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A PROCESS AND DEVICE FOR CUTTING STRIPS FROM
A MASS OF MATERIAL, IN PARTICULAR FROM A
LATEX COAGULUM

This invention relates to a process and apparatus for cutting strips from a mass of material, these strips being referred to as "sheets" when they have a small thickness in relation to their other
5 dimensions.

By way of example, this material may be a rubber and in particular a rubber obtained by coagulation from a latex, the material being in this case generally referred to as "coagulum". However, it
10 will be readily appreciated that the invention is not limited to rubber and may apply to other materials, for example plastics materials, food products, wood, mineral materials and metals.

Known processes used in natural rubber
15 plantations consist of coagulating the latex in elongated, shallow troughs. In this way, strips of latex coagulum are directly obtained, e.g. approximately 10 to 15 cm thick. According to known processes, these strips may be subjected to treatments
20 such as crushing or granulation followed by drying.

This technique for obtaining strips of rubber possesses the following disadvantages:

given the shallowness of the troughs, the coagulation installations require very large surfaces, 5 which poses siting problems and requires very high investments;

on coagulation, the ratio of surface/volume of the coagulum is great, such that its surface which is in contact with the air is large, which produces a 10 very appreciable superficial oxidation of the coagulum and hence a degradation of the material and a detrimental change in quality.

In order to obviate these disadvantages, attempts have been made to obtain thick blocks on 15 coagulation and to then cut these blocks into strips. Experience has shown that this cutting operation poses great difficulties, particularly due to the suppleness, the lack of rigidity and the poor resistance to traction of the coagulum. The handling 20 devices used in the cutting operation may lead to a crushing or a breaking of the coagulum, which poses complex manufacturing problems and brings about considerable variations in quality.

It is an object of the present invention to 25 reduce or avoid these disadvantages.

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Therefore according to the present invention there is provided a process for obtaining strips from a mass of material, in which the mass of material is supported by a solid piece arranged beneath and
5 directly in contact with the mass of material which is raised under the influence of a liquid and of the solid piece, the liquid being placed underneath the solid piece and directly in contact with the mass of material above the solid piece so as to enable strips
10 to be cut from the mass of material above the solid piece with the aid of cutting means which are moved along the mass of material during the cutting operation.

The invention also provides a device for
15 cutting strips of a mass of material comprising:

a) lifting means allowing the mass of material to be raised under the influence of a liquid and by means of a solid piece arranged beneath and directly in contact with the mass of material, said
20 lifting means causing the liquid to be placed directly under the solid piece and directly in contact with the mass of material above the solid piece;

b) cutting means allowing the strips to be cut above the solid piece; and

25 c) means for moving the cutting means along the mass of material.

The invention will now be described with reference to the accompanying drawings, in which:

Figure 1 represents a vertical section through a device according to the invention, the plane of section being represented by the line I-I in Figure 2,

Figure 2 represents a plan view of the device shown in Figure 1,

Figure 3 represents a vertical section through

a part of another device which is not in accordance with the invention, and

Figure 4 represents a vertical section through a part of a further device according to the invention.

5 Figures 1 and 2 represent a device 1 according to the invention which comprises a trough 2 of elongated shape arranged with its longitudinal axis horizontally. In the trough 2 is a mass of material 3 which is to be cut into strips. By way of example,
10 this material 3 is a block of natural rubber previously obtained directly in the trough 2 by coagulation from a latex introduced into this trough. Known means allowing this latex coagulum to be obtained comprise, for example, a conduit 4 of latex 5
15 opening into one end of the trough 2 and a conduit 6 of coagulating agent 7 (see Figure 2). Suitable coagulating agents include formic acid, acetic acid or a biological agent. The conduit 6 of coagulating agent opens into the conduit 4 of latex in order to
20 achieve a homogenous mixture. It will be readily appreciated that other means may be employed in order to obtain the block 3 of coagulum.

The device 1 comprises lifting means 8 to raise the mass of material 3. These means comprise an
25 inflatable bag 9 arranged underneath the mass of material 3, and a conduit 10 which allows a fluid 11,

(18)

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for example air, to be introduced into the bag 9 by means of the valve 12, so as to raise the mass of material 3 with the fluid 11 by means of the bag 9 which is situated directly in contact with the lower
5 face 13 of the mass of material 3. The bag 9 forms an air chamber, the wall 90 of which, made for example of vulcanised rubber, behaves like a solid and elastic intermediary piece, arranged between the air 11 and the mass of material 3, and placed directly in contact
10 with the mass of material 3 (Figure 1).

The device 1 additionally comprises means 14 for cutting strips 15 from the mass of material 3 situated above the bag 9. These cutting means may comprise a saw 16 comprising a band 17 wound around
15 two fly-wheels 18,19, this band 17 having a cutting edge 170 which is preferably without teeth.

