United States Patent

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[15] **3,669,011**

[45] **June 13, 1972**

[54] **METHOD OF AND APPARATUS FOR CONTINUOUS EXTRACTION OF LIQUID FROM A PASTY SUSPENSION**

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[22] Filed: **June 17, 1970**

[21] Appl. No.: **47,037**

[30] **Foreign Application Priority Data**

June 20, 1969 France 6920821

[52] **U.S. Cl.** **100/118,** 100/37, 210/400

[51] **Int. Cl.** **B30b 9/24**

[58] **Field of Search** ..... 100/118, 121, 37; 210/400, 210/401, 359, 356, 386, DIG. 21

[56] **References Cited**

UNITED STATES PATENTS

1,032,167	7/1912	Vernstein	100/121 X
1,958,279	5/1934	Morgan	100/118 UX
2,866,827	12/1958	Jurgeleit et al.	210/400 UX
3,053,392	9/1962	Morrison	210/401 X
3,176,607	4/1965	Lapham	210/386 X
3,487,927	1/1970	Yahnke	210/400 X

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[57] **ABSTRACT**

A device for the continuous extraction of a liquid from a pasty suspension arranged in a layer on a support strip comprising elastically deformable permeable zones separated by impermeable zones, the permeable zones putting into communication with each other the two faces of the strip are each subjected to a progressive contraction moving from the face in contact with the suspension towards the free face of the support. The compression pressure is obtained by passing the suspension-strip combination between press cylinders.

