

PROCESS AND DEVICE FOR CUTTING SHEETS  
FROM A MASS OF SUPPLE MATERIAL, IN  
PARTICULAR A BLOCK OF COAGULUM OF  
LATEX

This invention relates to processes by which sheets may be obtained from a supple material.

By way of example, this material may be a rubber and in particular a rubber obtained by  
5 coagulation from a latex, the material being in this case generally termed "coagulum". However, the invention is not limited but may be applied to other materials, for example plastics materials or food products.

10 Known processes carried out in natural rubber plantations for the manufacture of sheets consist of causing the latex to coagulate in troughs comprising aluminium partitions arranged in baffles. These sheets are then subjected to known treatments, for  
15 example, calendering followed by drying.

This method of obtaining sheets presents the following disadvantages:

the coagulation installations require a large number of troughs and accordingly the plant requires a  
20 large area and necessitates high investments;

the troughs themselves are complex, fragile

and costly, furthermore, they require extensive manpower for their operation and cleaning;

for each trough, the position of the aluminium partitions is fixed and it is therefore necessary to  
5 adjust the concentration of the latex, for example by dilution, to give it a constant predetermined value so that the sheets of coagulum (i.e. the sheets of coagulated latex) obtained in this trough are capable of having a constant thickness after drying, this  
10 adjustment being both time consuming and costly;

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 allows a very appreciable superficial oxidation of the coagulum,  
15 hence a degradation of the material and a detrimental change in quality.

In an attempt to eliminate these disadvantages thick blocks of coagulum were obtained and these blocks were then cut into sheets. Experience has  
20 shown that this cutting operation poses great difficulties particularly due to the suppleness, lack of rigidity and poor resistance to traction on the part of the coagulum. The handling devices used in the cutting operation lead, for example, to a crushing  
25 or breaking of the coagulum, which poses complex manufacturing problems and causes considerable variations in quality.

It is an object of the present invention to at least substantially reduce these disadvantages.

According to the present invention there is provided a process for obtaining sheets from a mass of  
5   supple material, in which:

a) the mass of material is floated in a fluid so that a part of the material emerges above the fluid;

b) a depression is created on a portion of the emerged part by depressing means;

10       c) the sheets are cut in the depressed portion by cutting means, and

d) the thickness "e" of the sheets is regulated by varying the difference in height "h" between the level  $H_2$  of the depressing means and the  
15   level  $H_1$  of the cutting means, in the depressed portion.

Also according to the invention there is provided a device for cutting sheets from a mass of supple material, comprising:

20       a) means to cause the mass of material to float in a fluid such that a part of the material emerges above the fluid;

b) depressing means capable of causing a depression on a portion of the emerged part;

25       c) cutting means adapted to cut a sheet from the depressed portion; and

d) means allowing the difference in height "h" between the level  $H_2$  of the depressing means and the level  $H_1$  of the cutting means, in the depressed portion, to be varied, so as to regulate the thickness  
5 "e" of the sheets.

The invention also relates to sheets obtained by the process of the invention and from the device in accordance with the invention.

The invention will now be illustrated by the  
10 accompanying drawings, in which:

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

Figure 2 represents a plan view of the device  
15 of Figure 1;

Figure 3 represents a vertical section of a part of the device of Figures 1 and 2, taken along the line III-III in Figure 2; and

Figure 4 represents a side elevation of a  
20 further device in accordance with the invention.

Figures 1, 2 and 3 represent a device 1 according to the invention. The device 1 comprises a trough 2 of elongated shape, arranged horizontally in the longitudinal direction. A mass of material 3 is  
25 located in the trough 2, which is intended to be cut into sheets. By way of example, 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. The known means allowing this coagulum of latex to be obtained may comprise, for example, a conduit 4 for latex 5 entering at one end of the trough 2 and a conduit 6 for coagulating agent 7, e.g. formic acid, acetic acid or a biological agent. The conduit 6 of coagulating agent opens into the conduit 4 of latex (Figure 2) in order to obtain a homogenous mixture of latex and coagulating agent. It will be appreciated that other means are possible for obtaining the block 3 of coagulum.

The device 1 comprises a conduit 8 allowing a fluid 9 to be introduced into the trough 2, the fluid 9 being for example a liquid, and in particular water, this inlet of fluid being controlled by the sluice 10 (Figure 1). The water 9 enters the trough 2 such that it is directly in contact with the material 3, which thus floats in the water and comprises a part 11 situated above the water level 'A', termed the "emerged part". The coagulum 3 floats in the water, since its density varies in practice from 0.6 to 0.9.

The device 1 comprises means 12 which are able to cut the sheets in the emerged part 11. These cutting means comprise a saw 13 with a band 14 wound around two fly-wheels 15, 16, this band 14 comprising a cutting edge 140 which is preferably without teeth.

