(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 969 131 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.01.2000 Bulletin 2000/01

(51) Int. Cl.[7]: **D06B 13/00**

(21) Application number: **99202091.7**

(22) Date of filing: **28.06.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.06.1998 NL 1009525**
31.05.1999 NL 1012194

(71) Applicant: **Stork Brabant B.V.**
5830 AA Boxmeer (NL)

(72) Inventors:
- **Breeuwer, René**
  2633 HP Delft (NL)
- **Frieling, Karel**
  7411 ET Deventer (NL)
- **Gooijer, Hendrik**
  1055 PL Amsterdam (NL)
- **Dunnewijk, Jeroen**
  7553 TM Hengelo (NL)
- **Gerritsen, Jan Willem**
  6602 EP Wijchen (NL)

(74) Representative:
Riemens, Roelof Harm
van Exter Polak & Charlouis B.V.
P.O. Box 3241
2280 GE Rijswijk (NL)

(54) **Device and method for treating textiles**

(57) Device for treating textile, comprising a tank (2) for holding treatment liquid (3), conveyor means (4) for conveying a textile substrate (7) which is to be treated through the tank (2), a transducer (8) for generating ultrasonic vibrations in the treatment liquid (3), an interference element (19) placed opposite the transducer for together delimiting a vibration cavity (13), wherein the transducer (8) together with the interference element (19) is designed to generate an interference pattern in the vibration cavity (13) of ultrasonic vibrations amplifying each other, in which a concentration area (11) of intensified vibration energy occurs at a distance from the transducer (8) and the interference element (19), in which the conveyor means (4) are designed to guide the textile substrate (7) through the concentration area (11), and in which energy of the ultrasonic vibrations is destined to dissipate by means of cavitation in the concentration area (11) at the location of the textile substrate (7).

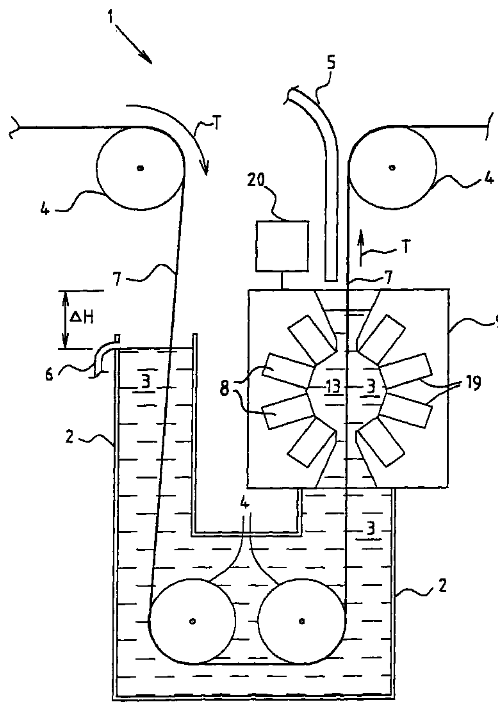

Fig. 1

Description

[0001] The invention relates to a device according to the preamble of claim 1.

[0002] A device of this nature is known from Austrian patent AT 402 076 B.

[0003] In the textile-treating industry, so-called wet treating processes are often used. Examples of such processes are dyeing, finishing, enzymatic processes, pretreatment processes, washing and rinsing. In many cases, the liquid used is water with an added agent which is suitable for the desired treating process, or possibly without any added agent. These processes usually involve large amounts of time, energy and water, owing to the fact that the diffusion of the particles which have to be introduced into the textile yarns or to be removed from the textile yarns proceeds relatively slowly.

[0004] It is known to accelerate the said processes with the aid of ultrasound.

[0005] The said Austrian patent describes a device in which a textile substrate is conveyed through a treatment liquid bath. Inside the bath a transducer is present for transmitting ultrasonic vibrations towards a reflection surface laying opposite of the transducer. The textile substrate is conveyed between the transducer and the reflection surface in such a way, that the substrate is essentially in contact with the transducer.

[0006] This known device has the drawback that the mechanical contact between transducer and substrate may have an adverse effect on the conveying of the substrate and that the working surface of the transducer may become worn. Moreover, this known device has the drawback that owing to the minimal distance between transducer and substrate it is difficult to make the working area of adjacent transducers overlap correctly in the width direction of the substrate. A band of reduced ultrasonic action may be formed between two adjacent transducers. Particularly in the case of relatively wide substrates, many such interruption bands may be formed. It will be clear that this is undesirable.

[0007] The object of the invention is to provide a device for treating textile, in which these drawbacks are eliminated, and in particular to provide a compact treating device with which, at very short process times and minimum energy supply, textile substrates can be treated efficiently and satisfactory.

