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71 Applicant: Ciatti Angiolo s.a.s. di Roberto Benassai & C.  
Via Dino Campana 76  
I-50047 Prato (Florence)(IT)

72 Inventor: Benassai, Roberto  
Viale Montegrappa 125  
I-50047 Prato Florence(IT)

74 Representative: Bardini, Marco Luigi et al,  
c/o Società Italiana Brevetti S.p.A. Corso dei Tintori 25  
I-50122 Firenze(IT)

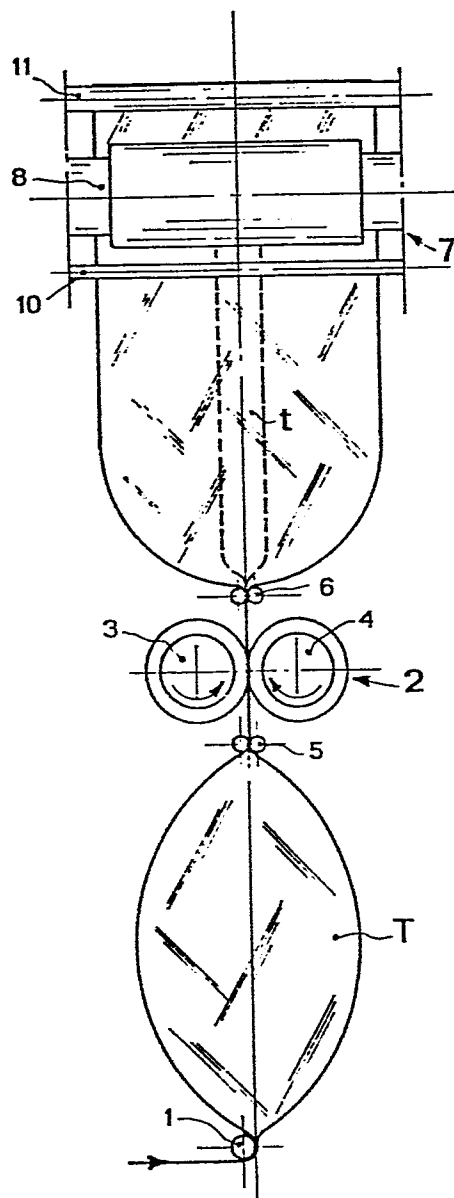
54 Apparatus for removing a process liquid from tubular knit fabrics.

57 An apparatus for tubular knit goods production process, especially designed for the removal of a process liquid (washing water, dyeing bath, etc.) from tubular knit fabric (T), which comprises a first (2) and a second (7) series-arranged liquid removing units, through which the fabric is successively passed as a continuous flat tubular strip, the second unit being arranged in a substantially perpendicular, operative position with respect to the first unit so that the respective working planes are angularly displaced of substantially 90° with respect to each other along the direction of advancement of the strip. Each unit comprises means for removing the liquid from a central band of said flat strip. The still soaked side bands, remaining in the strip at the outlet of the first unit, are processed in the second unit, where they lie in the central band of the strip covered by the relevant liquid removing means, as a consequence of the angular displacement of the working planes of the liquid removing units.

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Fig. 1



Ciatti Angiolo s.a.s. di Roberto Benassai &  
C.

"Apparatus for removing a process liquid from  
tubular knit fabrics".

The present invention relates to machinery for textile industry and more particularly to an apparatus for removing a process liquid from tubular knit fabric.

As is known, in the art of knit good production, any operation which involves processing the fabric with a liquid substance (for instance, washing, dyeing, etc..) is usually followed by a treatment for removing the excess of process liquid (washing water, dyeing bath, etc..) still soaking the fabric. This can be accomplished by application of heat for evaporating the excess liquid and by generally called mechanical methods, such as fabric squeezing process and liquid suction process.