The fly-wheel 16 is driven by the motor 17. The assembly of fly-wheels 15,16 and of the motor 17 is fixed on a frame 18, which frame is mounted on four wheels 19 which roll on two horizontal rails 20 arranged along the upper part of the trough 2 and on either side of this trough. The frame 18 and the wheels 19 constitute a carriage 21 which is movable horizontally above the trough 2 and along the whole length of the trough 2. The equipment allowing the carriage 21 to be moved along the material 3, on the rails 20, is not represented in the drawing, in the interests of clarity. This equipment may comprise, for example, a winch.

The device 1 comprises means allowing a depression to be created on a portion of the emerged part 11. The depressing means 22 comprise, for example, a roller 23, the axis 24 of which is parallel to the cutting edge 140 of the band 14. This roller has, for example, a cylindrical shape and its length is preferably equal to, or greater than, the width "l" of the trough 2, measured at the upper part of this trough (Figures 1 and 2). This axis 24 is connected to two arms 25, which are in turn connected to the frame 18. The roller 23 rests on the emerged part 11 and causes a depression on the portion 26 of this

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emerged part (Figure 3). This depression is localised to the portion 26, due to the suppleness of the coagulum. On movement of the carriage 21 in the direction of the arrow F (Figures 2,3), the roller 23 rolls over the emerged part 11 and therefore the  
5 portion 26, corresponding to the localised depression, moves along the material 3. The lower part 14A of the band 14 has a horizontal orientation and the cutting edge 140 of this lower part 14A is situated at a level  $H_1$  (Figure 3). The lowest generant 27 of the cylinder  
10 23 is termed the "inferior generant" and it is situated at a level  $H_2$  which is higher than the level  $H_1$ .

The part 14A of the band saw allows the material 3 to be cut horizontally in the depressed  
15 portion 26, On progression of the carriage 21, a sheet 28 is thus obtained, the thickness "e" of which varies as a function of the difference of height "h" between the levels  $H_1$ ,  $H_2$  in the depressed portion (Figure 3).

20 The thickness "e" may for example be regulated as required by altering the height of the roller 23, i.e. the level  $H_2$ , by known means which are not shown in the drawings, these means being, for example, joints, levers or jacks which allow the orientation of  
25 the arms 25 to be altered. The thickness "e" may also

be regulated by altering the level  $H_1$  of the lower part 14A of the band 14 by known means which are not shown in the drawings, this regulation being obtained for example by displacing the fly-wheels 15,16 vertically with the aid of screws or jacks.

5           In Figure 2, the lower part 14A of the band saw has been represented as perpendicular to the rails 20, but this is not essential and if desired this part 14A may be at other angles to the rails 20, to promote the cutting of the block 3.

10           Given that the block 3 floats in the liquid 9, the depressing means 22, owing to Archimedes' pressure, allow the block 3 to be applied against the lower part 14A of the band 14, which facilitates cutting and allows a constant thickness "e" to be  
15 obtained for a given setting of levels  $H_1, H_2$ .

          Preferably, the roller 23 is arranged slightly in front of the band 14 in the direction of the arrow F such that its inferior generant 27 is arranged substantially directly above the cutting edge 140 of  
20 the lower part 14A, as represented in Figure 3. The thickness "e" is therefore practically equal to the difference in height "h" between the levels  $H_1, H_2$  which thus represents the distance between the cutting edge 140 and the generant 27.

The value of the depression is represented by the difference in height  $E$  between the levels  $H_3$  and  $H_2$ ,  $H_3$  being the upper level of the block 3 before the depression, in front of the roller 23.  $E$  represents, for example, from 5 to 30% of the total height of the material 3 in the trough 2. This total height, not shown in the drawing in the interests of clarity, is measured on the block 3 before the depression and before the cutting of the first sheet

5 28. It corresponds practically to the depth of the trough, if the latter is completely filled with latex prior to coagulation.

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It will be appreciated that the levels  $H_1$ ,  $H_2$ ,  $H_3$  correspond to horizontal planes, the heights of which are measured in relation to a single horizontal plane of reference, which is not shown in the drawing in the interests of clarity.

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The localised depression due to the roller 23 takes place practically without appreciable crushing of the material 3, given that this material has a supple structure and that it is floating in the liquid

20 9.

It will be appreciated that the roller 23 could be replaced by any other means allowing a localised depression of the emerged part 11, for example a plurality of rollers or wheels, a runner sliding over the surface of this emerged part. In

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this case, the level  $H_2$ , still corresponds to the level of the lowest points of the depressing means 22, on contact with the material 3.

