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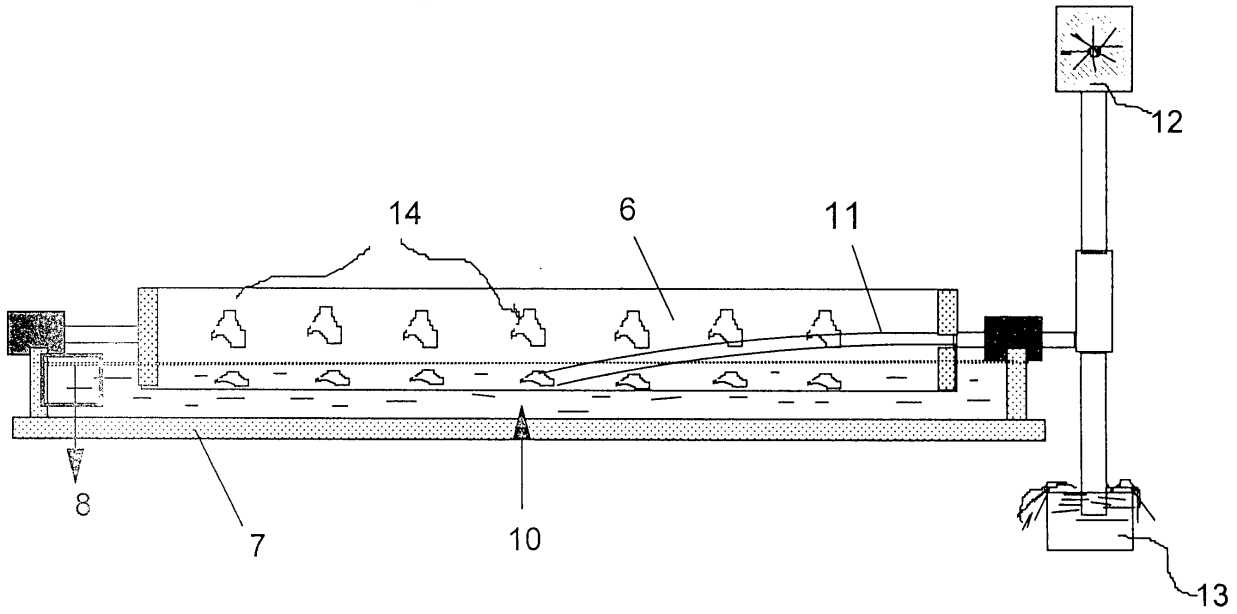
(54) **Producing security paper**

(57) A method of producing coloured watermarks includes using a watermark applicator to which auxiliary coloured stock is supplied. The watermark applicator includes a cylinder (6) with an open structure (similar to the open body of a dandy roll) and covered with an embossed wire mesh.

Figure 2



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Description

Field of the Invention

[0001] This invention relates to the manufacture of security paper and is particularly concerned with a method for producing coloured watermarks in security paper.

Background to the Invention

[0002] The watermark is an important feature in security papers as a means for preventing counterfeiting of the final printed document. The reason for the effectiveness of the watermark is that, as it is formed in the early stages of manufacture, it is created as part of the paper structure and therefore cannot be easily simulated in the illegal production of a false document.

[0003] It is believed that the introduction of colour into the watermark would further enhance the effectiveness of the feature as an anti-counterfeit device. It is accordingly an object of the present invention to provide a method of manufacturing security paper that incorporates a coloured watermark.

[0004] The invention is concerned with watermarks of the tonal type where the image is created by variations in fibre density, both light and dark, and does not relate to the simple line-mark type that are completely light in appearance in relation to the paper.

[0005] Tonal watermarks are created from impressions embossed into woven wire-mesh and are generally referred to as "embossed".

[0006] There are two methods of producing watermarks in paper based on the two methods of paper production, the fourdrinier and the cylinder mould. Both processes are well established and relate to the method of forming the paper structure. The technologies are well known and have been in use since the early part of the 19th century. The fourdrinier forming process is by far the most common, whilst the cylinder mould process finds a niche in specialist areas.

[0007] With the fourdrinier process, the watermark comes from images embossed into a wire-mesh cover of a roll known as the dandy roll. In paper manufacture, the dandy roll is in intimate contact with already formed paper web. At the point of contact, the web is still in the wet state and the fibres are relatively mobile. The action of the dandy is to partly reorganise the fibre structure in line with the embossings on the surface of the dandy, thus creating an image of varying density, which is visible in transmitted light when the paper web is subsequently dried.

[0008] Unlike the fourdrinier method, which is based in the paper web being formed on a flat table, the cylinder mould forms the web on the surface of a wire-mesh covered cylinder, and the watermark image is embossed into wire-mesh covering. It is clear, therefore, that in the case of the cylinder mould the watermark is formed during the formation of the basic sheet, whereas with the fourdrinier, the sheet is formed and at a critical point after this, fibres are moved into coincidence with the embossed design on the dandy cover.

[0009] In both processes, there is generally no difference between the fibres forming the watermarks and the fibres forming the main sheet structure. This integral structure does not allow for a difference in fibre type or colour for the watermark using conventional methods.