Both processes are carried out by using equipment comprising means for removing the process fluid from the fabric, which is continuously fed to it in the form of a flat strip of considerable length. In the squeezing equipment said means consist of a pair of squeeze rollers which strongly press the fabric passing thereinthrough. In the suction equipment the fabric is slid on suction manifolds (generally a pair of parallel, perforated pipes which the fabric slides between), connected to an aspirator, a vacuum pump or similar equipment for sucking the liquid from the fabric. Suction process operates with a lower removal efficiency than the squeezing process.

The length of the squeeze rollers (as well as the suction manifolds) is greater than the width of the fabric strip, thus performing the liquid removal by a single pass. The use of squeezing or suction equipment of the above described type has an inconvenience when producing tubular knit goods. In fact, when the tubular fabric is passed through said liquid removal means, is reduced to a flat, continuous strip formed of two, superimposed layers of fabric joined together at the edges of the strip. When passed through a pair of squeeze rollers, in correspondence of these edges there are formed two permanent fold lines that are detrimental both from the aesthetic point of view and in respect to any further treatment to which the fabric may be subjected. For instance, an uneven dyeing is obtained in correspondence of the folding lines. Likewise, when using suction manifolds, because of the lower suction power in correspondence of the ends thereof, two side bands are produced in the flat tubular strip where a not negligible amount of liquid remains.

The above described problem, in the field of the tubular knit goods, is especially felt with cotton fabric and synthetic fibers of similar characteristics.

The purpose of the present invention is to provide an apparatus for removing a process liquid from tubular knit goods without producing permanent folding lines or unsqueezed side bands in the flat tubular strip of fabric, as occurs with known equipment.

The main feature of the invention consists in the fact that the removal of any process liquid, remaining from the treatment to which the fabric has been subjected (washing, dyeing, etc..) is performed in a first and a second series-arranged units, having working planes, i.e. the advancement planes of the fabric inside the units, angularly displaced of substantially 90° with respect to the common advancement direction. Each unit is equipped with means for removing the liquid from a central band of the fabric tubular strip, said band extending for more than 50% of the total width of said strip, whereby at the outlet of the first unit two still soaked side bands are left in the strip. Between the first and the second unit compressed air blowing means are provided for spreading the tubular strip by blowing air therein and guide means for changing said spread tubular into a flat strip advancing on the working plane of the second unit and having said still soaked side bands at the centre thereof. In this way, the complete removal of the process liquid from the tubular knit fabrics is performed in two steps: in the first unit the liquid is removed from a central band of the tubular strip, leaving two still soaked side bands; in the second unit the liquid is removed from the side bands that, owing to the angular relation between the working planes of the units, are positioned within the central band of the tubular strip covered by said second unit. It has to be noted that, according to the invention, this result is obtained without twisting the tubular strip, but by spreading the tubular strip coming out of the first unit and forming a new flat tubular

strip, before entering the second unit, which is rotated of 90° with respect to the flat tubular strip entering the first unit. In this way any risk of damage to the tubular knit fabric is avoided.

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Further characteristics, as well as the advantages, of the apparatus according to the present invention will be apparent from the following description of a preferred embodiment, given as a non limiting example with reference to the attached drawings, in which:

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Figure 1 is a schematic front elevational view of an apparatus for removing a process liquid from a tubular knit fabric operating according to the principles of the invention;

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Figure 2 is a schematic side elevational view of the apparatus of Figure 1;

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Figure 3 is a front elevational view of a squeezing apparatus for tubular knit fabric according to the invention; and

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Figure 4 is a side elevational view of the apparatus of Fig. 3, parts being removed for the sake of clarity.

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With reference to Fig. 1 and 2, it has been indicated at T a continuous strip of tubular knit fabric coming from an upstream process treatment, such as wasing or dyeing, and fed to a first liquid removing unit 2 by a guide roller 1, unit 2 comprising a pair of squeeze rollers 3 and 4, the first one being motor driven, the second being idle. Upstream of squeeze rollers 3 and 4 there is provided a compressed air blowing device 5, for instance of the type formed by two tubular perforated distributors, for inflating and spreading the tubular strip T, so as to avoid the formation of creases that, on passing bet-

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ween squeeze rollers 3 and 4, would become permanent in the fabric.