The fly-wheel 19 is driven by the motor 20. The assembly of fly-wheels 18,19 and motor 20 is fixed on a chassis 21, which in turn is mounted on four
20 wheels 22 which roll on two horizontal rails 23 arranged along the upper part and on either side of the trough 2. The chassis 21 and the wheels 22 constitute a carriage 24 which is mobile horizontally above the trough 2 over the entire length of the
25 trough 2. The device additionally comprising means

for moving the carriage 24 along the mass of material 3, on the rails 23, e.g. a winch (not shown in the drawing in the interests of clarity).

The lower part 17A of the band 17 has a horizontal orientation and the cutting edge 170 of this lower part 17A allows the mass of material 3 above the bag 9 to be cut horizontally, so as to obtain a strip 15 upon movement of the carriage in the direction of arrow F. When the strip 15 is cut, it is moved laterally by known means (not shown in the drawing in the interests of clarity), e.g. a conveyor belt or a floating trough. A new quantity of fluid 11 is introduced into the bag 9 to raise the mass of material 3 to the desired height, such that, for example, the upper face 25 of the material 3 reaches the same level as before the preceding cutting operation, and a new strip 15 is cut. The thickness "e" of the strips 15 is determined by the quantity of fluid 11 introduced into the bag 9. The thickness "e" may also be adjusted by altering the height of the lower part 17A of the band 17 by known means (not shown in the drawing) e.g. by vertical movement of the fly-wheels 18,19.

The lifting means 8 are constructed such that it allows a liquid 26 to be introduced into the

trough 2 via a conduit 27 and a valve 28, so that the liquid 26 is directly in contact with the mass of material 3, above the bag 9, the liquid 26 being for example, water. Thus, the weight supported by the bag
5 9 is reduced, owing to Archimedes' pressure, which facilitates the raising of the mass of material 3. The valve 28 allows the quantity of liquid 26 in the trough 2 to be varied, if required, between cutting operations. Also, the density of this liquid 26 may
10 be altered, e.g. by using a supply of salt water (not shown in the drawing).

During the raising of the mass of material 3 the liquid 26 circulates underneath the bag 9 thereby raising the bag 9 which remains in contact with the
15 mass of material 3 as it rises. Accordingly, the conduit 10 must be sufficiently long and supple to allow this rise. Thus, a uniform rise of the mass of material 3 is obtained over the entire length of the trough.

20 The lateral opposing walls 29 of the trough 2, arranged parallel to the rails 23, preferably diverge upwardly from each other, thus forming an angle α so as to facilitate the upward movements of the block 3. This angle α preferably has a value such that the
25 walls 29 retain their guiding role during all

successive cutting operations. The angle α between the walls 29 may vary, for example from 2 to 10°, and preferably from 2 to 5°. The distance between the walls 29 and the material 3 has been exaggerated in Figure 1 in the interests of clarity.

The advantages obtained by the device 1 include the following:

- 1) The cutting operation is operated without handling the mass of material 3, so that no crushing of this material results, despite the supple, low-resistant structure of the coagulum. It is, therefore, possible to perform the cutting of the strips on thick blocks obtained by coagulation of latex in troughs 2 which may be practically as deep as is desired. Thus, for example, cutting of strips has been carried out on blocks of coagulum approximately 25 m long, 60 cm wide, 1 m thick, which have a total weight of approximately 15 tonnes, these blocks being obtained in troughs 2 having practically the same dimensions as the blocks. The thickness of the blocks corresponds practically to the depth of the corresponding troughs. In the case where the walls 29 of a trough form between them an angle which is not zero, the width of the trough is determined at the level of its median depth. Known techniques for

directly obtaining strips by coagulation only produce blocks of approximately 1.5 tonne.

The invention therefore allows the surface areas required for the latex coagulation installations
5 to be reduced approximately ten-fold, which means considerably reduced investments and operating costs.

The preceding figures concerning the practice of the invention are given only by way of example and one can in fact envisage troughs having a considerably
10 greater depth than 1 m and any length which may be greater than 25 m. The blocks may be of any width, because this width is limited only by the construction of the cutting means.

2) The invention allows thick blocks to be
15 treated, i.e. blocks having a low surface/volume ratio. Thus, the superficial oxidation of the coagulum in air is limited considerably. This advantage, together with the substantially total absence of crushing during the cutting operation
20 allows production of rubber of constant and satisfactory quality.

3) The invention allows the thickness "e" of the strips
15 to be varied readily and within broad limits, the thickness "e" currently most used varying
25 for example from 10 to 20 cm, without there being any

loss, given that the lifting means according to the invention allow the mass of material 3 to be raised in a regular manner over its entire length, until all the material is cut, even if the mass of material 3 has 5 irregularities over its length.

