is brought to lie in a predetermined transverse position by the operator, so that differently wide selvages (14) as well as irregular unwinding of the fabric can be compensated for as to transverse positioning.
35. A fabric custom cutting apparatus in accord with Claim 34, therein characterized, in that the fabric band edge sensor (13) is designed in the manner of a light-relay, being comprised of one or more light sources which illuminate the fabric edge immediately after the unwinding and of one or more sensors for spatial detection of the light interrupted by the fabric or detection of random light falling on the fabric band.
36. A fabric custom cutting apparatus in accord with Claim 27 or 28, therein characterized, in that due to input of the speed of the conveyor belt (5), and the point in time of the recognition of the fabric end by means of the fabric end sensor, the control is enabled to determine that cutout (24') of a pattern, which, before reaching the fabric end, can be fully cut out, and said control is able to store in memory the remaining cutouts (24'') of the pattern figures whereby the said control sets the custom cutting of said remaining cutouts automatically forward to a new fabric band.
37. A fabric custom cutting apparatus in accord with Claim 36, therein characterized, in that, in case a fabric roll end is reached within a pattern to be cut out, the said pattern is controllably apportioned, since those single cutouts (24'') of the pattern, which cannot be completely cut out from space poor fabric rolls (7) are immediately recognized and, advantageously, after an automatic resetting of the zero point in the direction of said belt travel, are assigned to be cut from the next fabric roll.
38. A fabric custom cutting apparatus in accord with one of the foregoing Claims,

therein characterized, in that the marking apparatus (2, 2') applies line-like markings (25) for seam and quilting lines on the respective fabric band which has been laid down on the conveyor belt (5) by the unwinding device (1, 1').

39. A fabric custom cutting apparatus in accord with one of the Claims 26 to 38, therein characterized, in that the marking apparatus (2, 2') possesses a marking head (20) movable in transverse and/or in direction of travel of the fabric band, the position of which said head and its marking activity are controllable by the control of the equipment, the design of which is in particular supported by CAD, especially as CNC or DNC-control.
40. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in that the custom cutting apparatus (3) possesses a cutting head (18), the position of which and cutting activity thereof is controllable from the control of the equipment.
41. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized,
 - in that the fabric band(s) are under negative pressure on the conveyor belt (5)
 - or in that the conveyor belt (5) is designed without suction apparatuses and for this reason is provided with a rough and/or adhesive surface, preferably in the form of a surface made of felt.
42. A fabric custom cutting apparatus in accord with one of the Claims 28 to 41, therein characterized, in that for a fold-free layout of the fabric bands, the forward advance of the unwinding devices (1, 1') or, if necessary, the fabric band tensioning apparatuses (10) is somewhat smaller than the advance of the conveyor belt (5).

43. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in that, for the purpose of a fold-free laying out of a fabric band, this said band is pressed especially by a pressure roller (19) against the conveyor belt (5).
44. A fabric custom cutting apparatus in accord with one of the foregoing Claims, therein characterized, in which, instead of the conventional clip-outs, recognition symbols (26) for seam ends or seam starts in the form of markings on the fabric are applied, preferably made by the marking apparatuses (2, 2').
45. A fabric custom cutting apparatus in accord with one of the foregoing Claims, for the cutting of fabric pieces to achieve a projecting sewed addition, which extends itself from a previous seam, and onto which addition, data (27) can be applied in coded or uncoded form.
46. A fabric feed apparatus with:
- at least two sequentially arranged fabric unwinding devices (1, 1') for a fabric roll (7),
 - a conveyor belt (5) for transporting the unwound fabric, and
- whereby the unwinding devices (1, 1') lay the fabric band directly on the conveyor belt (5) or on one or more already deposited fabric bands, wherein, on the conveyor belt (5), two or more layers of fabric lay one on the other and to each of the unwinding devices (1, 1') at least one marking apparatus (2, 2') is assigned, whereby the marking apparatuses (2, 2') are so placed, that they respectively are able to apply markings on one fabric band layer and are so controllable as to time and place, that the markings of the final fabric bands laying one over the other are congruent.
47. A procedure for the custom cutting of fabric by the following steps:
- laying out at least one layer of a fabric on a conveyor belt (5) by the

unwinding of a roll of fabric (7) from one or more unwinding devices (1, 1') and the direct deposition on the continuous or discontinuous movable conveyor belt (5) or on one or more already deposited fabric bands thereon.

