



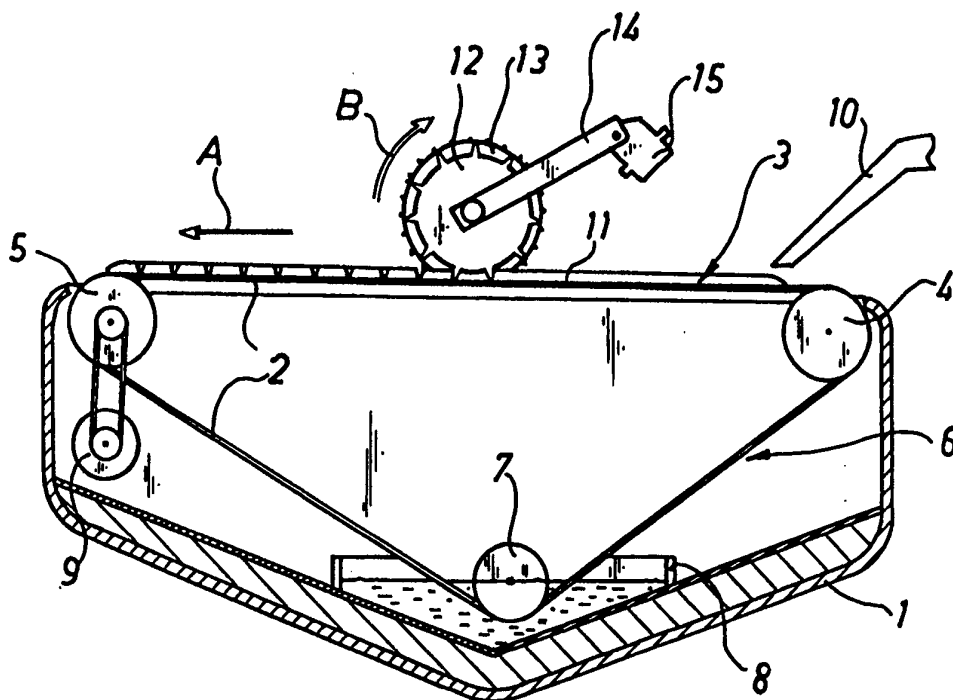
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE96/00827</p> <p>(22) International Filing Date: 25 June 1996 (25.06.96)</p> <p>(30) Priority Data: 9502289-3 26 June 1995 (26.06.95) SE</p> <p>(71) Applicant (for all designated States except US): AGA AKTIEBOLAG (publ) [SE/SE]; S-181 81 Lidingö (SE).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): ANDERSSON, Alvar [SE/SE]; Vångavägen 19, S-260 40 Viken (SE).</p> <p>(74) Agent: AWAPATENT AB; P.O. Box 5117, S-200 71 Malmö (SE).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report. In English translation (filed in Swedish).</p>	

(54) Title: METHOD AND DEVICE FOR FREEZING A SEMILIQUID OR LIQUID FOOD PRODUCT

## (57) Abstract

A semiliquid or liquid food product is frozen in pieces by chilling an impervious support (2) as well as at least one cutter blade (12) arranged to be moved into contact with the support, to a sufficiently low temperature to freeze a food product, upon its contact with the support and the cutter blade, over the entire surface of contact of said product without the latter freezing fast thereto. The cutter blade is lowered into contact with the support while cutting through the food product (11) dispensed onto the support, and is removed from the food product dispensed onto the support as soon as a layer of said product closest to



the support and to the cutter blade has frozen and formed a supporting bottom and one or several side walls that are contiguous with the bottom. The finally formed discrete pieces are removed from the support for final freezing thereof in a second freezer.

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METHOD AND DEVICE FOR FREEZING A SEMILIQUID OR LIQUID  
FOOD PRODUCT

The subject invention relates generally to a method of freezing a semiliquid or liquid food product into discrete pieces, and to a device for performing the method. More specifically, the invention relates to a method and a device in accordance with the preamble of claims 1 and 2, respectively.

As is well known, freezing of liquid or semiliquid food products in the shape of discrete pieces provides several advantages. More precisely, the method permits rapid freezing as well as rapid thawing, which is advantageous from a quality point of view. The manufacturer benefits since separately frozen pieces makes it easy to use a variety of different package sizes and the user benefits, since he need use only a part of the separately frozen pieces in the package on each occasion.