[0008] According to the invention, this purpose is achieved by a device according to claim 1. The device comprises a tank with a treatment liquid in which a vibration cavity is present which is delimited by a transducer and an interference element laying opposite the transducer. The transducer and the interference element are designed to generate together an interference pattern of ultrasonic vibrations amplifying each other in the vibration cavity. Thereby a location of intensified vibration energy of the interference pattern occurs in a concentration area which lies in the vibration cavity at a distance from the transducer and from the interference element. Conveyor means are provided for guiding a textile substrate to be treated free from the transducer and free from the interference element through the concentration area. The energy coming from the ultrasonic vibrations is destined to dissipate by means of cavitation in the concentration area at the location of the textile substrate and thus to accelerate and improve the treatment of the textile substrate conveyed through the concentration area. The pressure maxima and pressure minima occurring in the concentration area are able to lower the pressure in the liquid so strongly that vapour bubbles are formed far beneath the boiling point, which implode at a subsequent compression. As a result of this cavitation a brushing effect at the surface of the textile substrate to be treated and a so-called secondary flow in the yarns arises. As a result the process can be carried out at a lower process temperature and with a shorter process time. Moreover, the shorter process time makes it possible for the treating device to be of a compact design.

[0009] The concentration of the soundwaves in the concentration area makes it possible to convey the substrate at a certain distance from the transducer while nevertheless obtaining a sufficient intensity of the ultrasonic vibrations at the location of the substrate. Cavitation only has to take place in the concentration area, with the result that energy losses caused by cavitation elsewhere in the liquid can be limited. Moreover, in this case the working areas of the transducers will overlap one another more successfully.

[0010] According to the invention, a more efficient treating process is obtained than in the prior art, with the result that it is possible to save energy and/or treatment liquid, as well as any added agents.

[0011] Advantageously the transducer together with the interference element is adapted to generate a standing wave in the vibration cavity, in which an antinode of the standing wave comes to lie in the concentration area. In order to achieve the standing wave, the vibration frequency of the transducer must be adapted to the natural frequency of the vibration cavity, or the distance between the transducer and the interference element must be adapted to the ultrasonic vibration generated by the transducer.

[0012] Advantageously the distance between the transducer and the interference element is such, for example equal to a half or whole wavelength, that only one antinode occurs in the vibration cavity. With this it is achieved that only there where cavitation really is needed, that is to say onto or nearby the textile substrate to be treated, cavitation is generated. As a result almost no ultrasonic energy is lost elsewhere in the tank with treating liquid. The investments in power electronics and transducers can be kept small.

[0013] In an embodiment the interference element is a fixed reflection element. The ultrasonic longitudinal waves produced by the transducer shall as a result of reflection against the reflection element cause a back running wave, which together with the forward running wave may produce a standing or stationary wave.

[0014] In another embodiment the interference element is a second transducer, which is designed to generate ultrasonic vibrations with a vibration frequency which is substantially equal to the ultrasonic vibration generated by the first transducer. With this also a standing wave may occur, which is a superposition of two running waves with equal vibration frequency and amplitude, but opposite propagation direction.

[0015] Preferential embodiments of the invention are stated in claims 6-21.

[0016] The invention will be explained in more detail below with reference to the drawing, in which:

fig. 1 shows a diagrammatic view of a device according to the invention;

fig. 2 is a view at an enlarged scale of the ultrasonic unit in fig. 1;

fig. 3 is a diagrammatic cross-sectional view of an alternative embodiment of the ultrasonic unit in fig. 2; and

fig. 4 is a diagrammatic cross-sectional view of a further alternative embodiment of the ultrasonic unit in fig. 2.

[0017] The device 1 for treating textile, which is illustrated diagrammatically, purely by way of example, in fig. 1, comprises a tank 2 for holding liquid 3. With the aid of rollers 4, a substrate 7 which is to be treated is conveyed through the tank 2 in the direction of the arrows T. An ultrasound unit 9 is attached to the tank 2, the interior of which unit is in open communication with the tank 2, so that liquid 3 is also present in the interior of the ultrasound unit 9.

[0018] A feedline 5 is arranged above the ultrasound unit 9, in such a manner that liquid 3 can flow into the inlet funnel (16 in fig. 2). A discharge line 6 is arranged on that side of the tank 2 where the substrate 7 enters the tank. Due to the difference in height ΔH between the top side of (the inlet funnel 16 of) the ultrasound unit 9 and the discharge line 6, the liquid 3 is made to flow, specifically in the opposite direction to the conveying direction T of the substrate 7. It will be clear that a plurality of feed and/or discharge lines 5 and 6, respectively, may be provided and that these lines may be arranged one behind the other, in a transverse direction with respect to the plane of the drawing.