5 The width of strip T is greater than the length of rollers 3 and 4, whereby squeezing covers a large central band of the strip. The width of said central band is more than 50% of the total width of the strip and preferably equal to 85-90% of it. Side bands t, exceeding the length of roller 3 and 4, pass through first unit 2 without being  
0 squeezed. At the outlet side of first unit 2 a pair of guide rollers 6 is provided, parallel to squeeze rollers 3, 4 for keeping the tubular fabric flat and closed when advancing in the working plane of unit 2.

; A second liquid removal unit 7, formed by a pair of squeeze rollers 8 and 9 (the first being motor driven, the second idle), is provided in series with respect to first unit 2 with the function of squeezing from fabric T the process liquid still soaking side bands t. To this purpose, unit 7 is arranged in an orthogonal relation with respect to unit 2, i.e. the working plane of unit 7 is angularly displaced of, substantially, 90° around the common advancement direction with respect to the working plane of unit 2. In other words, in the present embodiment of the invention axes of the two pairs of squeeze rollers 3, 4 and 8, 9 are parallel to one another and the axes of rotation of parallel squeeze rollers 3, 4 are rotated of an angle of, substantially, 90° with respect to the axes of rotation of parallel squeeze rollers 8, 9. Therefore, in order to pass through second unit 7, the fabric strip T has to be positioned on an advancement plane perpendicular to the corresponding advancement plane in the first unit 2. In this way, the unsqueezed side bands t, in consequence of the rotation of the advancement plane of fabric strip T, pass through unit 7 centrally, so that any residual liquid in side bands t is finally removed. A compressed air blowing device 10, equal to that mounted at the inlet of unit

2, is installed at the inlet of second unit 7 with the same functions. Guide means for the completely squeezed fabric strip T, schematically shown as a guide roller 11, are provided downstream the second unit 7, for directing fabric strip T towards further processing or to storage. With reference to Figures 3 and 4, there is shown a squeeze rollers apparatus according to the invention. The apparatus substantially comprises a metallic frame 12 for supporting, in a stacked relationship, first and second liquid removal units 2 and 7 having working planes, as previously defined, mutually rotated of 90° around the advancement direction of tubular fabric strip T. Squeeze rollers are supported by bearings 13 slidably mounted on respective guides 31 for allowing roller replacement. Second unit 7 is positioned vertically above first unit 2, the latter being situated above a liquid receiving basin 15, where, in the apparatus of Fig. 3 and 4, a specific treatment of fabric strip T is also performed. In this case the tubular fabric strip T coming from a storage station not shown, is collected to basin 15 via a feeding duct 14.

A geared motor 16 (shown in Figure 3 only), mounted on frame 12, drives in rotation a gear 17 which rotates squeeze roller 8 of second unit 7 by means of transmission chain 18 and gear 19 integral to it. The same motor 16 rotates squeeze roller 3 of the first unit 2 by means of a transmission comprising a chain 29 connected to a gear 21 coupled with a gear 22, with axis of rotation perpendicular to that of gear 21. The transmission further comprises a chain 23 for driving the rotation from gear 22 to a gear 24 integral to squeeze roller 3. It is to be understood that equivalent transmission means may be used as alternative.

The distance between squeeze rollers 3 and 4 of first unit 2, as well as the distance between squeeze rollers

8 and 9 of second unit 7, can be varied to the end of registering the squeezing pressure on the fabric strip T. The translation of idle rollers 4 (removed in Fig. 4) and 9 to and from motor driven rollers 3 and 8 in the first unit 2 and second unit 7 respectively is performed by pneumatic or, alternatively, hydraulic means, manually or automatically operated, of the known type. In the present embodiment of the invention each unit is provided with a pair of double-acting hydraulic cylinders 25 and relevant piston 26 connected to rollers supports 27 sliding on frame 12.

To the outlet end of second unit 7, the completely squeezed tubular fabric strip T is directed by means of guide rollers 11 and 11a to a lap-folding device, generally indicated at 28 in Figure 3, of the oscillating type. The description of the above device is omitted as well known in the art and falling out of the scope of the invention.