Prior-art methods of freezing semiliquid or liquid food products in discrete pieces comprise freezing the food product in containers of the desired shape and volume, forming pellets by compressing already frozen smaller particles of the food product, rolling the food product after cooling thereof into manageable consistency, and division by cutting or sawing the food product after freezing thereof on a conveyor belt.

The prior-art methods suffer from several drawbacks, among them that they treat the food product in a less than careful manner, that they leave residues of the food product adhering to the manufacturing device, or that they are incapable of providing sufficient productivity. In accordance with US 5,156,008 it is known, however, to freeze a bottom layer of a food product by making use of an extremely cold support.

Consequently, it is a purpose of the subject invention to provide a method and a device for freezing liquid

or semiliquid food products while eliminating the drawbacks inherent in the prior-art technology.

This purpose is achieved by means of the method of the subject invention possessing the characteristic features defined in the appended claim 1, and by means of the device featuring the characteristics appearing from the appended claim 2. Preferred embodiments of the device are defined in the dependent claims.

The invention is based on a two-step freezing method. In a first step preferably liquid nitrogen is used. The purpose of this first step is to stabilise the food product pieces rapidly by freezing a thin layer or shell thereof, at least at the bottom of the product and on one side of the discrete pieces. An additional purpose is to prevent the food product from freezing fast to the device designed to form the discrete pieces.

In a second step, the freezing of the products is completed in a more cost-efficient freezer, since, as a result of the first step, it becomes possible to transfer the food products to e.g. a conventional freezer using cool air to effect the freezing.

Generally, an impervious support and at least one cutter blade arranged to be moved essentially into contact with the support are chilled to a sufficiently low temperature to freeze the entire surface of contact of a food product, upon its contact with the support or the cutter blade or blades, without the product freezing fast thereto. The support and the cutter blade or blades which are subsequently continuously maintained at the said low temperature, are made use of in the following manner.

The semiliquid or liquid food product is initially discharged onto the support to a predetermined depth or a predetermined thickness. Subsequently, the cutter blade or blades are lowered so as to penetrate through the discharged food product and essentially into contact with the support. As a result, a layer of the food product closest to the support and to the cutter blade or blades

freezes and in doing so it forms a supporting bottom as well as one or several side walls that are contiguous with the bottom, these serving as barriers against the yet unfrozen part of the food product, in at least a future discrete piece thereof. As soon as these bottom and side wall or walls have formed, the cutter blade or blades are removed from the product resting on the support, whereafter at least one discrete piece of the food product is at least partly formed on the support.

10 The measures indicated above are repeated, as desired, to achieve the final shaping of discrete pieces of the initially semiliquid or liquid food product. The completely shaped separate pieces are finally removed from the support to complete the freezing thereof in a second freezer. The method may be performed in batches as well as continuously.

A device for continuous performance of the method comprises a chilled conveyor belt and a dispensing means for discharging the food product onto the moving conveyor belt so that a continuous string of the product is formed on said conveyor belt, which string is allowed to freeze, beginning in a layer closest to the surface of the conveyor belt. A cutter blade positioned downstream of the dispensing means in the direction of travel of the conveyor belt is arranged to periodically be moved into contact with the conveyor belt in order to sever said string into a plurality of discrete pieces. In accordance with the preferred embodiment of the invention a plurality of radially directed cutter blades are mounted on a rotatable roller. Devices of this nature are known per se, see e.g. US-A-4,060,998.

In accordance with the subject invention this kind of device also comprises cooling means arranged to chill the conveyor belt, as well as the cutter blade or blades to a sufficiently low temperature to freeze a food product in contact with said cutter blade or blades without the product freezing fast thereto. In accordance with

the invention, the duration of the conveyor belt movement, from the dispensing means to the cutter blade or roller, is chosen to ensure that the cutter blade or each cutter blade cuts through the string before more than  
5 just a layer of said string closest to the conveyor belt freezes, and freezes a layer of said string adjacent the cutter blade or blades. Finally the pieces, having been divided by said cutter blade or blades, are removed from the conveyor belt and the freezing thereof is completed  
10 in a second freezer.