[0019] The ultrasound unit 9 comprises a number of ultrasonic transducers 8 and opposite interference elements 19, which are also formed by ultrasonic transducers here. According to the invention, the transducers 8 and the interference elements 19 are disposed in such a manner that the ultrasonic energy which they generate is concentrated within a vibration cavity 13 at or in the vicinity of the substrate 7 by means of a suitable interference of ultrasonic vibrations amplifying each other. As a result, it is possible for the substrate 7 to be conveyed not directly along the transducers 8 but at a certain distance therefrom. This will be explained in more detail below with reference to fig. 2.

[0020] The ultrasound unit 9 is situated at the end of the conveying path of the substrate 7 through the treatment liquid, so that air which is attached to the substrate is as far as possible released to the liquid 3 before the substrate 7 reaches the vibration cavity 13.

[0021] A control unit 20, which is connected to the ultrasound unit 9, is used to control the transducers 8. The transducers 8 which lie on both sides of the substrate 7 may, for example, be actuated in phase in order to generate a standing wave. The control unit 20 may comprise a microprocessor and may be designed in such a manner that the way in which the transducers are actuated can be varied by the user of the device 1.

[0022] It will be clear that the device 1 will in practice contain further components which, however, have been omitted from the drawing for the sake of clarity.

[0023] Fig. 2 shows part of the ultrasound unit 9 of fig. 1 in more detail. A vibration cavity 13 is situated inside the ultrasound unit 9. In the example shown in fig. 2, the vibration cavity 13, which in operation is filled with liquid, is enclosed by concentration surfaces 12, which here form both focusing means 10 and the walls of the vibration cavity 13. At the top and bottom sides, the vibration cavity 13 ends by merging into inlet and outlet funnels 16 and 17, respectively, which are delimited by guide surfaces 14 and 15, for the liquid 3. The liquid 3 flows in a direction opposite to the direction T in which the substrate 7 is conveyed through the vibration cavity 13 in fig. 1.

[0024] It will be clear that the concentration surfaces 12 extend perpendicularly with respect to the plane of the drawing. Preferably, a plurality of transducers 8 are distributed in the longitudinal direction for each concentration surface 12, in order to be able to treat a substrate which is to be treated with ultrasound over its entire width. In the example illustrated, the concentration surfaces 12 are straight, but obviously it is also possible to use curved concentration surfaces. The substantially flat concentration surfaces 12 advantageously make it possible to use flat transducers, which can be produced more easily and more economically. The effectiveness of the ultrasound unit 9 is enlarged because the several concentration surfaces 12 are flexibly connected to one another, for example by means of bellows 18. A further improvement can be achieved if each concentration surface 12 in the longitudinal direction at both sides is also provided with a flexible connection, for example by a pair of bends in the wall of the concentration surface 12. With this also the flexibility of the concentration surface 12 is enlarged.

[0025] In the example illustrated, a transducer 8 is positioned against each concentration surface 12, specifically in such a manner that (ultrasonic) energy generated by the transducer 8 reaches the vibration cavity 13 via the concentration surface 12. The concentration surfaces are disposed in such a way with respect to one another that the ultrasonic energy which is generated by the transducers 8 is concentrated in a concentration area 11 which lies in the centre of the vibration cavity 13. For this purpose, the centres of the concentration surfaces 12 are in each case situated at a radius R from a centre point M, and specifically the concentration surfaces on the right-hand side in fig. 2 are situated at a distance R from a first centre point M_1, and the concentration surfaces on the left-hand side in fig. 2 are situated at a distance R from a second centre point M_2. The concentration surfaces on the right-hand side form a first partial concentration area which is defined by the near and/or far field of the ultrasonic soundwaves and has a maximum intensity at a point which does not coincide with the centre of the vibration cavity 13 but nonetheless lies close to this centre. Likewise, the concentration surfaces on the left-hand side form a second partial concentration area with a maximum intensity at a symmetrically opposite point. These partial concentration areas together form the concentration area 11.

[0026] Although in the embodiment in accordance with fig. 2 a transducer is arranged on all the concentration surfaces 12, it will be clear that this is not necessary and that, by way of example, a transducer may be arranged on just one or two concentration surfaces. In this case, it is also possible for only the left-hand and/or only the right-hand half of the concentration surfaces illustrated to be provided with a transducer.

[0027] The transducers are preferably formed by piezoelectric transducers, although transducers of a different type, such as for example magneto-restrictive transducers, may also be used.

[0028] The transducers are designed to produce ultrasonic vibration frequencies at which cavitation will readily occur, preferably frequencies of between 16 kHz and 100 kHz.

[0029] As illustrated in the figures, the substrate 7 is guided through the vibration cavity 13 in the vertical direction. The advantage of this is that in this way air bubbles can easily be discharged from the vibration cavity 13. Obviously, it is also possible to guide the substrate 7 through a suitably disposed vibration cavity 13 in a manner other than vertical, for example horizontally or at an angle to the vertical.

