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(54) **Method and apparatus for reducing the liquid content of gas-permeable material.**

(57) A tube (12) of gas-permeable material (22) has its liquid content reduced by passing the tube through a frame (20) which surrounds the tube and which defines a suction slot which is at least substantially continuous in the direction around the tube.

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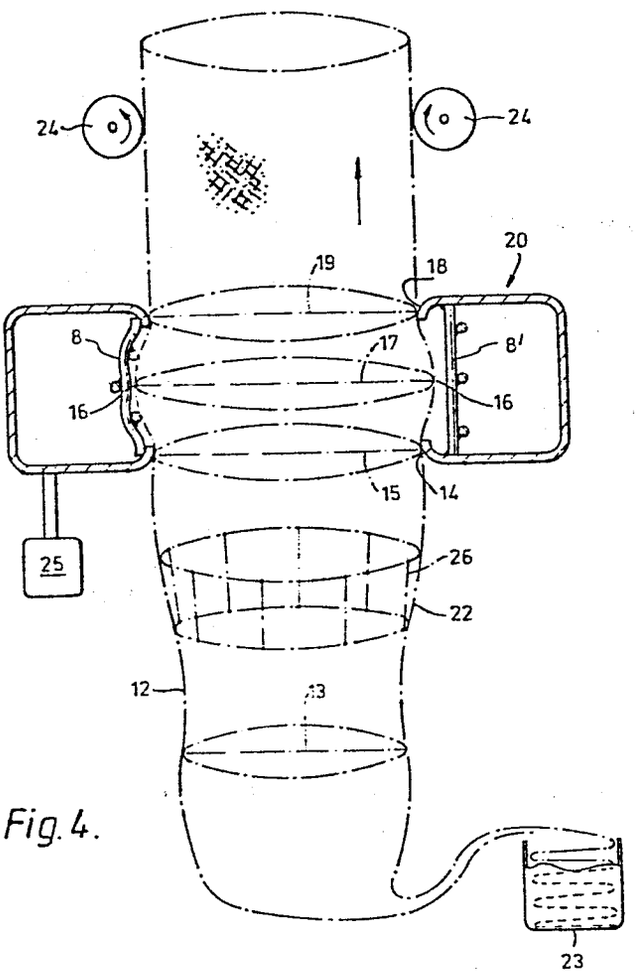


Fig. 4.

Method and Apparatus for Reducing the Liquid Content of Gas-Permeable Material

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of and apparatus for reducing the liquid (e.g. moisture) content of a gas-permeable material (e.g. a fabric) in tubular form.

2. Description of the Prior Art

A method of reducing the liquid content of a tubular fabric is described in British Specification No. 2,004,998. In that method, a tube of fabric is passed through a surrounding frame comprising at least one hollow member connected to a source of suction. The surface of the frame presented to the tube is provided with elongate apertures which are inclined at a slight angle to the direction of movement of the tube of fabric through the frame. Preferably, the elongate apertures are inclined at an angle of no more than 10^{o} to the direction of movement of the tube of fabric. All parts of the surface of the tube of fabric receive the same treatment.

A disadvantageous side effect of the inclination of the suction apertures has been observed under certain working conditions. There is a tendency for the tube of fabric moving through the frame in contact with the inclined suction apertures to develop a twist in the direction of the inclination of the apertures. Slippage between the apertures and the fabric reduces considerably the actual twist developed, nevertheless, in some cases, it has been found that the twist builds up during a fabric run and it is almost impossible to counteract it.

Summary of the Invention

According to the present invention, this disadvantage is overcome in a method of reducing the liquid content of a gas-permeable material by passing a tube of the gas-permeable material through a frame which subjects the outer surface of the tube of gas-permeable material to suction via a slot in the frame, which method is characterised in that the slot is at least substantially continuous in the direction around the tube of gas-permeable material.

The frame may be adjustable in size to correspond to the outer surface of the tube of gas-permeable material.

The frame may be constituted by a tubular member surrounding the tube of gas-permeable material and thus providing an aperture through which the tube of gas-permeable material moves, the slot being constituted by a gap in the wall of the tubular member which defines the aperture.