In order to impart to said cutter blade or blades the required low temperature it/they preferably is/are hollow in accordance with the invention, such that a cavity is formed, through which a cooling medium, such as  
15 liquid nitrogen, is allowed to circulate. Preferably, the cavities of several cutter blades are joined together to form one single cavity, common to all cutter blades, for instance in the roller interior.

In order to achieve satisfactory shaping of the  
20 products it is essential that the movements of the conveyor belt and those of the cutter blade or roller are synchronised, i.e. that the cutter blade or each cutter blade may be moved essentially into contact with the conveyor belt without sliding thereon during the brief pe-  
25 riod required to freeze the side-wall layers of the discrete pieces.

Such a synchronous movement may be achieved by arranging the conveyor belt so as to directly or indirectly drivingly engage the roller, thus omitting the  
30 need to provide the roller with its separate drive unit. For instance, the roller could be provided, at least at one end thereof, with teeth for engagement with corresponding apertures formed along the corresponding marginal edge of the conveyor belt.

35 The cutter blade may be configured in such a manner that by cyclically repeating the pattern of movement of the cutter blade, viz. lowering it towards the belt, dis-

placing it in a brief synchronous movement together with the belt essentially in contact with the latter, lifting it from the belt and reversing its direction of movement relatively thereto, the desired discrete pieces are produced, which are delimited by a frozen bottom layer and frozen side-wall layers. Also the roller cutting blades may be disposed in any pattern that produces the desired separate pieces.

The discrete pieces could, however, advantageously be produced by means of two rollers, each with its individual cutter blade pattern, which together produce the desired division of the food product into discrete pieces.

The invention will be described in closer detail in the following with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic lateral view, which partly in cross-section illustrates one embodiment of a device in accordance with the invention,

Fig. 2 is a lateral view, showing in closer detail one embodiment of a roller incorporated in the device in accordance with the invention,

Fig. 3 is a longitudinal sectional view through the roller of Fig. 2,

Fig. 4 is a cross-sectional view of one embodiment of a conveyor belt incorporated in the device in accordance with the invention,

Fig. 5 is a longitudinal sectional view through a further embodiment of a roller for use in the device in accordance with the invention, and

Fig. 6 is one example of a different divisional pattern for use in connection with the invention.

The device illustrated in Fig. 1, comprises a housing 1 in which an endless conveyor belt 2 moves in an upper path 3 from a pulley 4 to a pulley 5, and in a lower path 6 above an insulated bottom of the housing 1 from the pulley 5 back to the pulley 4. In the lower path

6 a further pulley 7 guides the conveyor belt 2 into a trough 8 containing liquid nitrogen. Alternatively, liquid nitrogen may be sprayed directly onto the belt 2, for instance on the lower face of the belt in path 3. The  
5 conveyor belt 2 is driven so as to move in the direction indicated by arrow A by means of a motor 9 connected to pulley 5.

Owing to the movement of the conveyor belt 2, dipping into the liquid nitrogen contained in the trough 8,  
10 a very low temperature is obtained, in any case approximately below  $-60^{\circ}\text{C}$ , advantageously below approximately  $-100^{\circ}\text{C}$  and preferably in the range from  $-150^{\circ}\text{C}$  to  $-190^{\circ}\text{C}$ . The condition is that while moving in the upper path 3 the conveyor belt 2 is to have a sufficiently low tem-  
15 perature to ensure that food products resting on the upper path 3 of the conveyor belt, will freeze very rapidly in the form of a layer of the product closest to the upper surface of the conveyor belt 2, without the product freezing fast onto said surface.

20 In addition, the device comprises a dispensing means 10 discharging liquid or semiliquid food products, said dispensing means 10 having one or several nozzles dispensing at least one string 11 of the liquid or semiliquid food product onto the conveyor belt 2 adjacent the  
25 pulley 4. Thus, the dispensed string or strings 11 are moved together with the conveyor belt 2 in the direction towards the pulley 5.

A roller 12 and a toothed wheel 13, the axes of which are concentric and extend in parallel with the axes  
30 of the pulleys 4, 5, are supported by a frame 14 which is pivotally mounted in a cross bar 15 extending above the housing 1. In a manner not illustrated the cross bar 15 is stationarily mounted with respect to the housing 1.