- transporting the laid out fabric on the conveyor belt (5) to a custom cutting apparatus (3)
- automatic cutting out of a desired pattern form with the said custom cutting apparatus (3),

whereby, on the conveyor belt (5), two or more layers of fabric lay one on the other and to each of the unwinding devices (1, 1') at least one marking apparatus (2, 2') is assigned, whereby the marking apparatuses (2, 2') are so placed, that they respectively are able to apply markings on one fabric band layer before the deposition of another fabric band layer and are so controllable as to time and place, that the markings on the final fabric bands, laying one over the other, are congruent.

48. A procedure in accord with Claim 47, whereby the conveyor belt (5) is continuous at least from the point of deposition of the fabric band from the unwinding device (1, 1') to the operational area custom cutting apparatus (3).
49. A procedure in accord with Claim 47 or 48, which exhibits one or more of the features of the Claims 26 - 45.

*[This concludes the entire text of
the assigned PCT/EP97/06500]*

Fig. 1

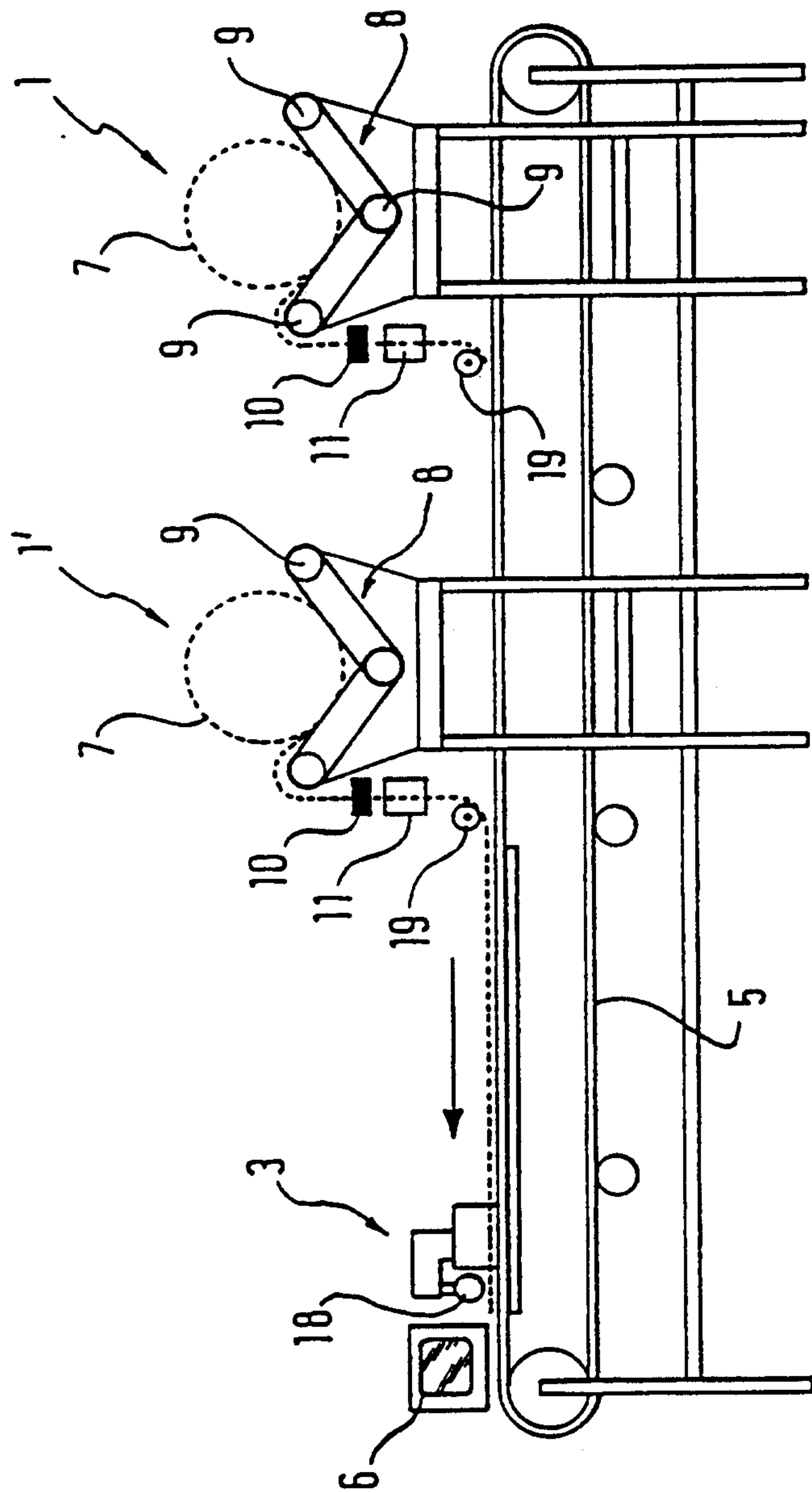


Fig. 2

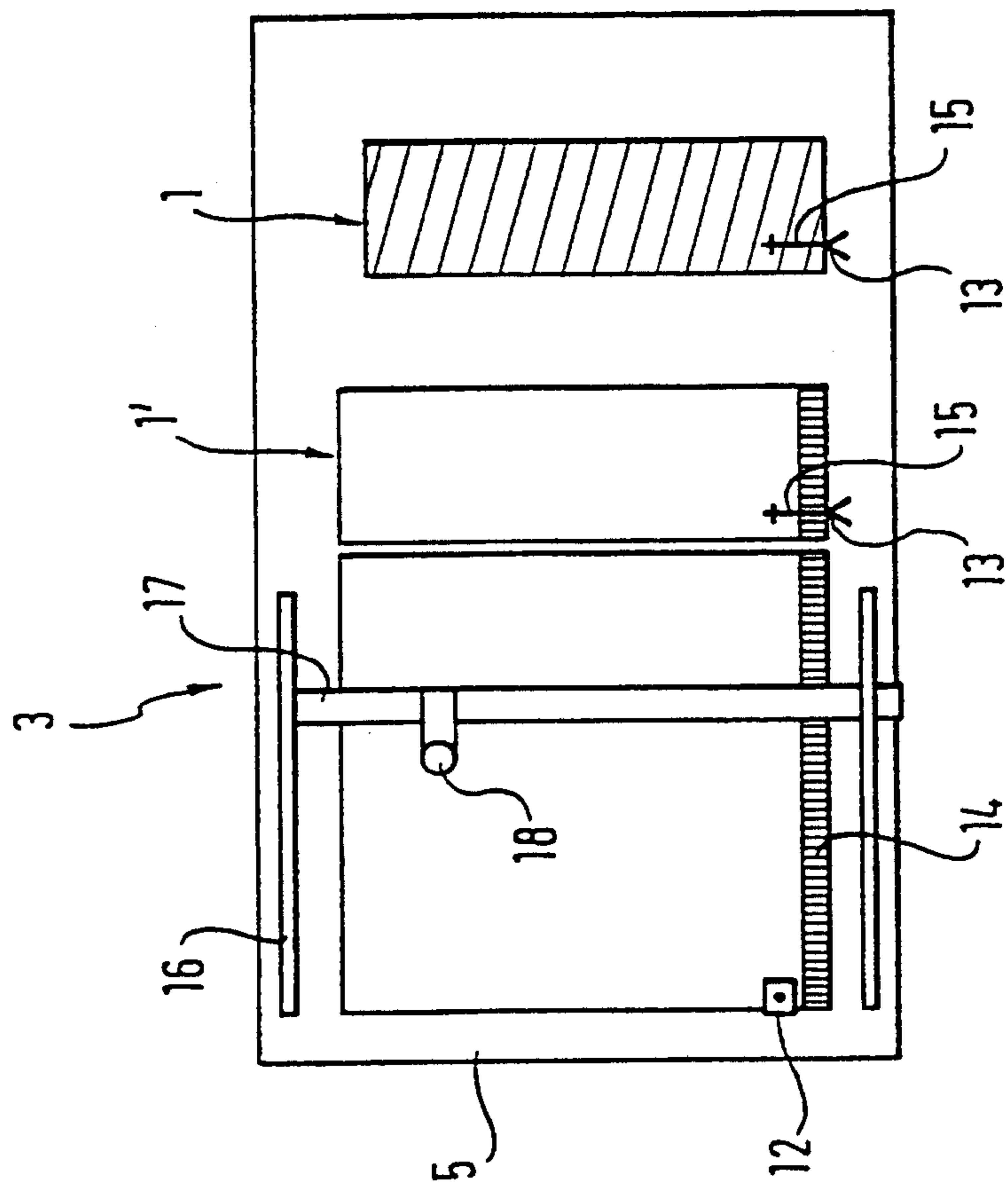


Fig. 3