In order to limit the movement of the gas-permeable material into the slot, the slot may be partially closed with perforated material, such as a mesh or a sieve-like plate, which may be set back into the slot so as normally not to be in contact with the gas-permeable material passing through the frame. The perforated material may present a concave surface to the gas-permeable material.

An insert may be located within the tube of gas-permeable material so that as the latter moves over the insert, the tube is spread out to bring it into close proximity with the slot (eg with the wall defining the aperture in the frame).

It may be arranged that the pressure within the tube of gas-permeable material as it approaches the frame is greater than atmospheric and this will assist in expanding the tube as it approaches the slot (eg in adhering the tube closely to the wall defining the aperture in the frame).

The width of the slot, in the direction of movement of the tube of air permeable material past it, may be in the region of 100 mm.

The invention includes apparatus for carrying out the method described above and fabric subjected to the method.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described, by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a schematic perspective drawing of a tubular member constituting a frame for an apparatus according to the invention,

Figures 2 and 3 illustrate in greater detail part of the tubular member of Figure 1 showing two alternative forms of perforated member partially closing a slot in the tubular member, and

Figure 4 is a schematic cross-section through the frame of Figure 1 illustrating a tube of air permeable material (eg a textile material) passing through the frame and showing, on opposite sides of the tube, the two alternative forms of perforated member illustrated in Figures 2 and 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A frame 20 of the apparatus according to the invention illustrated in Figure 1 comprises a tubular member comprising a duct 1 (Figures 2 and 3) formed into a U-shaped member 9. The mouth of the U-shaped member 9 is closed by a further hollow part 11 of the tubular member constituting the frame 20 and the part 11 is slidable on the limbs of the U-shaped member 9. Thus, by moving the U-shaped member 9 in the directions shown by the arrows 10, or the part 11 in the directions shown by the arrows 10A, the frame 20 is adjustable to alter the size of the aperture 21 defined by the duct 1 and the part 11.

The ducts 1 shown in Figures 2 and 3 are of square cross-section with upper and lower walls 2 and 3. One wall of each duct 1 is formed with a gap constituting a slot 6 bordered by lips 4 and 5. The wall containing the slot 6 of the duct 1 defines the aperture 21 in the frame 20. (The part 11 is formed with a similar gap so that the slot 6 is substantially continuous around the inner wall of the frame 20.)

The entry 7 of the frame 20 (see Figures 2 and 3) is outwardly flared and thus the entry cross-section of the aperture 21 is larger than the cross-section at the lips 4 and 5.

Inset with respect to the lips 4 and 5 and located within the duct 1 in Figure 2, is a perforated member constituted by a mesh 8 which presents a concave surface to the slot 6 and the aperture 21. Figure 3 shows an alternative flat mesh 8' inset with respect to the lips 4 and 5 of the duct 1 by spacers 13.

Instead of the mesh 8 or 8', the perforated member which partially closes the slot 6 may be constituted

by a sieve-like apertured plate which may be concave like the mesh 8 or inset like the mesh 8'. Figure 4 shows schematically a tube 12 of air-permeable fabric 22 drawn upwardly (from a reservoir 23 thereof) by means 24 through the frame 20. The initial cross-section 13 of the tube 12 expands and within the frame 20, the tube barrels out under the influence of suction applied to the duct 1 and part 11 of the frame 20 by means 25 (and of the superatmospheric pressure created in the tube 12 as described below). At the level 14 at the lip 5, the tube 12 has the cross-section 15. At the level 16 of its progress through the frame 20, the tube 12 further expands to the cross-section 17 and is reduced at the level 18 to the cross-section 19. Because the mesh 8 (if used) is concave and slightly inset and the mesh 8' (if used) is further inset within the duct 1, the tube 12, despite its expansion, does not, during normal operation of the apparatus, contact the mesh 8 or the mesh 8' or at least does not contact either mesh to such an extent as to generate any frictional conjunction deleterious to the fabric 22. However, if, for example, the speed of movement of the fabric 22 through the apparatus were to fall, or the fabric were to come to a halt so that the tension in the fabric became reduced to the extent that the fabric would otherwise be drawn into the slot 6, the mesh 8 or 8' would prevent that.