35 As illustrated in Figs 2 and 3 the roller 12 is in rolling contact in path 3 with the upper face of the conveyor belt 2 without sliding relatively to the latter because of the provision of the toothed wheel 13, which is



formed with teeth 16 around its circumference, said teeth 16 successively engaging holes 17 formed along one marginal edge of the conveyor belt 2, thus causing the roller 12 to rotate in the direction indicated by arrow B as a result of the movement of the conveyor belt 2 in the direction of arrow A.

More precisely, the roller 12 is in the form of a closed-end cylinder having eleven radially directed cutter blades 18 extending axially along the entire length of the roller 12 and being equally spaced from the centre axis of the roller 12. Together with the toothed wheel 13 the roller 12 is rotatably mounted on a hollow shaft 19 formed with a lengthwise channel 20, and radially directed openings 21, 22 for supply of cooling medium, preferably liquid nitrogen, to the cavity of each cutter blade 18, as well as for removal of evaporated nitrogen. The supply and removal conduits (not illustrated) may be disposed in the frame 14.

As illustrated in Fig. 2, the roller 12, with the aid of the cutter blades 18, will divide the string 11 into successive discrete pieces 23 which are delimited on the one hand by a frozen bottom layer in contact with the conveyor belt 2 and on the other by two frozen wall layers formed as a result of the contact of the product with the cutter blades 18.

By adjusting the speed of the conveyor belt 2 and the spacing between the dispensing means 10 and the roller 12 the duration of the movement of the conveyor belt 2, from the dispensing means 10 to the roller 12, may be controlled to ensure that the roller 12 with the aid of its cutting blades 18, severs through the string 11 before more than a layer of the string closest to the conveyor belt 2 freezes, and freezes a layer adjacent the blades 18. The thus formed, discrete pieces 23 are removed from the conveyor belt 2 adjacent the pulley 5, to complete the freezing thereof in a preferably separate second freezer.

The device in accordance with the invention thus is utilised to freeze only a layer of the food product closest to the conveyor belt 2 and to the cutter blades 18, whereby a supporting bottom and walls contiguous therewith are formed in each individual piece 23, with the result that the pieces 23 may be handled separately and be transferred for example to a conventional air blast freezer to complete the freezing of the products, and the thus discrete pieces 23 are able to withstand impact caused by the movements of the air blast freezer conveyor belt, the latter not either being able to make any impressions on these discrete pieces 23 because of the supporting frozen bottom layer of each individual piece 23.

Fig. 4 illustrates the cross-sectional configuration of a conveyor belt 2' which is formed as a trough or channel whereby a completely liquid food product 11' may be contained within its lateral edges, freezing a layer of the food product 11' in contact with the conveyor belt 2'.

When using the belt in accordance with Fig. 4 in combination with the roller 12 in accordance with Figs 2 and 3 the formed discrete pieces 23 will have a rectangular configuration and extend across the entire width of the roller 12. A further roller 12' (Fig. 5) may be arranged downstream of the roller 12 in the direction of travel of the conveyor belt 2, and this second roller 12' may have its cutter blades 18' disposed as illustrated in Fig. 5, i.e. extending circumferentially around the roller 12' and being hollow like the cutter blades 18. By combining the rollers 12 and 12' each rectangular piece severed by roller 12 thus will be divided by roller 12' into a number of smaller pieces.

By altering the configuration of the pattern of the cutter blades 18 on the roller 12, discrete pieces of the food product having different configuration may be achieved, for instance the hexagonal configuration illus-

trated in Fig. 6 which in a flat development view also illustrates the pattern of the cutter blades on part of the peripheral face of a roller being an alternative to roller 12.

- 5       It should be obvious that the above-described embodiments of the device in accordance with the invention could be modified in several respects within the scope of the invention as defined in the appended claims.