[0010] A specific object of the present invention is to provide an alternative method for the production of high definition, watermarks.

[0011] The primary advantage of the method of the present invention is to allow the manufacture of coloured watermarks, However, there are advantages to be gained if the method of the present invention is used for non-coloured watermarks. The term "coloured" implies a range of colouring from very light and subtle shades to strong bright colours when viewed against the colour of the basic paper sheet. It is further intended that the term "colour" also covers the colouring of the watermark structure with optical brightening agents (OBA), thus allowing a visual difference when viewed under ultra violet (u.v.) light, when the main sheet is u.v. dull.

Summary of the Invention

[0012] According to a first aspect of the present invention there is provided a method of producing coloured watermarks that includes using a watermark applicator to which auxiliary coloured stock is supplied.

[0013] The watermark applicator may be a former.

[0014] According to a second aspect of the present invention there is provided a watermark applicator that includes a cylinder with an open structure (similar to the open body of a dandy roll) and covered with an embossed wire mesh.

[0015] Discrete embossings are applied to the mesh, the areas of the mesh within the embossings being permeable while the parts of the mesh between the discrete embossings are rendered impermeable to water.

[0016] According to a third aspect of the present invention there is provided a method of making security paper that includes the use of coloured auxiliary stock and in which the coloured auxiliary stock is concentrated only on the areas representing the watermark.

[0017] The watermark applicator cylinder may be in intimate contact with the pre-formed moist sheet leaving the forming section of the fourdrinier or cylinder mould. This, however, will not be the case for the open-draw fourdrinier process, nor when a former is used as an applicator.

[0018] According to a fourth aspect of the present invention there is provided a method of producing security paper that includes the use of concentrated stock for forming a watermark and in which the concentrated stock representing the watermark is transferred intact to the surface of a continuous paper web in discrete units, to then be carried into the press section of the paper ma-

chine where it is consolidated into the sheet structure by pressure and water removal.

[0019] In the method of the present invention, the watermark is totally formed by the watermark applicator and transferred to the continuous paper web after the fourdrinier and cylinder mould. As the watermark is formed solely by the watermark applicator, un-embossed wire-mesh can be used to cover the mould cylinder and the dandy roll. In this case, the dandy roll will be used solely to improve sheet formation. As mentioned above, coloured watermarks can be useful in providing additional security to a document against counterfeiting.

[0020] The production of non-coloured watermarks using the watermark applicator of the present invention can also provide advantages as follows:-

1) On the cylinder mould, the requirement for the number of embossings is greatly reduced giving savings in both time and cost.

2) The need to change the mould cover between different making orders is eliminated, thus giving savings in production time.

3) On the fourdrinier machine, it will generally be possible to produce watermarks of greater detail and clarity when compared with the dandy roll method of manufacture.

4) With the fourdrinier machine, it has been difficult to impart a watermark using stock that is highly fibrillated to achieve maximum paper strength - as in the case of currency paper. The method of the present invention enables clear watermarks to be achieved by supplying suitable auxiliary stock to the watermark applicator.

Brief Description of the Drawings

[0021]

Figure 1 is a simplified sectional view of a cylinder mould forming unit with the additional features of the present invention and with the first part of a press section,

Figure 1A shows a modification of the arrangement shown in Figure 1, such modification involving the introduction of a former adjacent the watermark applicator,

Figure 1 B shows another modification of the arrangement shown in Figure 1, such modification involving the use of a former to perform the function of the watermark applicator,

Figure 2 illustrates the watermark applicator of Figure 1,

Figure 3 is a sectional view of a suction pick-up from a fourdrinier forming unit with the additional features of the present invention followed by the first part of a press section, and

Figure 3A is a sectional view of an open draw web transfer from a fourdrinier forming unit with the additional features of the present invention followed by the first part of a press section.

Description of the Preferred Embodiments

[0022] Figure 1 represents a section through a conventional cylinder mould and the diameter is typically of the order of 1.4 metres. The plan view is not shown but the operating width of each component in the diagram may be about 1.8 metres in actual size.

[0023] In the paper making operation by this method, the moist web is transferred from the surface of the mould cylinder 1 by a couch roll 2 on to a continuous porous fabric 3. Under conventional conditions, the porous fabric 3 carrying the continuous web will be carried to the press section 5 by idling rolls represented by 4. From there it will continue on through further pressing and drying.

[0024] In the method of the present invention the watermarks are not formed from the surface of the mould cylinder 1, as would normally be the case, but by means of a watermark applicator represented by numbers 6, 7, and 8. Details of the watermark applicator are shown in Figure 2.

[0025] Dilute fibrous paper stock is fed to the watermark applicator at 10. This stock may be different from the main stock supplied to the mould cylinder at 9 although this is not necessarily so. Similar stock at 10 to the main supply at 9 would yield conventional watermarks. To obtain coloured watermarks, a different fibre stock, referred to as auxiliary stock, is prepared using pre-dyed fibres. This could be provided from repulped coloured or fluorescent papers. The auxiliary stock is diluted and dispersed in a separate system 19, and then pumped (at a consistency of about 0.3 to 0.9%) to the watermark applicator tray 7.