[0030] In order, in practice, to be able to adapt the configuration to the width of the substrate to be treated, the configuration may be of modular design, so that the vibration cavity (13 in Figure 2) can in each case be expanded using a length of concentration surfaces and associated transducers.

[0031] The ultrasound unit in fig. 3 comprises four transducers 30 and four opposite interference elements 31 which together delimit a vibration cavity 32. The vibration cavity 32 is filled with treatment liquid. A textile substrate 33 conveyed through the vibration cavity 32 is shown in the figure with an interrupted line. The transducers 30 each can be steered towards the generation of an ultrasonic vibration in the treatment liquid. The transducers 30 are positioned straight beneath one another onto a wall plate 35. The wall plate 35 passes the vibration to the liquid and at the same time protects the transducers 30 against corrosion by the liquid. The propagation directions of the respective produced ultrasonic vibrations lie substantially parallel to each other in a direction perpendicular to the wall plate 35 and perpendicular to the conveying direction of the textile substrate 33. The interference elements 31 lie face to face with the transducers 30 and provide for the reflection of the vibrations arriving there. The interference elements are also positioned straight beneath one another at a wall plate 36.

[0032] The distance L between each transducer 30 and corresponding interference element 31 is substantially equal to a whole wavelength of the ultrasonic vibration generated by the transducer 30. As a result of resonance between the transducer 30 and the interference element 31 a standing wave pattern occurs, with antinodes at the location of the wall plates 35 and 36 and the middle of the vibration cavity 32. The antinodes lying in the middle of the vibration cavity 32 of the several transducer interference element pairs together define an elongated concentration area 38 through which the textile substrate 33 is conveyed. The imaginary concentration area 38 is substantially located at and nearby the textile substrate 33 and is diagrammatically shown with an interrupted line. The pressure differences occurring in the concentration area are large enough for the formation of cavitation vapour bubbles at both sides of and in the textile substrate 33, which bubbles subsequently implode. The cavitation causes local secondary flow, and accelerates and improves the treating process. Because at a distance from the wall plates 35, 36 only one antinode occurs in the vibration cavity, cavitation advantageously mostly occurs in the middle of the vibration cavity 32. Instead off a whole wavelength, the distance L can also be equal to a multiple thereof, the concentration area through which the substrate is conveyed, then optionally can be defined at the location of one or several of the occurring antinodes.

[0033] The interference elements 31 can be formed by fixed reflection elements which reflects waves running against it. Advantageously the interference elements 31 are, however, formed by transducers which are designed to generate ultrasonic vibrations with a vibration frequency which is substantially equal to the ultrasonic vibrations generated by the opposite transducers 30. The two ultrasonic vibrations generated in opposite directions, can amplify each other and produce an interference pattern with pressure maxima and pressure minima in the vibration cavity 32. Here also resonance may occur and a standing wave interference pattern may be achieved.

[0034] The distance between the transducers 30 and interference elements 31 is larger than 4 mm, and in particular larger than 10 mm. With such mutual distances the textile substrate can be conveyed with some play through the vibration cavity 32, without the risk that the substrate runs against one of the wall plates 35, 36.

[0035] Instead of several transducers and interference elements placed behind one another, only one transducer and one opposite interference element may also suffice. The arrangement with several transducers and interference elements has the advantage that, with a particular conveying speed, the substrate can be subjected to a longer process time.

[0036] In fig. 4 an alternative embodiment of fig. 3 is shown, in which the transducers 40 are mounted with a centre plane onto a wall plate 41. This is the neutral plane of the transducer 40. In order to prevent the transducers 40 to be contacted by the treatment liquid, a foil 42 is placed before the frontside of the transducers 40. Preferably, the foil is as thin as possible, and for example 0,1 mm thick. Preferably, the foil is corrosion resistant foil, which is chemically resistant, but it may also be aluminium foil. The foil 42 can vibrate freely, as a result of which, in the case of the occurrence of a standing wave interference pattern, a node may occur at the location of the foil 42. As a result of this, the concentration area in which the first antinode lies, lies at a quarter of a wavelength from the foil 42. The distance M between each transducer 40 and opposite interference element 43 must at least be equal to half a wavelength or a multiple thereof. The foil 42, where a node of the standing wave pattern is present, advantageously stays free from cavitation.

[0037] With the embodiment shown in fig. 3 and 4, the wall plates 35, 36 respectively 41 can be constructed segmented, in which the segments are connected to one another by means of flexible connection pieces.

[0038] Thus, according to the invention, a treating device is provided, in which efficient use is being made from interference patters of ultrasonic waves, in order to generate cavitation phenomena at a desired conveying location.

[0039] It will be clear to the person skilled in the art that numerous modifications and additions will be possible without departing from the scope of the invention.