## CLAIMS

1. A method of freezing semiliquid or liquid food  
5 products, according to which an impervious support is  
chilled to a sufficiently low temperature to freeze the  
entire surface of contact of a food product, upon its  
contact with the support, without the product freezing  
fast to the latter, and a predetermined thickness of the  
10 semiliquid or liquid food product is discharged on to the  
support, c h a r a c t e r i s e d by the steps of  
chilling also at least one cutter blade arranged to  
be moved essentially into contact with the support, to a  
sufficiently low temperature to freeze the entire surface  
15 of contact of a food product, upon its contact with the  
cutter blade or cutter blades, without the product freez-  
ing fast to the cutter blade or blades,  
after discharge of the semiliquid or liquid food  
product onto the support, depressing the cutter blade or  
20 blades through the semiliquid or liquid food product,  
essentially into contact with the support,  
removing the cutter blade or cutter blades from the  
food product discharged onto the support, as soon as a  
layer of the food product closest to the cutter blade or  
25 blades has frozen and has formed one or several side  
walls that are contiguous with a food product layer  
already frozen above the support and forming a supporting  
bottom, said one or several side walls together with said  
bottom layer serving as barriers against the yet unfrozen  
30 part of the food product, in at least a future discrete  
piece thereof, and  
removing the finally formed discrete pieces from the  
support for final freezing thereof in a second freezer.
2. A device for freezing a semiliquid or liquid food  
35 product, said device comprising  
a chilled conveyor belt (2) including a drive means  
(9) to drive the conveyor, and a dispensing means (10)

for discharging the food product onto the moving conveyor belt to form a continuous string (11) of the product on said conveyor belt, thus causing the string to freeze, beginning in the area closest to the surface of the conveyor belt, and

5 cooling means (8) for chilling the conveyor belt (2) to a sufficiently low temperature to freeze a food product, while in contact with the conveyor belt, without the product freezing fast to said belt, c h a r a c t e r -  
10 i s e d in that

at least one cutter blade (18) positioned downstream of the dispensing means (10) in the direction of travel of the conveyor belt (2) is arranged to periodically be moved essentially into contact with the conveyor belt in order to sever said string (11) into discrete pieces  
15 (23),

cooling means (21, 21) are arranged to chill the cutter blade or cutter blades to a sufficiently low temperature to freeze a food product, upon its contact with  
20 the cutter blade or blades (18), without said product freezing fast to said cutter blade or blades,

the drive means (9) is arranged to control the movements of the conveyor belt (2) from the dispensing means (10) to the cutter blade or blades (18) in such a manner  
25 as to ensure that the cutter blade or blades cut(s) through the string (11) before more than just a layer of said string closest to the conveyor belt freezes, and freeze(s) a layer of said string adjacent the cutter blade or blades, and

30 the conveyor belt (2) comprises a pulley (5) so spaced from the cutter blade or blades (18) that the pieces (23) separated by said cutter blade or blades are removed from the conveyor belt for final freezing in a second freezer.

35 3. A device as claimed in claim 2, c h a r a c -  
t e r i s e d by a plurality of radially directed cutter

blades (18) which are arranged on the circumferential surface of a roller.

4. A device as claimed in claim 3, characterised in that the cutter blades (18) are hollow  
5 so as to form a cavity and in that a cooling medium flows through said cavity.

5. A device as claimed in claim 4, characterised in that the roller (12) is formed with one single cavity common to all cutter blades (18).

10 6. A device as claimed in any one of claims 3-5, characterised in that the conveyor belt (2) is in driving engagement with the roller (12) to ensure that said roller rotates in contact with said conveyor belt without sliding relatively thereto.

15 7. A device as claimed in claim 6, characterised in that the roller (12) is non-rotationally connected with the toothed wheel (13) the teeth (16) of which engage corresponding holes (15) formed along a side edge of the conveyor belt (2).

20 8. A device as claimed in any one of claims 2-7, characterised in that the dispensing means (10) is arranged to discharge a number of parallel strings (11) onto the conveyor belt (2).

25 9. A device as claimed in any one of claims 2-7, characterised in that the dispensing means (10) is arranged to discharge one single string (11') on to the conveyor belt (2'), and in that said conveyor belt is in the shape of a trough (Fig. 3) so as to hold also liquid food products.

30 10. A device as claimed in any one of claims 3-9, characterised by a second roller (12') having a different pattern of cutter blades but otherwise having a function identical to that of the first roller (12), said second roller being arranged downstream of the first  
35 roller in the direction of travel of said conveyor belt (2).