It will also be appreciated that means other than saws can be envisaged to cut the sheets, for example wires, which may optionally be heated. In this case, the level  $H_1$  still corresponds to the level of the points at which the cutting of the material 3 begins. The upper level  $H_3$  corresponds to the horizontal upper surface of the block before the depression, this surface being in contact with the air. This level  $H_3$  is determined by the quantity of water introduced into the trough 2 prior to each cutting. This level  $H_3$  may also be regulated by varying the density of the fluid 9, for example by using a fluid which is heavier than pure water and is compatible with the material 3, in particular by using a supply of saline water (not shown in the drawing).

The separation between the sheet 28 and the remainder of the material 3 is facilitated by arranging a wedge-shaped piece 29 behind the roller 23 and close to the lower part of this roller, the sheet 28 being arranged between the roller 23 and the wedge 29. The guiding of the sheet 28 in relation to the carriage 21 may be facilitated by using one or more guide rollers 30 in contact with the sheet 28. In the interests of clarity the wedge 29 and a guide roller 30 have only been shown in Figure 3.

When the sheet 28 is cut, it is moved laterally by known means (not shown) for example a conveyor belt or a flotation trough. A further quantity of fluid 9 is passed into the trough 2, if  
5 required, so that the merged part 11 reaches the same level as before, and a new sheet 28 is cut.

The last sheet may be constituted, for example, by the remainder of the block 3 in the trough 2 at the end of the cutting.

10 The lateral opposing walls 31 of the trough 2, arranged parallel to the rails 20, preferably diverge from each other upwards, forming an angle  $\alpha$  therebetween so as to facilitate the upward movement of the block 3. This angle  $\alpha$  is preferably of a value  
15 such that the walls 31 retain their role of guide during all the successive cutting operations. The angle  $\alpha$  which these walls 31 form may vary, for example from 2 to 10°, and preferably from 2 to 5°. The distance between the walls 31 and the material 3  
20 has been exaggerated in Figure 1 to clarify the drawing.

The advantages obtained by the device 1 are as follows:

a) it is possible to carry out the cutting of  
25 the sheets on large blocks obtained by coagulation of latex in troughs 2, which troughs may practically be as

large as is desired. Thus, for example, sheets can be cut on blocks of coagulum of approximately 25 m in length, 60 cm in width and 1 m thickness, namely a total weight of block of approximately 15 tonnes, these blocks being obtained in troughs 2 having substantially the same dimensions as the blocks. In the case where the walls 31 of one of these troughs form between them an angle  $\alpha$  which is not equal to zero, the width of the trough is determined at the level of its median depth. By way of comparison, the known techniques for the direct obtaining of sheets by coagulation in troughs with aluminium partitions only yield quantities of coagulum of approximately 600 to 900 kg. The invention therefore allows the installations for coagulation of latex to be simplified considerably, since in this way a limited number of troughs is used, without complex partitions, which obviously means considerably reduced investments and operating costs. The preceding figures concerning the execution of the invention are, however, only given by way of example; in fact, troughs can be envisaged which have a depth distinctly greater than 1 m and any length, which may be much greater than 25 m. The blocks may be of any width, because the latter is only limited by the structure of the cutting and depressing means, this structure being varied as required.

b) The invention allows latices of variable concentration to be used, without it being necessary to adjust this concentration, which further accentuates the simplicity, flexibility and economy of the process. It is sufficient to regulate the thickness "e" in order to obtain, after drying, sheets which have a desired thickness, this regulation of thickness varying as a function of the concentration of the latex.

c) The invention allows blocks to be treated which have a low surface/volume ratio. Thus, the superficial oxidation in air of the coagulum is considerably restricted. This advantage, together with the almost total absence of crushing during the cutting operation allows the production of rubber sheets of both uniform and satisfactory quality.

d) The invention allows the thickness "e" of the sheets 28 to be readily varied as desired, the variation being within very broad limits, for example the thickness "e" may range from 1 to 20 cm, and preferably from 2 to 5 cm, these figures being in no way restrictive.

Figure 4 represents another device 40 according to the invention. This device comprises a roller 41, mounted at the rear of the carriage 21, i.e. at the extremity of this carriage opposite the

fly-wheels 15,16. The roller 41 is connected to the carriage 21 by means which allow the height of the roller 41 to be regulated, these means being, for example, an axle 42 which is movable vertically. The vertical movements of the roller 41 are shown in diagrammatic form by the arrows  $F_4, F'_4$ .