In order to allow handling of tubular fabric strips T of width lower than the length of squeeze rollers, without formation of permanent fold lines in correspondence of both edges of the tubular strip T, idle rollers 4 and 9 of first and second unit can be axially translated, in such a way to reduce the portion of rollers surface effective from squeezing to a length lower than the width of strip T. This can be achieved, as shown in Figure 3 and 4, by means, for instance, of a rackwork device, generally indicated at 29, engaging with a slide 32 supporting idle roller 4 (or 9) and the relevant pneumatic or hydraulic means, as described above.

The liquid removed from side bands t in second unit 7 falls down on the underlying first unit 2 and from there in basin 15. Alternatively, to reduce the amount of liquid falling down on the first unit 2, closely below rollers 4 and 9 and at both sides of tubular fabric

strip T, means for collecting the squeezed liquid, such as sucking manifolds 30 (see Figg. 3 and 4) may be provided.

In another embodiment of the invention the process liquid can be removed from the tubular fabric strip T by means of suction manifolds, mounted in place of squeeze rollers 3, 4 and 8, 9. In this case, motor 16 and relevant transmission means are replaced by a suction equipment and relevant connection with the suction manifolds, as well as means for separating the air from the process liquid and, if it is the case, for recovering the liquid. This embodiment is not described in detail nor shown, as it is considered to be an obvious variation of the previously described squeeze rollers apparatus according to the invention, this variation falling in the capacity of a person skilled in the art.

Furthermore, it is apparent that, instead of a single frame 12 supporting both liquid removal units 2 and 7 in a stacked position as previously described, two side-by-side frames for first unit 2 and for second unit 7 can be provided. Obviously, in this case intermediate guide means are to be provided between first and second unit for receiving the tubular fabric strip T coming out from the top side of first unit 2 and directing it to the bottom side or feed inlet of second unit 7.

The invention is not to be considered as being limited by the embodiments described herein and it is understood that it comprises any form of variation or modification which falls within the scope of the claims appended hereto.

WHAT IS CLAIMED IS:

1. Apparatus for removing a process liquid from a tubular knit fabric characterized in that it comprises a first and a second, series-arranged liquid removing units, through which the fabric is successively passed as a continuous flat tubular strip, the second unit being arranged in a substantially perpendicular, operative position with respect to the first unit so that the respective working planes are angularly displaced of substantially 90° with respect to each other along the direction of advancement of said strip, each unit being equipped with means for removing the liquid from a central band of said flat strip extending for more than 50% of the total width of said strip, whereby at the outlet of said first unit two still soaked side bands are left in said strip, said second unit being further provided with blowing means for spreading the flat tubular strip coming from said first unit and with guide means for positioning the strip on the working plane of said second unit, so that, in consequence of the angular relation between said working planes, said side bands lie within the central band covered by said liquid removing means of said second unit.

2. Apparatus according to claim 1, wherein said liquid removing means of said first and second units comprises a pair of squeeze rollers for each unit.

3. Apparatus according to claim 1, wherein said liquid removing means of said first and second units comprises suction manifolds at both sides of said flat tubular strip of each unit.

4. Apparatus according to claim 1, wherein said second liquid removing unit is placed vertically above said first removing unit and said liquid removing means of said first unit is parallel to said liquid removing means of said

second unit, the relevant working planes being substantially perpendicular to each other.

5. Apparatus according to claim 2, wherein said pair of  
5 squeeze rollers comprises a motor driven roller and a  
idle roller, the distance between their axes being re-  
gistrable.

6. Apparatus according to claim 5, wherein means for  
10 axially translating said idle roller with respect to  
said motor driven roller are provided so as to reduce  
the portion of rollers surface effective for squeezing  
to a length lower than the width of said flat tubular  
strip.

7. Apparatus according to claim 1, wherein further  
15 compressed air blowing means are provided at the inlet  
side of said first unit, guide means for said flat tubular  
strip being provided at the outlet side thereof.