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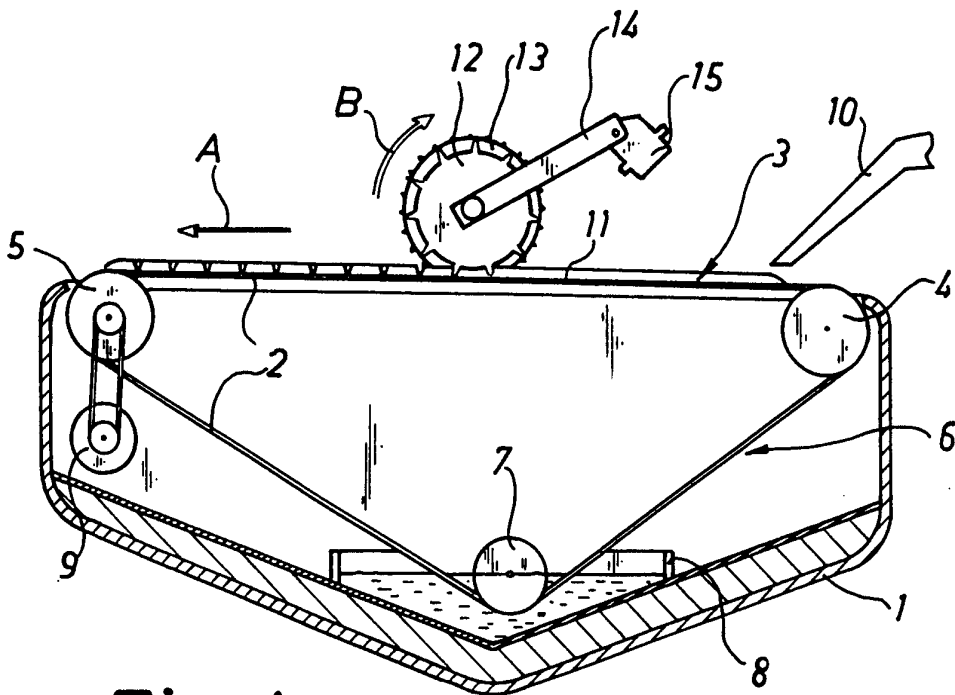