The aperture 21 in the frame 20 may be elliptical, or, as in the example shown in Figure 1, generally rectangular with rounded ends. Since the overall size of the aperture 21 can be adjusted by means of the part 11, the aperture may be made to correspond in size to the size (within limits) of any particular tube of gas-permeable material which is to have its moisture content reduced by passage through the apparatus.

Within the tube 12 of air-permeable material 22, there may be located an insert 26, for example in

the form of a wire cage, which will be supported by the tube of air-permeable material itself, so that in moving over the insert, which remains relatively stationary, the tube is spread and expanded to bring it into close proximity with the wall of the duct 1 and part 11 which defines the aperture 21. The insert is, of course, shaped to correspond to the shape of the aperture 21 in order to achieve this. As an alternative, or in addition, to the use of an insert, the tube 12 of air-permeable material may have within it, as it approaches the frame 20, water vapour and gas at a pressure higher than atmospheric. Such superatmospheric pressure may result from the introduction of gas into the tube of air-permeable material during another treatment, for example, passage through an upstream drying chamber in which gas is passed into the tube of air-permeable material through its wall, under pressure. Alternatively, the superatmospheric pressure may be the result of deliberate introduction of gas into the tube specifically for the purpose of producing the superatmospheric pressure. The gas may be introduced, for example, at a location downstream of the frame 20 in the direction of movement of the tube of air-permeable material yet cause an increase in the pressure of the gas within the tube 12 of air-permeable material extending upstream to the frame 20 and substantially beyond. The effect of the suction applied at the slot 6, together with the superatmospheric pressure within the tube of air-permeable material, and/or the presence of an insert within the tube of air-permeable material, causes the tube 12 of air-permeable material to adhere closely to, and possibly to come into practically airtight contact with, the lip 5 at the entry end of the duct 1 of the frame 20 and the lip 4 at the exit end (and the equivalent parts of the part 11). The slot 6 may have a width, in the direction of movement of the tube 12 through the frame 20, of between 50 mm and 150 mm, for example in the region of 100 mm. The suction means 25 connected to the duct 1 (and part 11) of the

apparatus in Figure 1 is preferably capable of applying an adjustable degree of suction at the slot 6. Advantageously, the suction means is capable of producing within the duct 1 a pressure of from 1.25 kPa to 5.00 kPa (5" to 20" water gauge) below atmospheric pressure.

If the tube of air-permeable material is in airtight (or practically airtight) contact with the entry and exit ends of the frame 20, the entire movement of gas into the duct 1 and part 11 is caused to take place from inside the tube 12 of air-permeable material. The gaseous flow is thus through the minute openings in the structure of the air-permeable material and will carry with it moisture held in the material.

It will be seen from Figure 1, that the slot 6 is substantially continuous around the inner wall of the duct 1 and the part 11, which together define the aperture 21. That is, the suction slot is continuous in the direction around the tube 12 of air-permeable material in Figure 4 and extends at least 50 mm in the length direction of the tube 12.

CLAIMS

1. A method of reducing the liquid content of a gas-permeable material by passing a tube of the gas-permeable material through a frame which subjects the outer surface of the tube to suction via a slot in the frame, characterised in that the slot (6) is at least substantially continuous, in the direction around the tube (12) of gas-permeable material (22).

2. A method as claimed in claim 1, characterised in that the frame (20) is adjustable in size to correspond to the size of the outer surface of the tube (12) of gas-permeable material (22).

3. A method as claimed in claim 1 or 2, characterised in that the frame (20) is constituted by a tubular member (1) surrounding the tube (12) of gas-permeable material and provides an aperture (21) through which the tube (12) moves, the slot (6) being constituted by a gap in the wall of the tubular member (1) which defines the aperture (21).

4. A method as claimed in claim 1, 2 or 3, characterised in that the slot (6) is partially closed with a perforated material (8, 8') to limit movement of the tube (12) of gas-permeable material (22) into the slot (6).