4 Claims, 3 Drawing Figures

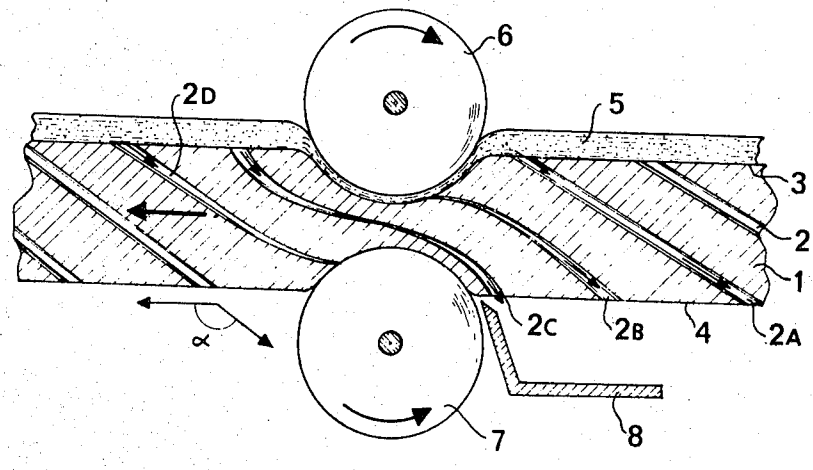


FIG. 1

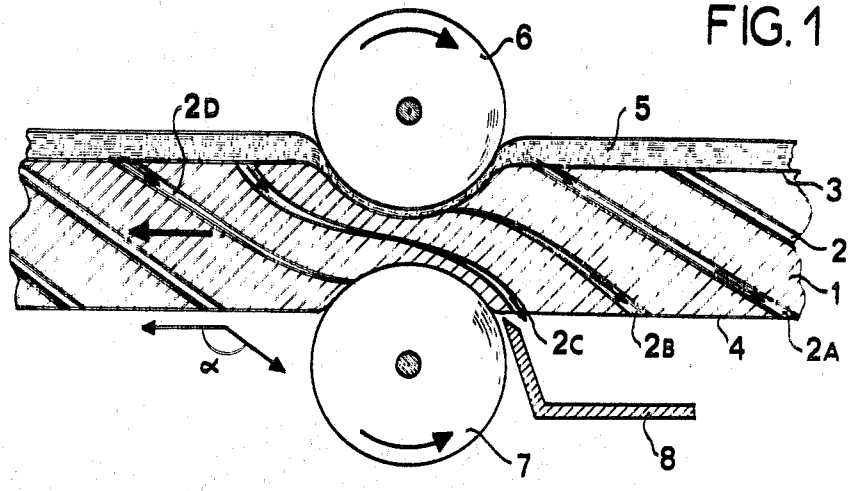


FIG. 2

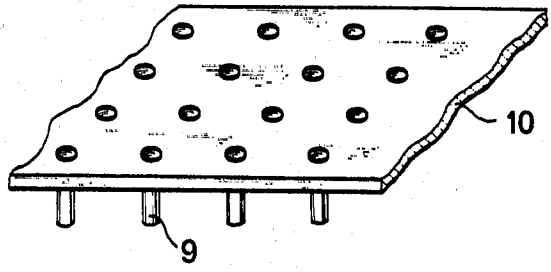
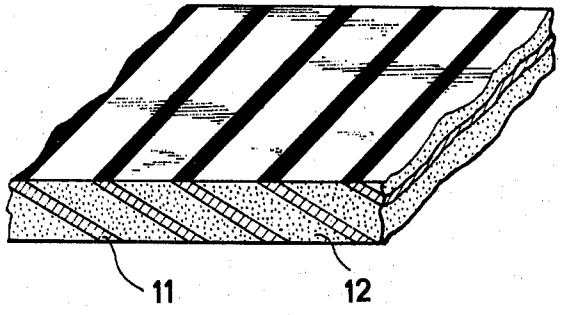


FIG. 3



METHOD OF AND APPARATUS FOR CONTINUOUS EXTRACTION OF LIQUID FROM A PASTY SUSPENSION

The present invention relates to an apparatus for continuous extraction of a liquid contained in a pasty suspension.

A conventional method of extraction consists of compressing, between the cylinders of a press, the pasty suspension arranged in a layer on a permeable support. If so desired, this suspension can be previously thickened by filtration.

However, the proportion of liquid extracted from the pasty material by this method is limited; in fact, the liquid extracted by continuous pressing in the compression zone of the cylinders flows back partially towards the upstream side and dilutes the suspension. This dilution may in certain cases be developed to the point at which the continuity of the pasty layer is broken.

In addition, the liquid absorbed by the permeable support is partly restored to the concentrated pasty material at the outlet of the cylinders, at the moment of release of pressure on the pasty layer. This disadvantage, due to a suction effect by decompression has been limited by certain devices comprising an under-fabric of synthetic material and recesses which retain the absorbed liquid. These devices limit the effect of suction by the layer during the compression, but they do not wholly eliminate this phenomenon.

The present invention is intended to obtain a systematic separation of the liquid expelled from the pasty layer by preventing its return movements at the outlet of the press. To this end, a method of continuous extraction of a liquid contained in a pasty suspension, previously thickened by filtration if so required, consists of compressing between press cylinders, the suspension arranged in a layer on a permeable support. According to the invention, at the level of the press cylinders, permeable and elastically deformable zones are subjected to a progressive contraction; these zones provided in the support between fluid-tight zones, put the two faces of the support into communication, the said contraction progressing in the center of each of the permeable zones, from the face in contact with the suspension to the free face of the support.

Thus, by compression of the pasty layer, the liquid is extracted from the suspension and is then absorbed by the permeable zones of the support; the progressive contraction of these zones tends to expel this liquid towards the free face of the support at which it is collected. This transfer of liquid is irreversible, due to the progression of the contraction which is effected from the face in contact with the suspension to the free face, thereby preventing any return of liquid by suction, to the pasty layer.

At a given moment, there exists in each permeable zone a depression upstream of the contracted section, which is located downstream of the press cylinders, namely in the part of the permeable zone located on the suspension side, while an over-pressure exists downstream of this contracted section, which is located upstream of the press cylinders, namely in the part of the permeable zone located on the side of the free face. The upstream liquid is thus sucked towards the contracted section while the downstream liquid is expelled towards the free face of the support, in an irreversible manner.

The invention also relates to a flexible, endless support-strip intended for carrying the method described into effect. A strip according to the invention comprises elastically deformable permeable zones separated by fluid-tight zones, the said permeable zones putting the two faces of the strip into communication and being capable of having an oblique direction with respect to the normal to the planes of these two faces.

The method of operation of a support-strip of this kind is as follows: The strip is caused to move parallel to its axis, and the active side which supports the suspension layer passes between the press cylinders. Between the press cylinders, the permeable zones have an oblique direction with respect to the normal to the planes of the two faces of the strip, either by their structure or by the effect of the action of the cylinders. The axis of these zones, oriented from the face in contact with the suspension towards the free face, forms an obtuse angle with the direction of movement of the strip, oriented in the direction of forward movement.

When it passes between the cylinders, the assembly of the flexible strip and the suspension layer is compressed. Each oblique permeable zone is subjected to a contraction in its section located between the cylinders. Due to the forward movement of the strip and the obliquity previously referred to, this contraction progresses through each permeable zone from the face in contact with the suspension to the free face. As has already been explained, the liquid expelled by the compression of the suspension is thus irreversibly directed towards the free face of the strip. The liquid downstream of the contracted section is expelled towards this free face, while the upstream liquid is sucked towards this face.

According to a first form of construction, the permeable zones may be constituted by a plurality of parallel channels, having an oblique direction with respect to the normal to the planes of the two faces of the strip. The progressive contraction which passes along these channels produces an actual pumping effect on the liquid of the suspension.