Fig. 1

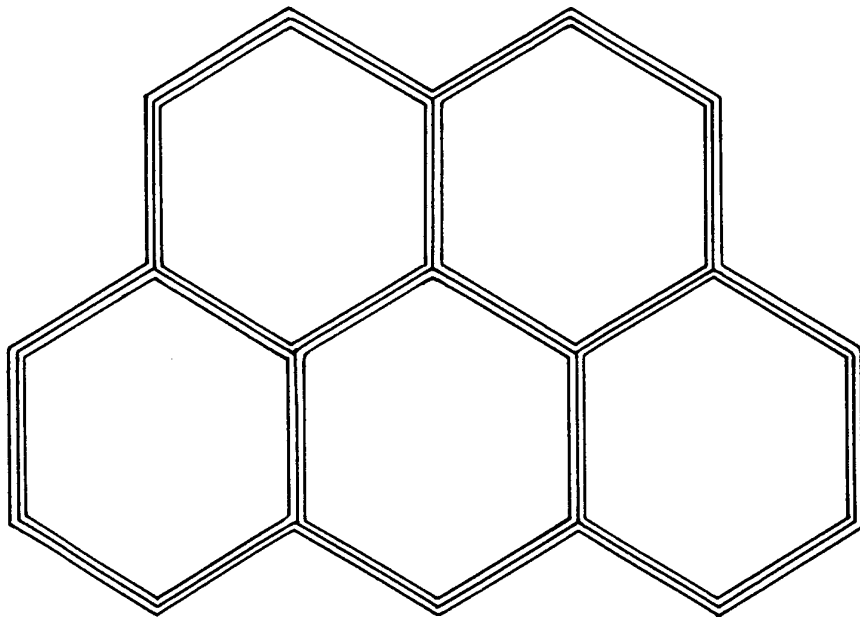


Fig. 6

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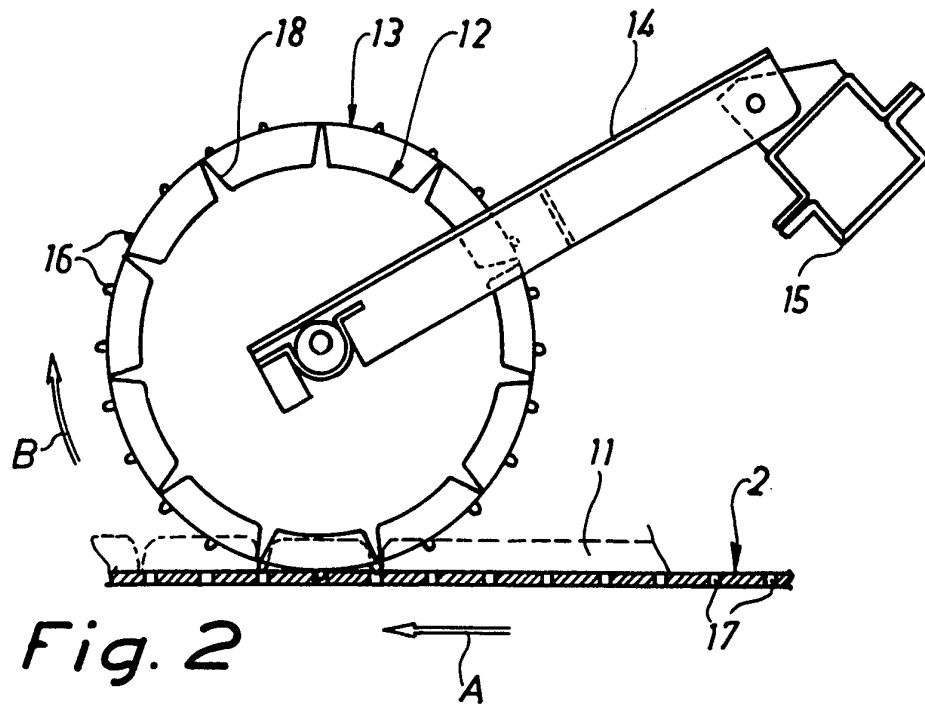