8. Apparatus according to claim 1, comprising a frame  
for supporting, in a stacked arrangement, said first and  
second liquid removing units, said liquid removing means  
in each unit comprising a pair of motor driven/idle squeeze  
25 rollers, support means for pivotally supporting said squeeze  
rollers on said frame, the support means of said idle rol-  
lers being further mounted on said frame for sliding both  
in their own axial direction and in the direction of the  
relevant motor driven rollers, means being provided for  
30 sliding said idle rollers supports in both directions  
for reducing the portion of rollers surface effective for  
squeezing operation and, respectively, for registering the  
squeezing pressure.

9. Apparatus according to claim 5, wherein closely below  
35 the pair of squeeze rollers of said second unit, at both  
sides of said flat tubular strip, means for collecting

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the squeezed liquid are provided.

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Fig. 1

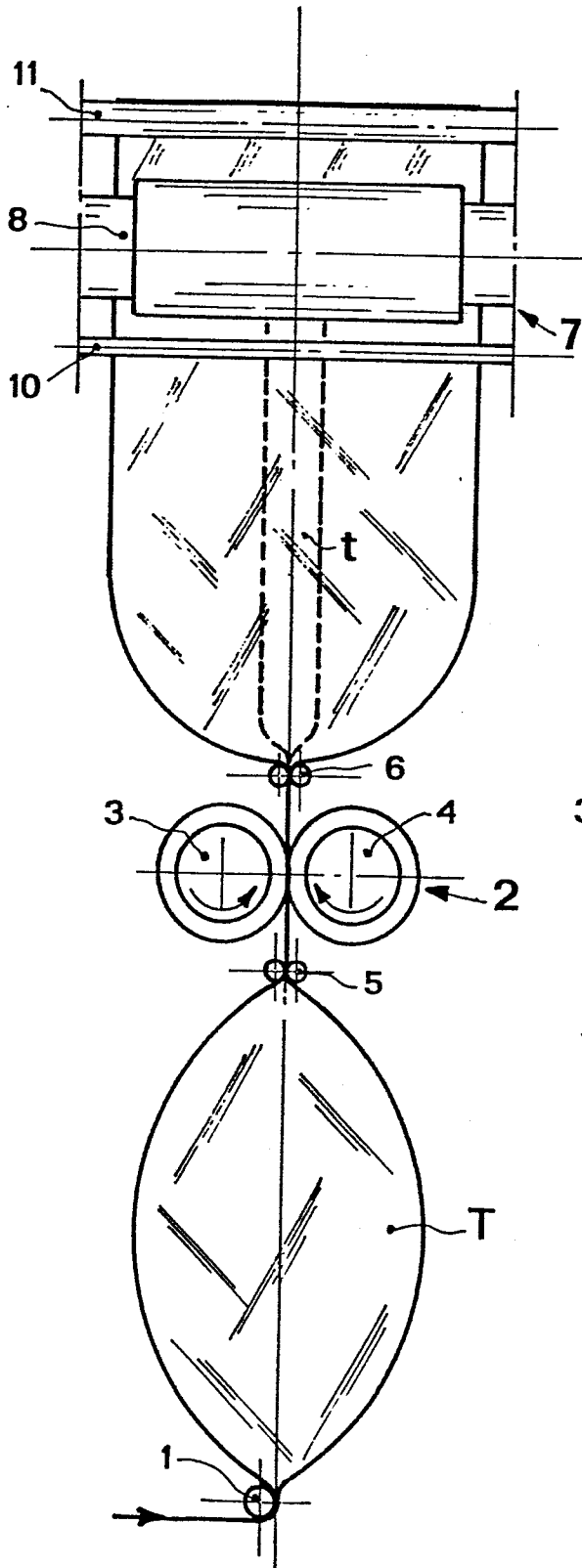


Fig. 2

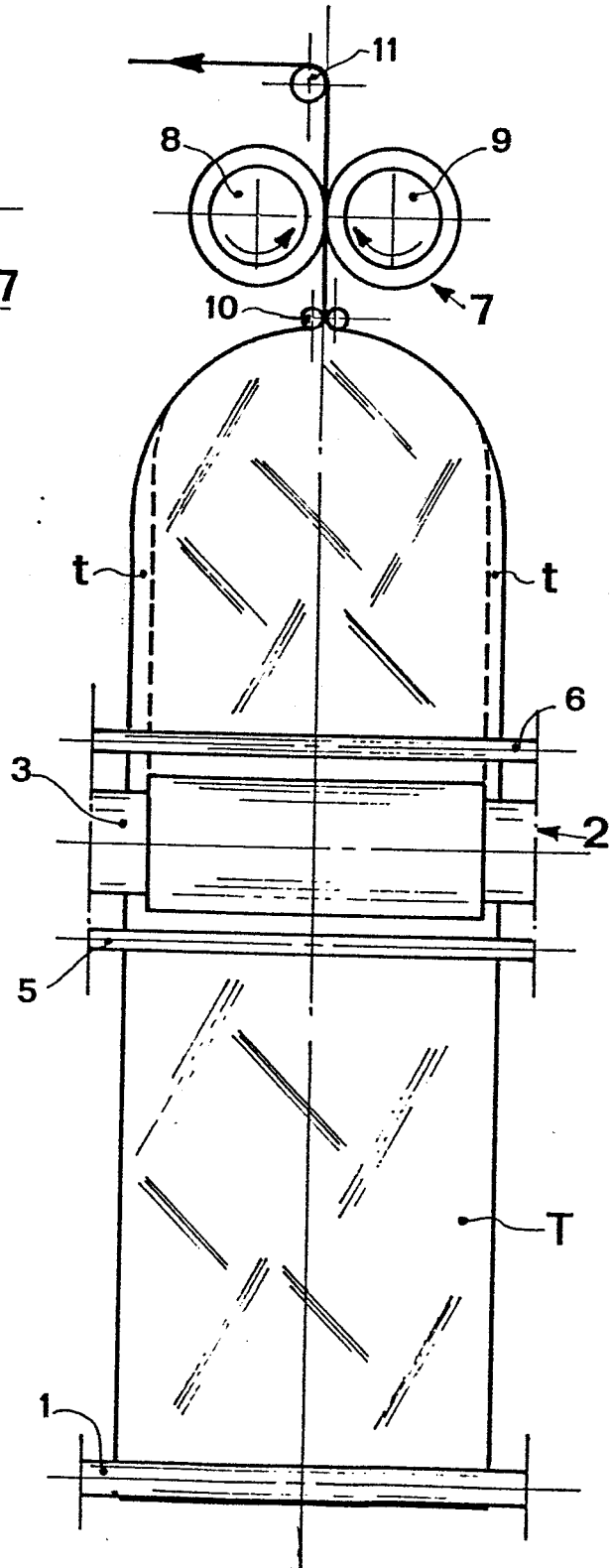
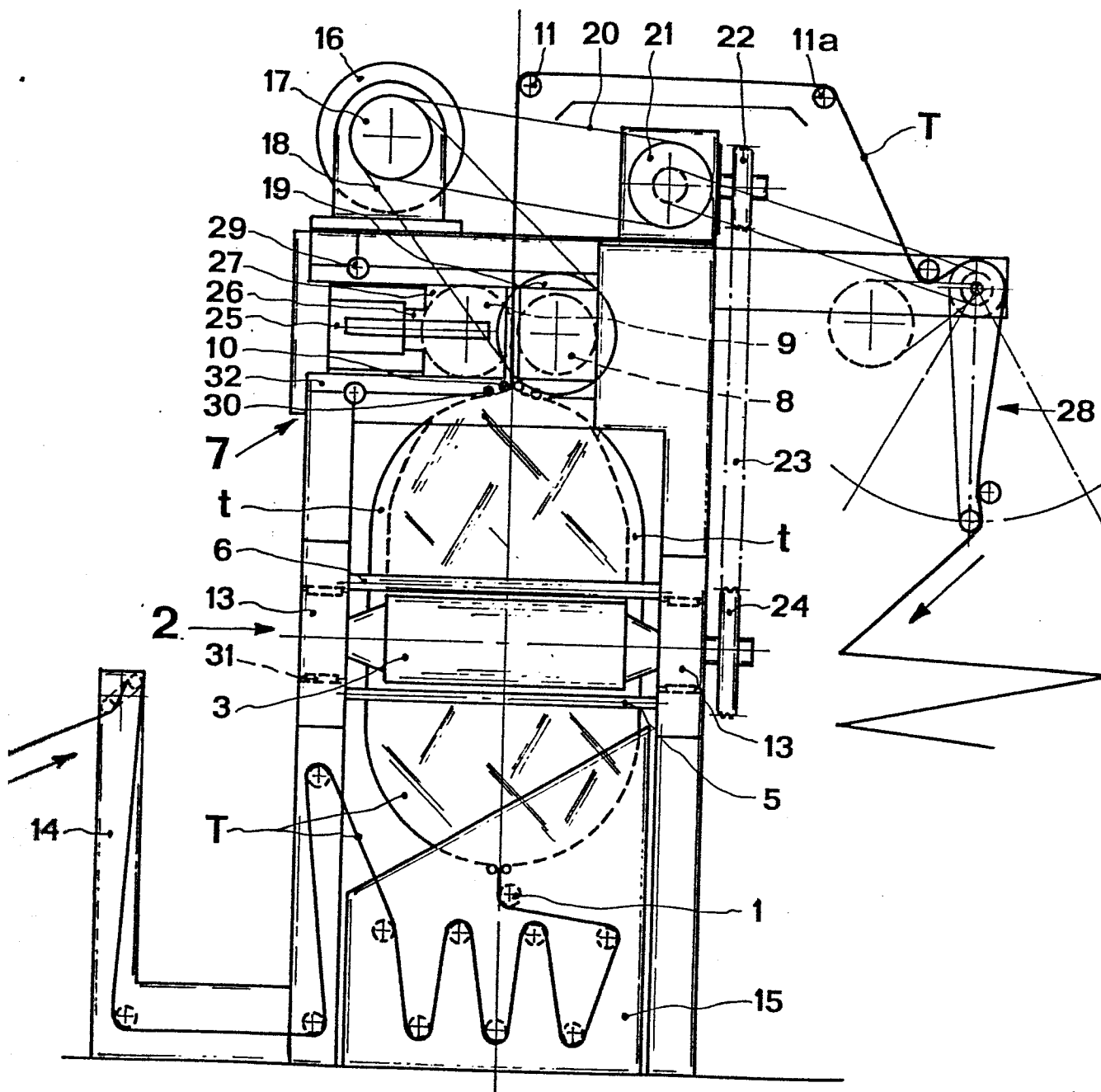