5. A method as claimed in claim 4, characterised in that the perforated material (8, 8') presents a concave surface to the gas-permeable material (22).

6. A method as claimed in any one of the preceding claims, characterised in that an insert (26) is located within the tube (12) over which the gas-permeable material of the tube (12) moves and which serves to spread the tube (12) and bring it into close proximity with the wall defining the said aperture (21) in the frame (20).

7. A method as claimed in any one of the preceding claims, characterised in that the pressure within the tube (12), as the material of the tube (12) approaches the frame (20), is arranged to be greater than atmospheric pressure to assist in adhering the tube (12) closely to the wall defining the aperture (21) in the frame (20).

8. Apparatus for reducing the liquid content of a gas-permeable material in the form of a tube by creating a current of gas through the tube via a slot formed in a frame surrounding the tube, characterised in that the slot (6) in the frame (20) is continuous, or substantially continuous, in the direction around the tube (12).

9. Apparatus as claimed in claim 8, characterised in that the frame (20) is adjustable in size to correspond to the outer surface of the tube (12) of gas-permeable material (22).

10. Apparatus as claimed in claim 8 or 9, characterised in that the frame (20) is constituted by a tubular member (1) providing an aperture (21) through which the tube (12) moves and the slot (6) is constituted by a gap in the wall of the tubular member (1) which defines the aperture (21).

11. Apparatus as claimed in claim 8, 9 or 10, characterised in that the slot (6) is partially closed with a perforated material (8, 8') to limit movement of a tube (12) into the slot.

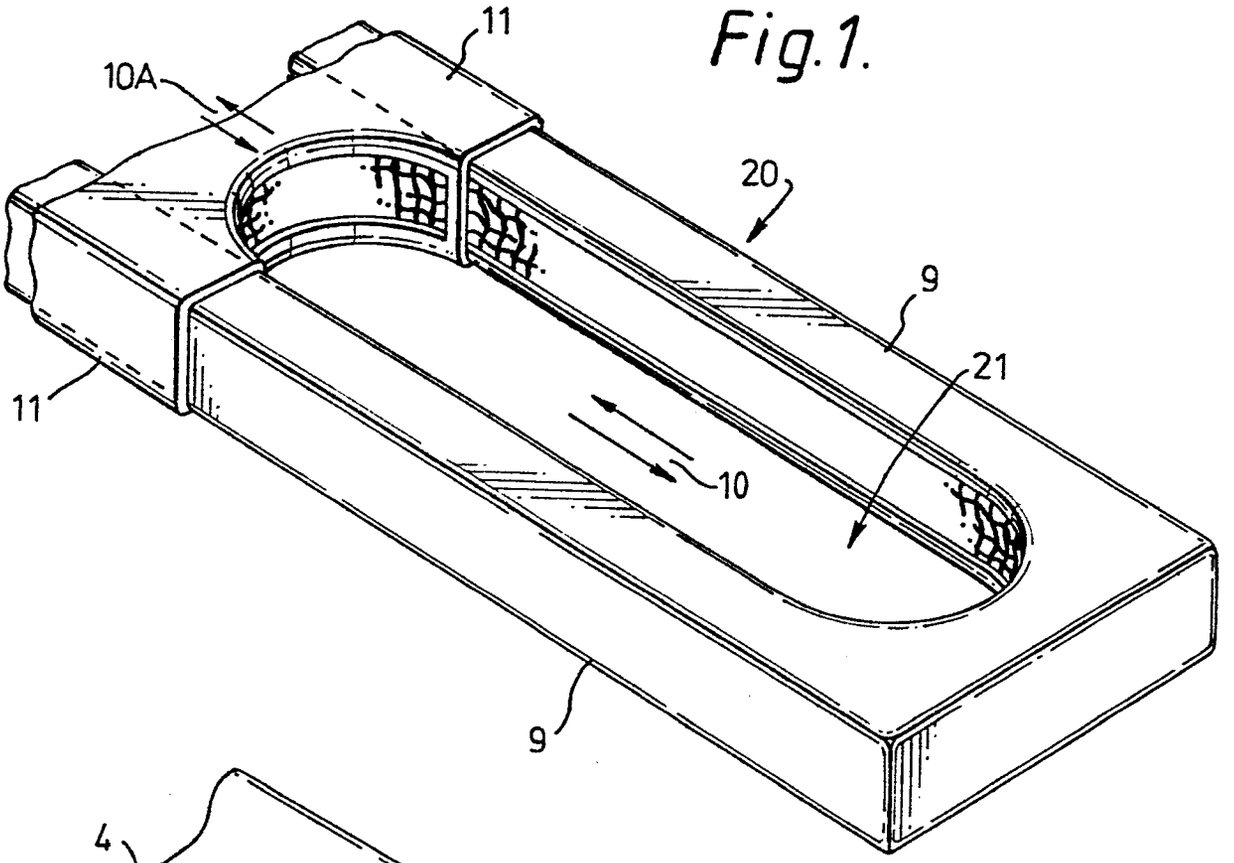
12. Apparatus as claimed in claim 11, characterised in that the perforated material (8, 8') presents a concave surface to the gas-permeable material (22).