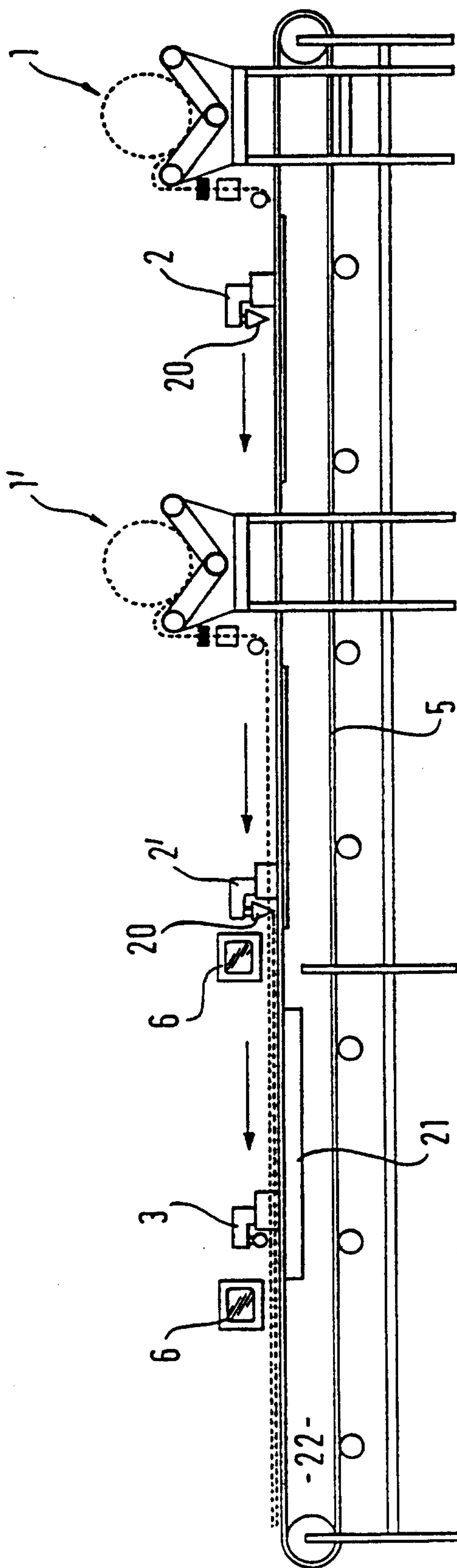


Fig. 4

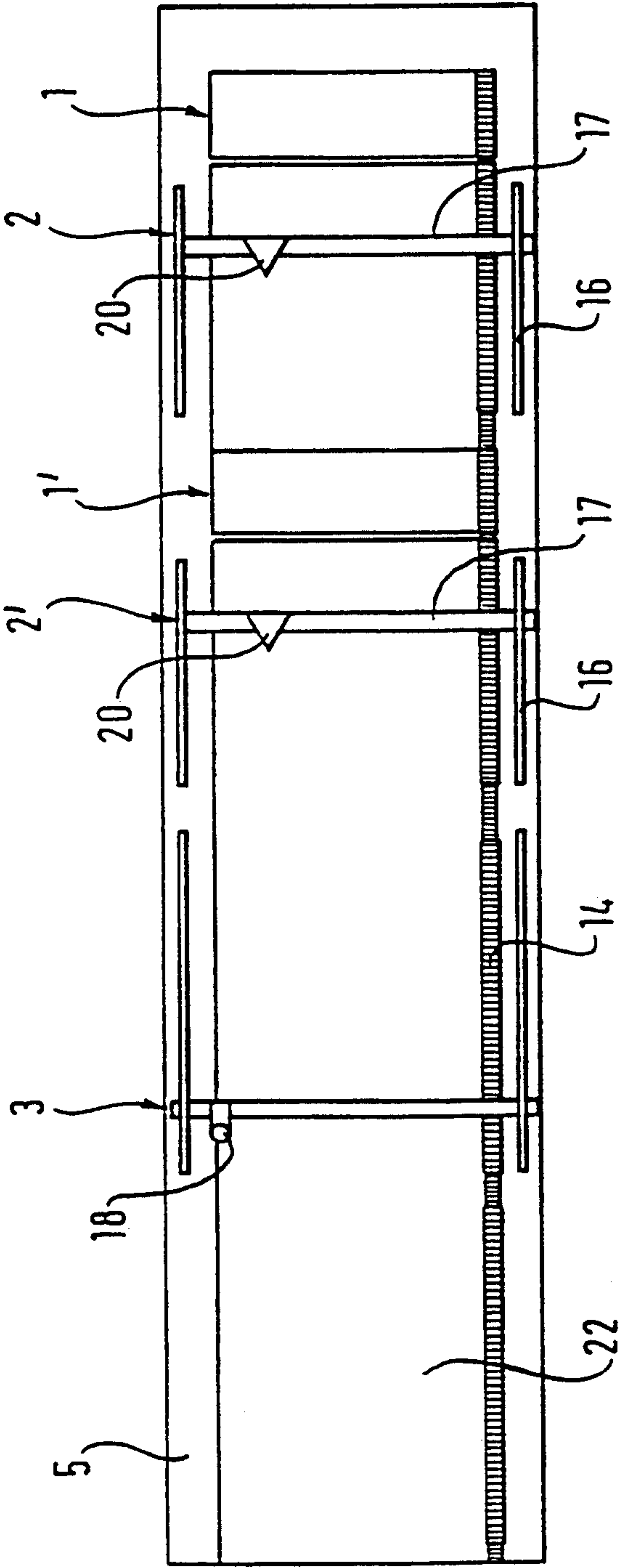
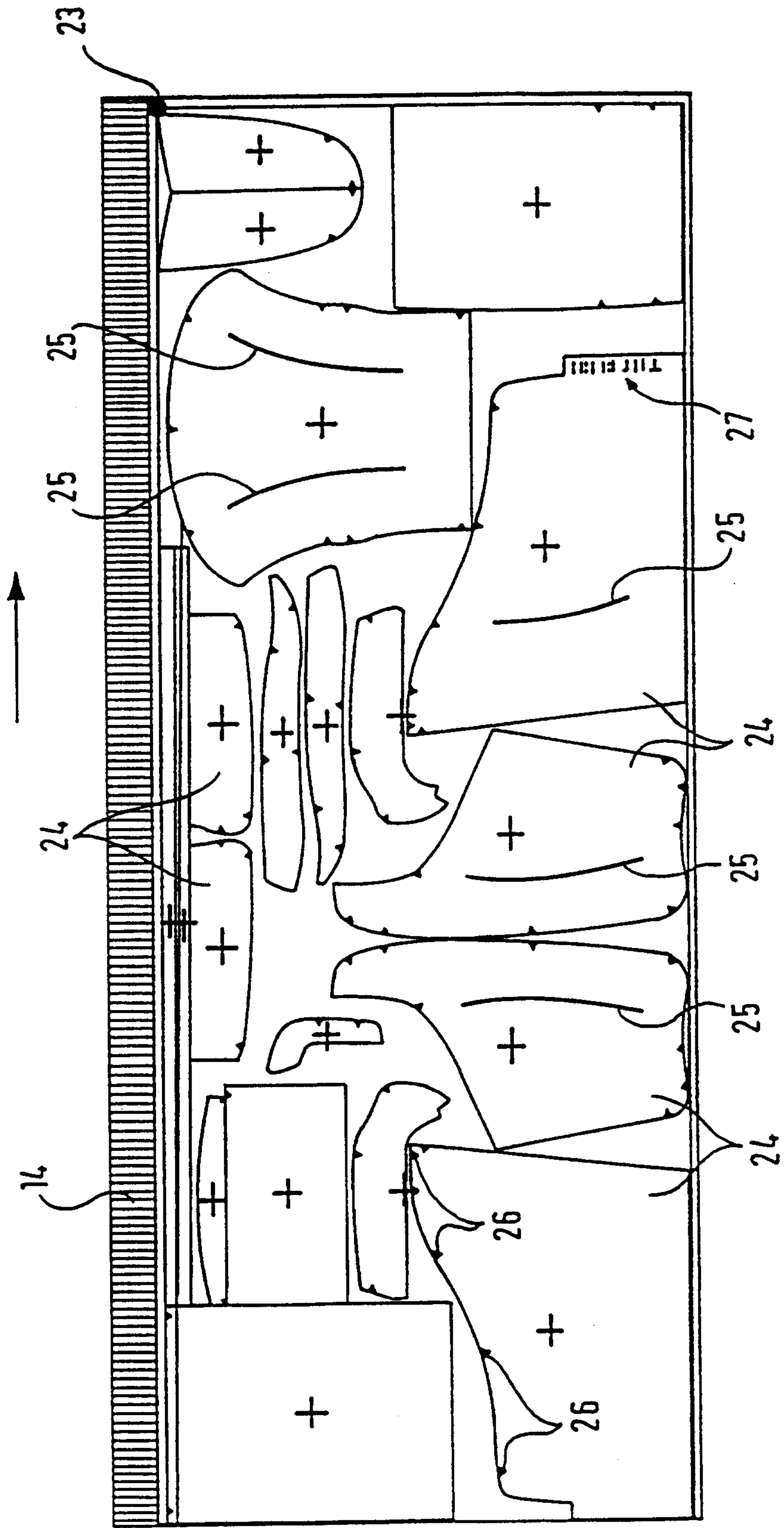
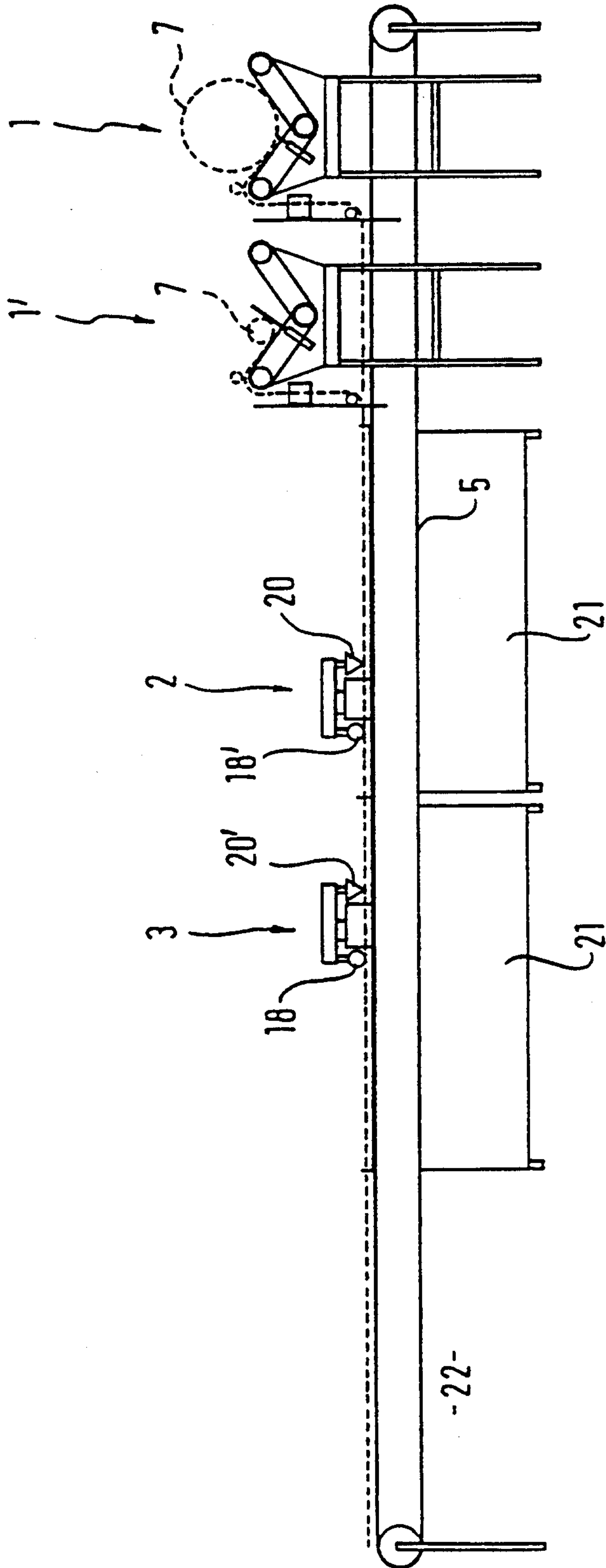


Fig.5



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Fig. 7



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Fig. 8