Claims

1. Device for treating textile, comprising:

- a tank (2) for holding a treatment liquid (3);
- conveyor means (4) for conveying a textile substrate (7) which is to be treated through the tank (2);
- at least a first transducer (8) for generating ultrasonic vibrations in the liquid (3);
- an interference element (19) laying opposite the transducer for together delimiting a vibration cavity (13), in which the conveyor means (4) are designed to guide the textile substrate (7) through the vibration cavity (13);

characterized in that the first transducer (8) together with the interference element (19) is designed to generate an interference pattern in the vibration cavity (13) of ultrasonic vibrations amplifying each other, in which a concentration area (11) of intensified vibration energy occurs at a distance from the first transducer (8) and the interference element (19), in which the conveyor means (4) are designed to guide the textile substrate (7) through the concentration area (11), and in which energy of the ultrasonic vibrations is destined to dissipate by means of cavitation in the concentration area (11) at the location of the textile substrate (7).

2. Device according to claim 1, in which the first transducer (30) together with the interference element (31) is adapted to generate a standing wave interference pattern with antinodes and nodes in the vibration cavity (32), in which an antinode is laying in the concentration area (38).

3. Device according to claim 2, in which the distance (L) between the first transducer (30) and the interference element (31) is such that only one antinode occurs in the vibration cavity (32).

4. Device according to one of the claims 1-3, in which the interference element is a fixed reflection element.

5. Device according to one of the claims 1-3, in which the interference element (31) is a second transducer, which second transducer is designed to generate ultrasonic vibrations having a vibration frequency which is substantially equal to the ultrasonic vibrations generated by the first transducer (30).

6. Device according to one of the preceding claims, in which the distance between the first transducer (30) and the interference element (31) is larger than 4 mm, and in particular larger than 10 mm.

7. Device according to one of the preceding claims, in which several pairs of transducers (8; 30) and opposite interference elements (19; 31) are placed behind one another in the transportation direction (T) of the textile substrate (7; 33) and together delimit the vibration cavity (13; 32).

8. Device according to claim 7, in which the several transducers (30) and interference elements (31) placed behind one another are substantially positioned in line, the propagation directions of the respective ultrasonic vibrations laying substantially parallel.

9. Device according to claim 7, in which the several transducers (8) and interference elements (19) placed behind one another are positioned such that the propagation directions of the respective ultrasonic vibrations cross each other in the concentration area (11).

10. Device according to one of the preceding claims, in which the transducer (8) and/or the interference element (19) is provided with focusing means (10) for focusing the ultrasonic vibrations in the concentration area (11).

11. Device according to claims 9 and 10, in which the focusing means (10) comprise substantially flat concentration surfaces (12) which enclose the vibration cavity (13).

12. Device according to one of the claims 7-11, in which the adjacent transducers (8) and/or interference elements (19) are connected to each other by means of flexible connection pieces (18).

13. Device according to one of the claims 7-12, in which the several transducers (8) and interference elements (19), or the focusing means connected therewith, are positioned or shaped in such a way, that during use the concentration area (11) extends on both sides of the textile substrate (7).

14. Device according to one of the preceding claims, in which the conveyor means (4) are designed to convey the textile substrate (7) substantially vertically through the vibration cavity (13).

15. Device according to one of the preceding claims, in which the vibration cavity (13) is situated at the end of a substrate conveyor path which is present in the liquid (3).

16. Device according to one of the preceding claims, in which the tank (2) comprises means (5, 6) for continuously refreshing the liquid (3).

17. Device according to claim 16, in which the refreshing means (5, 6) bring about a flow in the liquid (3), in a direction opposite to the conveying direction (T) of the textile substrate (7).

18. Device according to one of the preceding claims, in which the transducer (40) is substantially mounted in its centre plane onto a wall plate (41).

19. Device according to claim 18, in which the vibration cavity side of the transducer (40) is covered with a protection foil (42).

20. Device according to claim 19, in which the protection foil (42) is corrosion resistant foil.

21. Method for treating textile with a device according to one of the preceding claims, comprising the following steps:

- conveying a textile substrate (7) through a tank (2) containing treatment liquid (3),
- generating ultrasonic vibrations in the liquid (3) between a first transducer (8) and an interference element (19) laying opposite the transducer (8),

  characterized by the concentrated dissipation of energy of the ultrasonic vibrations by means of cavity at the location of the textile substrate (7) in a concentration area (11) at a distance from the first transducer (8) and the interference element (19).