13. Apparatus as claimed in any one of claims 8 to 11, characterised in that an insert (26) is located

within the tube (12) so that the tube (12) moves over the insert (26) and through the frame (20) and in that the insert (26) serves to spread the tube (12) and bring the gas-permeable material into close proximity with the part of the frame defining the slot (6) therein.

14. Apparatus as claimed in any one of claims 8 to 12, characterised in that means is provided for bringing the pressure within the tube (12), as the tube approaches the frame (20) to a value greater than atmospheric pressure to assist in adhering the gas-permeable material (2) closely to the part of the frame (20) defining the slot (6).

Fig.1.



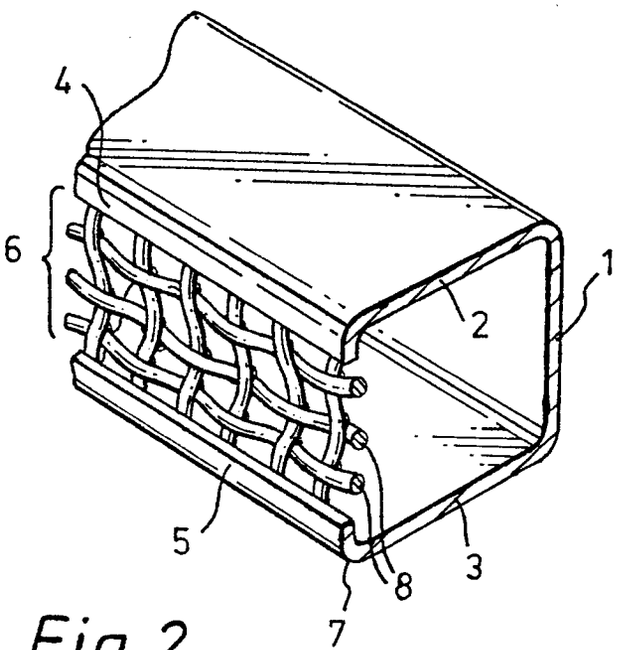


Fig.2.

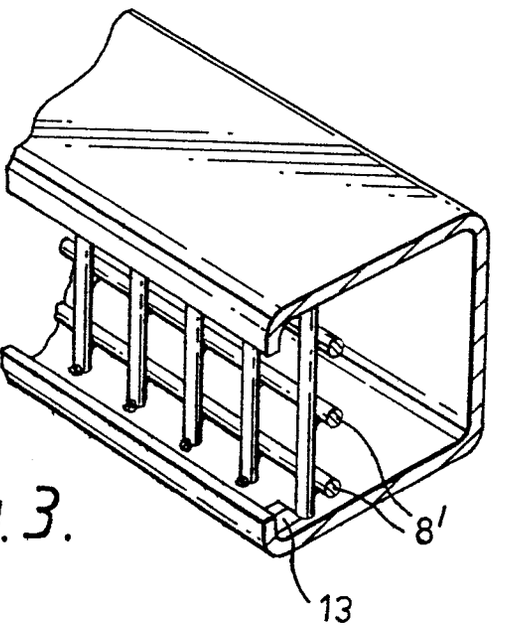


Fig.3.