Fig. 3





European Patent  
Office

# EUROPEAN SEARCH REPORT

0151374

Application number

EP 84 83 0356

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                               |                                                                                                                                                                                                                                                                                  |                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim                                                                                                                                                                                                                                                                | CLASSIFICATION OF THE APPLICATION (Int. Cl.4) |
| X                                                                                                                                                                                                                       | GB-A- 811 369 (WOLSEY)<br><br>* The whole document *                          | 1,2,4<br>8,9                                                                                                                                                                                                                                                                     | D 06 B 15/02                                  |
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|                                                                                                                                                                                                                         |                                                                               |                                                                                                                                                                                                                                                                                  | TECHNICAL FIELDS SEARCHED (Int. Cl.4)         |
|                                                                                                                                                                                                                         |                                                                               |                                                                                                                                                                                                                                                                                  | D 06 B                                        |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                               |                                                                                                                                                                                                                                                                                  |                                               |
| Place of search<br>THE HAGUE                                                                                                                                                                                            |                                                                               | Date of completion of the search<br>04-04-1985                                                                                                                                                                                                                                   | Examiner<br>PETIT J.P.                        |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                                                                                                                                                                      |                                                                               |                                                                                                                                                                                                                                                                                  |                                               |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                               | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br><br>& : member of the same patent family, corresponding document |                                               |