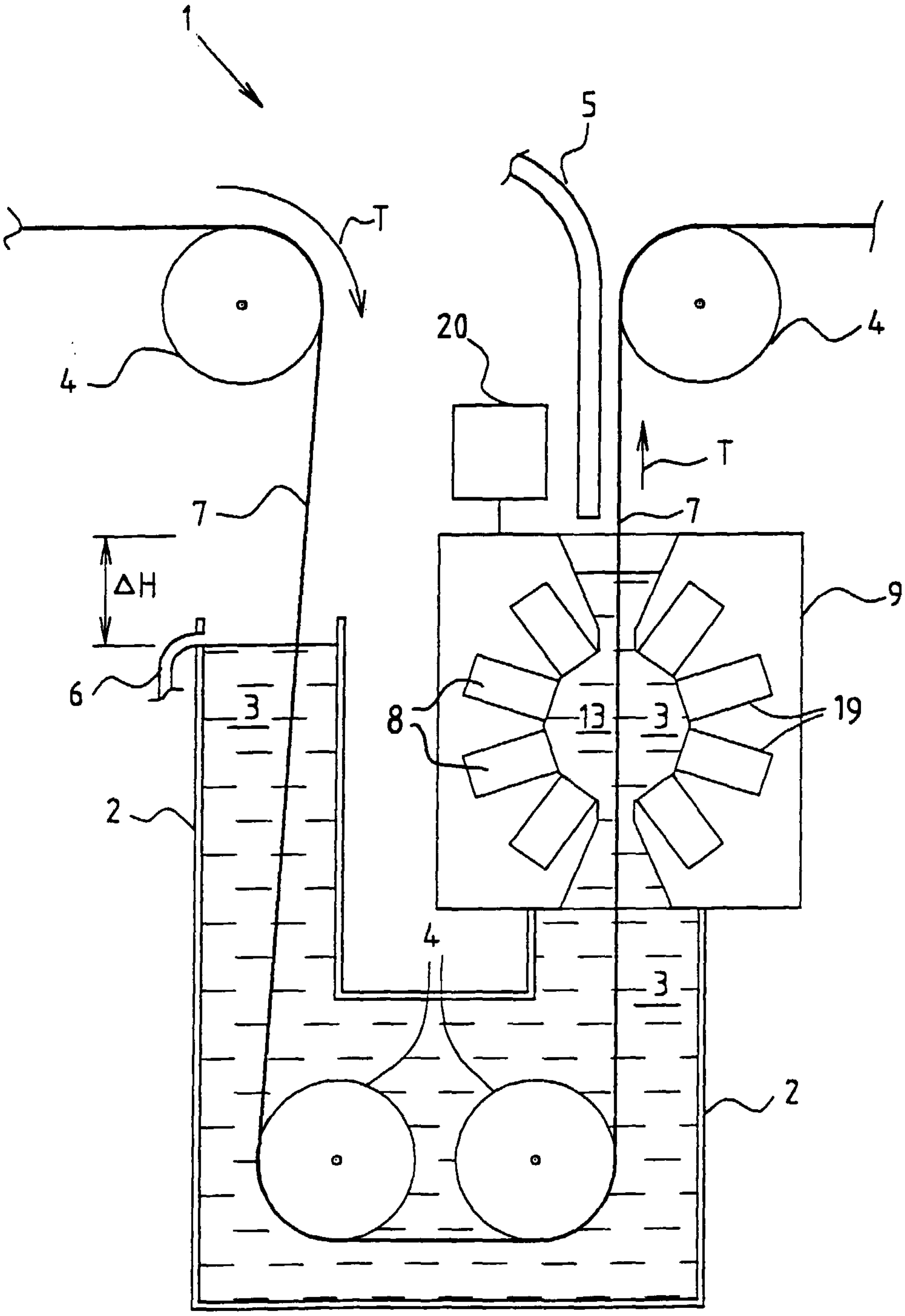

Fig. 1

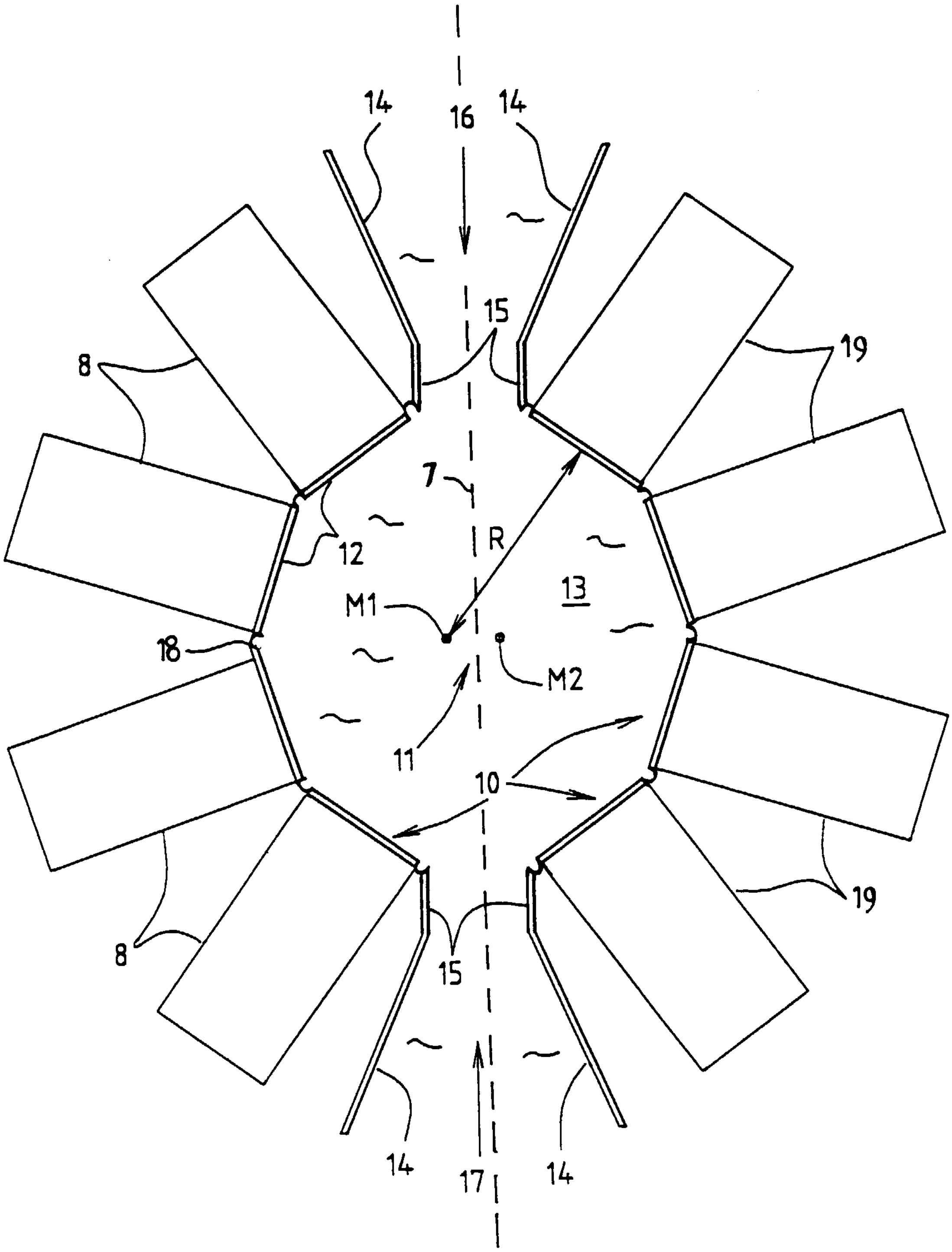

Fig. 2

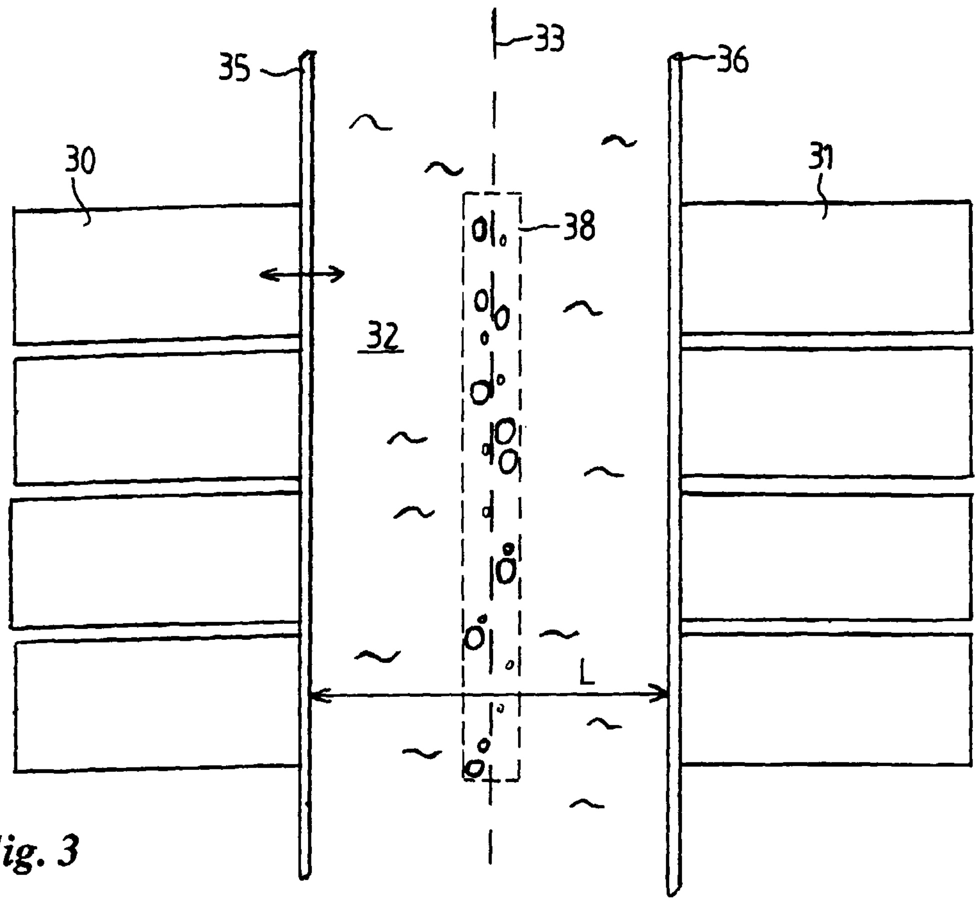

Fig. 3

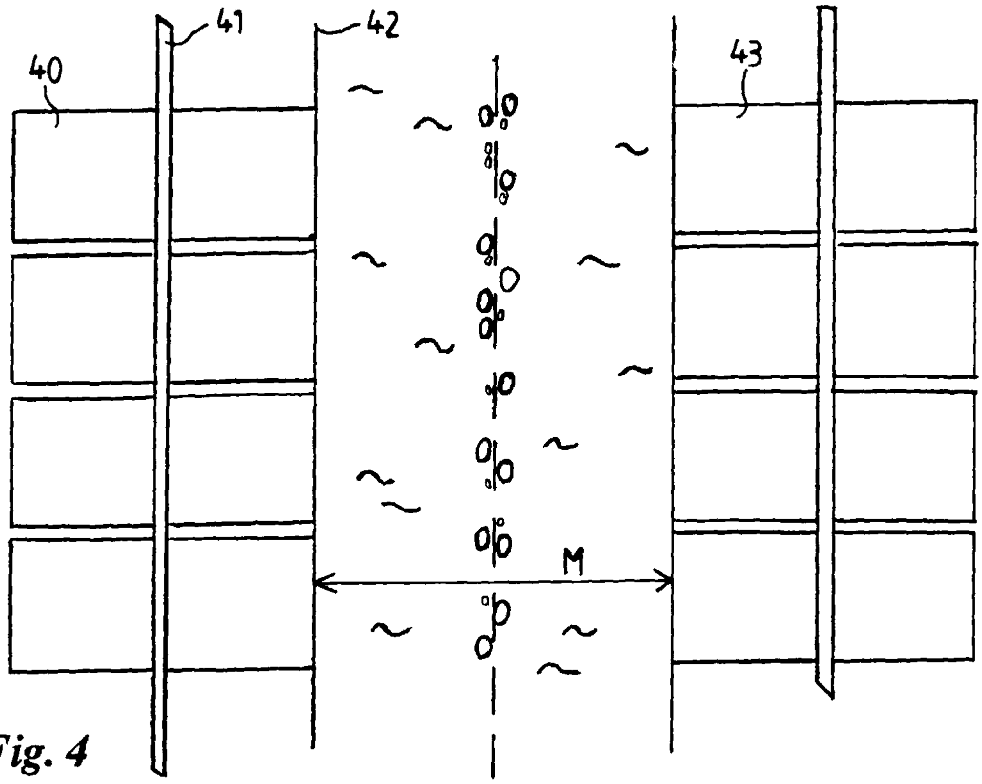

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 20 2091

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.7)
X	US 3 688 527 A (S. BLUSTAIN) 5 September 1972 (1972-09-05) * column 1 * * column 3, line 10 - column 4, line 4 * * column 8, line 14 - column 9, line 23 * * column 15, line 6 - line 14 * ---	1-4,21	D06B13/00