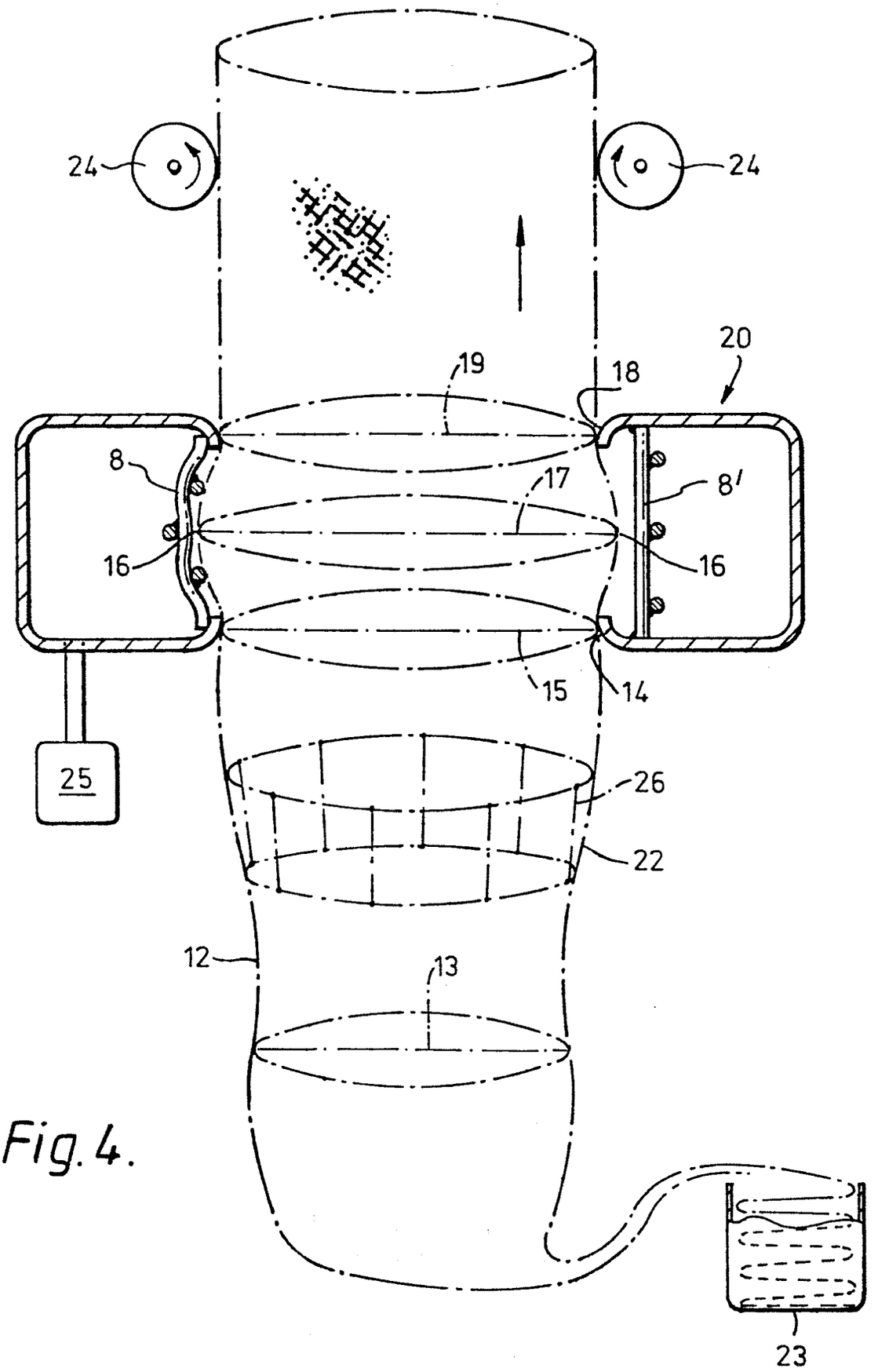


Fig. 4.