According to other forms of construction, the strip may be constituted by a succession of inclined thin porous plates separated from each other by thin inclined fluid-tight plates. It may also be formed by a plurality of small flexible tubes with a hollow core, suspended from a thin flexible strip pierced with holes facing the core of the said small flexible tubes. In the position of rest, these hollow-core tubes may be perpendicular to the faces of the strip, but at the moment of passing into the press they take-up an inclined direction which is essential for carrying the method described into effect.

Furthermore, for certain kinds of suspension, an intermediate filtering fabric may be provided between the suspension layer and the support-strip.

The description which follows below with reference to the accompanying drawings gives by way of non-limitative example several forms of embodiment of the invention. In these drawings:

FIG. 1 is a diagram intended to facilitate understanding of the principle of the apparatus according to the invention;

FIGS.2 and 3 are partial views in perspective of two support-strips according to the invention.

An endless flexible strip of impermeable material, of which one side is shown at 1 in FIG.1, comprises a plurality of oblique channels such as 2, putting its two faces 3 and 4 into communication. The angle α shown in FIG. 1 between the axis of forward movement of the strip and the direction of the channels, is an obtuse angle. The upper face 3 of the working side of the strip 1 carries a layer 5 of a pasty suspension which has been thickened by prior filtration.

The strip 1, which is given a movement of translation (from right to left in FIG.1), is intended to pass between press cylinders 6 and 7 which subject the strip and the layer 5 to a local compression. Means shown diagrammatically at 8 for collecting the extracted liquid are also provided underneath this strip 1.

The method of extraction of the liquid by means of this strip is as follows: at a given moment, the orifices (suspension side) of certain channels such as the channel 2*a*, reach the threshold of the zone compressed by the cylinders. The liquid expelled from this compressed zone passes through these orifices and flows out into the channels 2*a*.

A moment later, the orifices (suspension side) of these channels pass between the cylinders and are subjected to a contraction due to these cylinders (channels in the position of the channel 2*b*). The liquid contained in these channels is driven in the direction of the arrows towards the free face of the strip.

The contracted section then progress in each of these channels towards the free face (channel 2*c*). The liquid located on the side of the face 4 with respect to the contracted section is driven towards this face, while the liquid located on the side of the face 3 is sucked towards the contracted section.

The orifice on the side of the face 4 finally reaches the zone compressed by the cylinders (channel 2*d*); it is thus subjected to a contraction which blocks it, thus preventing the liquid extracted from being sucked towards the face 3 by a suction effect caused by the decompression of the suspension layer 5.

It will thus be understood that by this "pumping" effect directed from the face **3** towards the face **4**, the transfer of liquid becomes irreversible.

In the particular form of construction shown in FIG.**2**, the channels are simply constituted by small tubes **9** with a hollow core, suspended underneath a thin flexible strip **10**. In the position of rest, these tubes **9** are perpendicular to the plane of the strip **10**, but they take-up an oblique direction, similar to that of the channels **2**, at the moment of passage between the press cylinders.

The support-strip shown in FIG. **3** is formed by a juxtaposition of impermeable oblique plates **11** and porous oblique plates **12**. These plates may be formed from a porous fabric.

It will of course be understood that the present invention is not limited to the terms of the foregoing description, but comprises on the contrary all the alternative forms within the scope of those skilled in the art. The dimensions, angles, distribution of the channels thickness of the strip, deformability, etc., are naturally adapted to the products to be treated, to the speeds and other characteristics of the pressing action.

In particular, in certain cases, it may be advantageous to add on the surface an interposed filtering fabric so as to limit fouling of the strip or to reduce its imprints on the material to be concentrated.

It is furthermore obviously possible to utilize at the same time two similar endless strips located on each side of the layer of material to be treated.

What I claim is:

1. A flexible support-strip comprising elastically deformable permeable zones separated by impermeable zones, said permeable zones putting into communication the two faces of said strip and being adapted to have an oblique direction with respect to a line perpendicular to the planes of said two faces.

2. A flexible support-strip as claimed in claim **1**, in which said permeable zones are constituted by a plurality of parallel channels having an oblique direction with respect to a line perpendicular to the planes of the two faces of said strip.

3. A flexible support-strip as claimed in claim **1**, in which said strip is formed by a succession of inclined porous sheets separated from each other by impermeable inclined sheets.

4. A flexible support-strip as claimed in claim **1**, in which said strip comprises a plurality of small flexible tubes with hollow cores, suspended from a thin flexible strip provided with orifices facing each of the cores of said small flexible tubes.

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