If one wishes to obtain strips of small thickness, i.e. sheets, the thickness of which varies, for example, from 1 to 10 cm, it may be expedient to use, together with the invention, the technique 10 described in our copending British Patent Application No. 8315894 (Serial No. 2125330), this technique consisting of causing a depression on a portion of the material 3 and of cutting the sheets in the depressed portion, the thickness of the sheets therefore being 15 able to be regulated by varying the difference in height between the level of the depressing means and the level of the cutting means in the depressed portion.

By way of example, the depressing means may be 20 constituted at least in part by a cylindrical roller which rests on the upper face 25 of the material 3, the roller being arranged above the cutting edge 170 of the lower part 17A of the band 17, and being integral with the carriage 24. This roller rolls on 25 the face 25 and therefore on movement of the carriage

24 the depressed portion moves along the material 3, the thickness "e" of the sheets obtained varying as a function of the difference in height between the level of the inferior genetratrix of the roller and the level of the cutting edge 170 of the lower part 17A. Preferably the bag 9 extends substantially the entire length of the trough 2 and is arranged at the base of the empty trough 2. The latex which is to be coagulated is introduced into the trough 2 above the deflated bag 9. The bag 9 is thus positioned quite naturally beneath the coagulated mass 3 which it can easily raise on introduction of the fluid 11.

It may be advantageous to use, instead of a single bag, a superposed arrangement of several bags as shown in section in Figure 3. In this Figure which is not in accordance with the invention in as much as there is no provision for there to be liquid under the solid piece and directly in contact with the mass of material above the solid piece, a part of a device 30 is shown comprising three bags bearing the reference numerals 9.1, 9.2, 9.3, arranged beneath the mass of material 3. The bag 9.1 is directly in contact with the material 3, the bag 9.3 is the lowest, the bag 9.2 being the intermediary bag in contact with the bags 9.1 and 9.3. Each of these bags is associated with a separate conduit 10 and a valve 12. Accordingly, it is possible to inflate these bags successively in the course of the cutting operation,

commencing, for example, by inflating the lower bag 9.3. This technique may have the advantage of ensuring a constant raising of the mass of material 3 even if the trough 2 is very elongated, each of these bags extending substantially the entire length of the trough. It is obvious that these bags may form an assembly, in the form, for example, of a single bag comprising a plurality of impervious internal partitions which form component bags.

10 Instead of using several conduits 10, it is possible to use a single conduit 10 supplying the lower bag 9.3, each bag being connected to the upper adjacent bag by a pressure-sensitive valve, the pressure required for operation of each valve increasing from one bag to 15 the upper adjacent bag.

It is possible to provide the lifting means such that, on inflation of the bags 9.1, 9.2, 9.3, the variation in height of the assembly of these bags is sufficient to allow the entire block of material 3 to be 20 cut into strips, when it is raised by these bags. This may be the case, for example, when, in inflated state, the top 90.1 of the upper bag 9.1 reaches practically the level of the top 200 of the trough 2 or even rises above this level. It is thus possible to cut the entire 25 material 3 into strips without using a liquid 26, whilst



guaranteeing a regular rise of this material 3 over the whole length of the trough 2. This arrangement may be used in conjunction with means for supplying a liquid in a similar manner to the device of the
5 invention shown in Figure 1.

The invention is not limited to the cases where inflatable bags are used. Figure 4 shows a section through a part of a device 40 according to the invention, which comprises a light material 41, for
10 example a plate of polyurethane foam or polystyrene which floats in the liquid 26 whilst being applied against the lower face 13 of the mass of material 3. As a result of Archimedes' pressure, the great buoyancy of this plate causes the mass of material 3
15 to rise after each cut. This technique may have the advantage of simplicity, by choosing for the plate 41 a material having a much lower density than that of the liquid 26, and it is preferable for the mass of material 3 to have a density which is lower than that
20 of the liquid 26 so that it also floats in this liquid (which is the case of the coagulum which floats in the water, the density of the coagulum varying in practice from 0.6 to 0.9), the density of the material 3, however, being greater than that of the plate 41.

When the plate 41 is arranged at the base of the trough 2 and it is covered with latex, it is necessary to hold this plate fast to the base of the trough, for example with the aid of a lateral bolt, so
5 as to prevent it from rising to the surface of the latex before coagulation.

The invention also covers the case where equipment is used which allows the carriage to be moved in a direction other than along the material 3.
10 For example, our copending British Patent Application No. 8315894 discloses such equipment comprising a roller connected to one end of the carriage 24 and an apparatus allowing the height of this roller to be altered such that it comes to rest on a rail
15 perpendicular to the rails 23, which allows the carriage 24 to be transferred from one trough to another so as to carry out a new strip-cutting operation.