Fig. 2

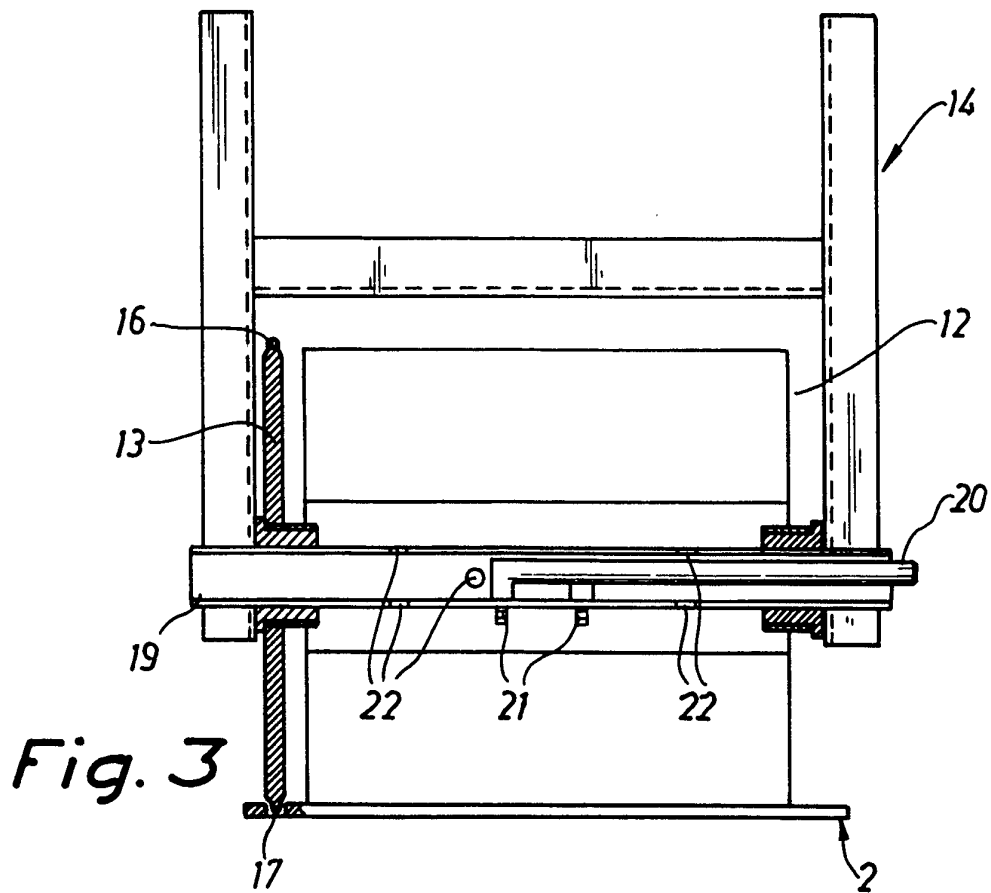


Fig. 3



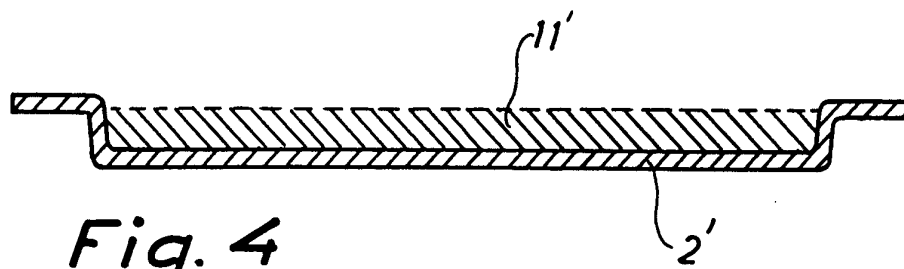


Fig. 4

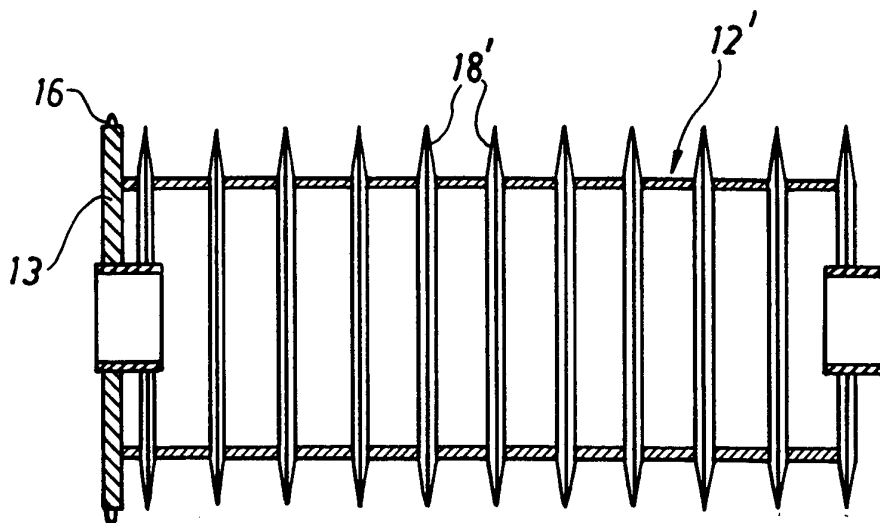


Fig. 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/00827

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: A23L 3/375, A23L 3/36 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: A23B, A23L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0423371 A1 (OSAKA SANSO KOGYO KK ET AL), 24 April 1991 (24.04.91), page 5, line 24 - page 6, claims 1-3 --	1-10
A	WO 9006693 A1 (FRIGOSCANDIA CONTRACTING AB), 28 June 1990 (28.06.90), page 6, line 10 - line 31 --	1-10
A	US 4060998 A (VINCENT E. BERNARD), 6 December 1977 (06.12.77) -- -----	1-10
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
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Date of the actual completion of the international search	Date of mailing of the international search report	
7 October 1996	11 -10- 1996	
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer  Inger Löfgren Telephone No. +46 8 782 25 00	

# INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0423371	24/04/91	JP-A- 2286064	26/11/90
		WO-A- 9013230	15/11/90
WO-A1- 9006693	28/06/90	AU-B- 629890	15/10/92
		AU-A- 4813590	10/07/90
		CA-A- 2006385	22/06/90
		DE-D, T- 68910535	17/03/94
		EP-A, B- 0452356	23/10/91
		ES-T- 2045898	16/01/94
		JP-T- 4503902	16/07/92
		RU-C- 2012207	15/05/94
		SE-B, C- 465401	09/09/91
		SE-A- 8804636	22/12/88
		US-A- 5156008	20/10/92
US-A- 4060998	06/12/77	US-A- 4124339	07/11/78
		US-A- 4165818	28/08/79
		US-A- 4193272	18/03/80
		US-A- 4195489	01/04/80