The operation of the device 40 is as follows. With the carriage 21 at one extremity of a trough 2, the roller 41 is lowered such that it comes to rest on a rail 43, for example perpendicular to the rails 20, the axis 42 of the roller 41 therefore being parallel to the rails 20. The end of the carriage 21 where the fly-wheels 15,16 are fixed is then raised, this movement being shown in diagrammatic form by the arrow  $F''_4$ . This raising may be operated manually, for example, or by mechanical means, not shown in the drawing, for example, a rolling bridge. It is then easy to move the carriage 21 by rotation of the roller 41 on the rail 43 so as to arrange the carriage 21 above another trough 2, for example, in order to carry out a new sheet cutting operation. The equipment allowing the carriage 21 to be moved on the rail 43, which is not shown in the drawing, in the interests of clarity may comprise, for example, a winch.



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**CLAIMS:**

1. A process for obtaining sheets from a mass of  
supple material, in which:
  - a) the mass of material is floated in a fluid  
so that a part of the material emerges above the fluid;
  - 5 b) a depression is created on a portion of  
the emerged part by depressing means;
  - c) the sheets are cut in the depressed  
portion by cutting means, and
  - d) the thickness of the sheets is  
10 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.
2. A process as claimed in Claim 1, in which the  
15 fluid is a liquid.
3. A process as claimed in Claim 1 or Claim 2, in  
which the mass of material is coagulum of latex.
4. A process as claimed in Claim 3, in which a  
latex is introduced into a trough, in which the latex  
20 is coagulated so as to obtain a block of coagulum, and  
a fluid is introduced into this same trough which  
allows this block to be floated in this trough, so as  
to enable the sheets to be cut from the emerged part  
of this block.



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5. A process as claimed in Claim 3 or Claim 4, in which the latex is a latex of natural rubber.

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

7. A device for cutting sheets from a mass of supple material, comprising:

- a) means to cause the mass of material to float in a fluid such that a part of the material  
10 emerges above the fluid;
- b) depressing means capable of causing a depression on a portion of the emerged part;
- c) cutting means adapted to cut a sheet from the depressed portion; and
- 15 d) means allowing the difference in height between the level of the depressing means and the level of the cutting means, in the depressed portion, to be varied, so as to regulate the thickness of the sheets.

20 8. A device as claimed in Claim 7, in which the means for floating the material comprise a trough.

9. A device as claimed in Claim 8, in which the lateral opposing walls of the trough diverge from each other upwardly.

25 10. A device as claimed in Claim 9, in which the angle, formed between the lateral walls is from 2 to 10°.



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11. A device as claimed in Claim 10, in which the angle formed between the lateral walls is from 2 to 5°.
12. A device as claimed in any one of Claims 7 to 11, in which the cutting means comprises a band saw.
13. A device as claimed in Claim 12, in which the  
5 band of the saw is without teeth.
14. A device as claimed in any one of Claims 7 to 13, in which the depressing means comprises a roller which is able to rest on the emerged part.
15. A device as claimed in any one of Claims 7 to  
10 14, in which, in the depressed portion the level of the depressing means is higher than the level of the cutting means.
16. A device as claimed in any one of Claims 7 to 15 in which the depressing means comprises a  
15 cylindrical roller and its inferior generant is arranged substantially directly above the cutting edge of a band saw in the depressed portion.
17. A device as claimed in any one of Claims 7 to 16, which comprises a carriage, on which is mounted  
20 the depressing means and the cutting means, and equipment allowing the carriage to be moved along the length of the mass of material.
18. A device as claimed in Claim 17, which  
25 comprises equipment allowing the carriage to be moved in a direction other than along the material.

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19. A device as claimed in Claim 18, in which the equipment allowing the carriage to be moved in a direction other than along the material comprises a roller connected to one extremity of the carriage and means allowing the height of this roller to be altered.
- 5 20. A device as claimed in any one of Claims 7 to 19, which comprises means allowing the quantity and/or the density of the fluid in contact with the material to be varied.
21. A device as claimed in any one of Claims 7 to 10 20, in which the fluid is a liquid.
22. A device as claimed in any one of Claims 7 to 21, adapted to cut sheets of coagulum of latex from a block of coagulum.
23. A device as claimed in Claim 22, which 15 comprises a trough, means allowing a latex to be introduced into this trough, means allowing the latex to be coagulated so as to obtain a block of coagulum constituting the material which is to be cut into sheets.
- 20 24. A device as claimed in Claim 22 or Claim 23, in which the latex is a latex of natural rubber.
25. A device as claimed in Claim 7 substantially as herein described with reference to the accompanying drawings.
- 25 26. Sheet obtained by the process as claimed in any one of Claims 1 to 6.



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27. Sheet obtained with the device as claimed in  
any one of Claims 7 to 25.

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10. The device of claim 1, wherein the  
sheet is a sheet of paper or a sheet of  
plastic material, and the device is  
configured to produce a sheet of paper or  
a sheet of plastic material.