It will be readily appreciated that means
20 other than saws may be envisaged for cutting the strips, for example wires which may be heated.



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CLAIMS:

1. A process for obtaining strips from a mass of material, in which the mass of material is supported by a solid piece arranged beneath and directly in contact with the mass of material which is raised
5 under the influence of a liquid and of the solid piece, the liquid being placed underneath the solid piece and directly in contact with the mass of material above the solid piece so as to enable strips
10 to be cut from the mass of material above the solid piece with the aid of cutting means which are moved along the mass of material during the cutting operation.
2. A process as claimed in Claim 1, in which the material is supple.
- 15 3. A process as claimed in Claim 2, in which a depression is made on a portion of the top of the mass of material with depressing means and strips are cut in the depressed portion, the thickness of the strips being regulated by varying the difference in height
20 between the level of the depressing means and the level of the cutting means in the depressed portion.
4. A process as claimed in any preceding claim, in which the mass of material is latex coagulum.
5. A process as claimed in Claim 4, which
25 comprises the steps of:



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a) positioning the solid piece at the base of an empty trough,

b) introducing latex which is to be coagulated into the trough, above the solid piece,

5 c) coagulating the latex, and

d) introducing a liquid into the trough so as to raise the mass of latex coagulum with the liquid and the solid piece.

6. A process as claimed in Claim 4 or Claim 5, in which the latex is a latex of natural rubber.

7. A process as claimed in Claim 1 substantially as herein described with reference to the accompanying drawings.

8. A device for cutting strips of a mass of material comprising:

a) lifting means allowing the mass of material to be raised under the influence of a liquid and by means of a solid piece arranged beneath and directly in contact with the mass of material, said
20 lifting means causing the liquid to be placed directly under the solid piece and directly in contact with the mass of material above the solid piece;

b) cutting means allowing the strips to be cut above the solid piece; and

25 c) means for moving the cutting means along the mass of material.



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9. A device as claimed in Claim 8, in which the lifting means comprise at least one inflatable bag arranged, in use, beneath and in contact with the mass of material.
- 5 10. A device as claimed in Claim 9, in which the bag is adapted to be inflated with air.
11. A device as claimed in any one of Claims 9 and 10, in which the lifting means comprises an inflatable bag or bags constructed and arranged such that the
10 variation in height of the bag or of the assembly of bags is sufficient to allow all the mass of material to be cut into strips when it is raised by the bag or bags.
12. A device as claimed in any one of Claims 9 to
15 11, in which the lifting means comprise several superposed inflatable bags, each bag being connected to the upper adjacent bag by a pressure-sensitive valve, the pressure required for operation of each valve increasing from one bag to the upper adjacent
20 bag.
13. A device as claimed in Claim 8, in which the solid piece is constituted by a plate floating in a liquid, the density of the plate being less than the density of the liquid and less than the density of the
25 material.

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14. A device as claimed in any one of Claims 8 to 13, which additionally comprises a trough in which the mass of material and the solid piece are arranged.

15. A device as claimed in Claim 14, in which the lateral opposite walls of the trough diverge from each other upwardly forming an angle α .

16. A device as claimed in Claim 15, in which the angle α varies from 2 to 10°.

17. A device as claimed in Claim 16, in which the angle α varies from 2 to 5°.

18. A device as claimed in any one of Claims 8 to 17, in which the cutting means comprise a band-saw.

19. A device as claimed in Claim 18, in which the band-saw is without teeth.

20. A device as claimed in any one of Claims 8 to 19 capable of cutting a mass of supple material, which additionally comprises depressing means allowing a depression to be made on a portion of the material, the cutting means allowing the strips to be cut in the depressed portion, the device comprising means allowing the difference in height between the level of the depressing means and the level of the cutting means to be varied, in the depressed portion, so as to regulate the thickness of the strips.



32

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21. A device as claimed in Claim 20, in which the depressing means comprise a roller which is able to rest on the upper surface of the material.
22. A device as claimed in any one of Claims 8 to 21, which comprises a carriage on which are mounted the cutting means and equipment which allows the carriage to be moved along the mass of material.
23. A device as claimed in Claim 22, combined with Claim 20 or Claim 21, in which the depressing means are fixed on the carriage.
24. A device as claimed in any one of Claims 8 to 23, adapted to cut strips from latex coagulum.
25. A device as claimed in Claim 24, which comprises a trough, means which allow the solid piece to be arranged at the base of the trough, means for introducing the latex which is to be coagulated into the trough above the solid piece, means allowing the coagulation of the latex, means for introducing a liquid so as to raise the mass of material with this liquid by means of the solid piece.
26. A device as claimed in Claim 24 or Claim 25, in which the latex is a latex of natural rubber.
27. A device as claimed in Claim 8 substantially as herein described with reference to the accompanying drawings.
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