A	DE 18 10 290 A (K.P. KAESLER) 4 June 1970 (1970-06-04) * claims 1,3,4,8; figure 1 * ---	1,5,7,8, 21	
A	FR 1 562 461 A (GENERAL MILLS INC.) 4 April 1969 (1969-04-04) * page 3, line 10 - page 4, line 21 * ---	1,4,21	
D,A	AT 402 076 B (H.D. MERTINAT) 27 January 1997 (1997-01-27) * page 4, line 42 - page 5, line 1 * ---	1,4,21	
A	US 2 950 725 A (S.E. JACKE ET AL) 30 August 1960 (1960-08-30) * column 3, line 7 - line 20 * -----	10	TECHNICAL FIELDS SEARCHED (Int.Cl.7) D06B D06M B08B B06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 October 1999	Goodall, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 20 2091

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-10-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3688527 A	05-09-1972	CA 974789 A	23-09-1975
		DE 2134966 A	20-01-1972
		GB 1356162 A	12-06-1974
		JP 56014795 B	06-04-1981
		US 3829328 A	13-08-1974
DE 1810290 A	04-06-1970	NONE	
FR 1562461 A	04-04-1969	NONE	
AT 402076 B	27-01-1997	AT 41695 A	15-06-1996
		WO 9628599 A	19-09-1996
US 2950725 A	30-08-1960	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82