[0026] The cross-section of the watermark applicator is shown in Figure 2. It consists of an applicator cylinder 6 with an open structure that is covered by a wire-mesh. This cylinder is manufactured as would be a dandy roll. Before the wire-mesh cover is fitted, it is first embossed in the required watermark design, represented as 14. A significant feature of the method of the invention is that the wire-mesh cover is treated so that the un-embossed land area is rendered impermeable to the inflow of water. This may be achieved in a number of ways, e.g. by coating with latex, lacquer or a plastic material or by shrinking on a sleeve and exposing the embossings by "cut-outs". A stainless steel tray 7 receives the auxiliary stock through 10. The level in the tray 7 may be controlled by an overflow 8 or by a level control system (not shown).

[0027] The applicator cylinder 6 is shown (see Figure

1) in intimate contact with the continuous web supported by the porous fabric 3 backed by the light pressure of a couch roll 15. This contact causes the applicator cylinder surface to rotate at the speed of the continuous web. During this rotation, fibres from the auxiliary stock are concentrated in the watermark embossings by the inflow of water through the open mesh forming a moulded replication of the image. As the rotation proceeds, the watermark replicas are transferred to the continuous web in step with the spacing on the cylinder. They are then carried forward to the press section 5. Here, by pressure and water removal, the watermark replicas become completely bonded into the paper.

[0028] Water must be continuously removed from the inside of the applicator cylinder 6. This can be achieved by an open-end to the cylinder with an appropriate sealing arrangement (not shown) or, as in Figure 2, by means of a rotating joint carrying a siphon pipe 11 activated by a fan 12 and sealed by a drop-leg 13. The ends of the cylinder 6 are sealed.

[0029] It is common practice in many modern plant to introduce a forming unit (or former) that is arranged to operate in tandem with the mould cylinder. This arrangement is shown in Figure 1A, which illustrates the relative positions of the former 21, the watermark applicator cylinder 6 and the mould cylinder 1.

[0030] Figure 1 B shows an arrangement in which the former 21 performs the function of the watermark applicator of Figure 1. A stock supply header 22 receives auxiliary stock through a supply pipe 10 and the wire mesh covering the cylinder of the former 21 is watermark-embossed, with the un-watermark areas being blocked as described above. The watermark replicas are transferred directly on to the transfer fabric 3 and this couching process is aided by the application of a partial vacuum from a suction box 23. The watermark replicas are consolidated into the main sheet structure at the nip of the couch roll.

[0031] The parts of the apparatus shown in Figures 1A and 1B that correspond to the parts of the apparatus shown in Figure 1 are indicated by the same reference numerals as those used in Figure 1.

[0032] Similar technology applies to the fourdrinier process. As shown in Figure 3, the continuous web of paper is removed from the forming fabric 20 by means of a suction pick-up roll 16 and is carried forward by a continuous porous fabric 3, normally to the press section 5. According to the method of the present invention, the watermark applicator is interposed between the suction pick-up 16 and the first idling roller 4. The action of the watermark applicator is precisely the same as for the cylinder mould process and delivers watermark replicas that are taken to the press section 5 for consolidation into the paper web. The paper web at 18 continues on to be dried in the normal way, and the final paper will contain watermarks of the normal appearance or coloured, if coloured fibres are used in the watermark applicator.

[0033] Figure 3A shows an open-draw fourdrinier forming unit in which the web is transferred from the suction couch 16 to the press fabric 17 unsupported. With this arrangement, the watermark replicas are created on the surface of the applicator cylinder 6 in the manner described above, but they are then couched directly on to the transfer fabric 3. They are then combined and consolidated into the continuous paper web in the nip of the first press section 5. To aid the couching (transfer) process from the watermark applicator to the fabric 3, an inverted suction box (not shown) may be used either to replace the couch roll or in combination with the couch roll.

[0034] The parts of the apparatus shown in Figures 3 and 3A that correspond to the parts of the apparatus shown in Figure 1 are indicated by the same reference numerals as those used in Figure 1.

[0035] In order to avoid difficulties in printing the security paper with watermarks formed in accordance with the present invention, it is important to avoid undue thickness above the un-watermarked areas of the sheet. To this end it is advisable, firstly, to limit the embossing depths on the applicator wire mesh to a maximum of the order of 1.0 mm. Secondly, in order to increase the apparent density in the watermark areas, and thus selectively reduce the thickness in these areas, it is advantageous to use a wet smoothing press (an offset press) immediately following the (wet) press section.

Claims

1. A method of producing coloured watermarks that includes using a watermark applicator to which auxiliary coloured stock is supplied.

2. A method as claimed in Claim 1, in which the water mark applicator is a former.

3. A watermark applicator that includes a cylinder with an open structure (similar to the open body of a dandy roll) and covered with an embossed wire mesh.

4. A method as claimed in Claim 1, that includes the use of a watermark applicator as claimed in Claim 3.

5. A method as claimed in Claim 4, in which discrete embossings are applied to the mesh, the areas of the mesh within the embossings being permeable while the parts of the mesh between the discrete embossings are rendered impermeable to water.

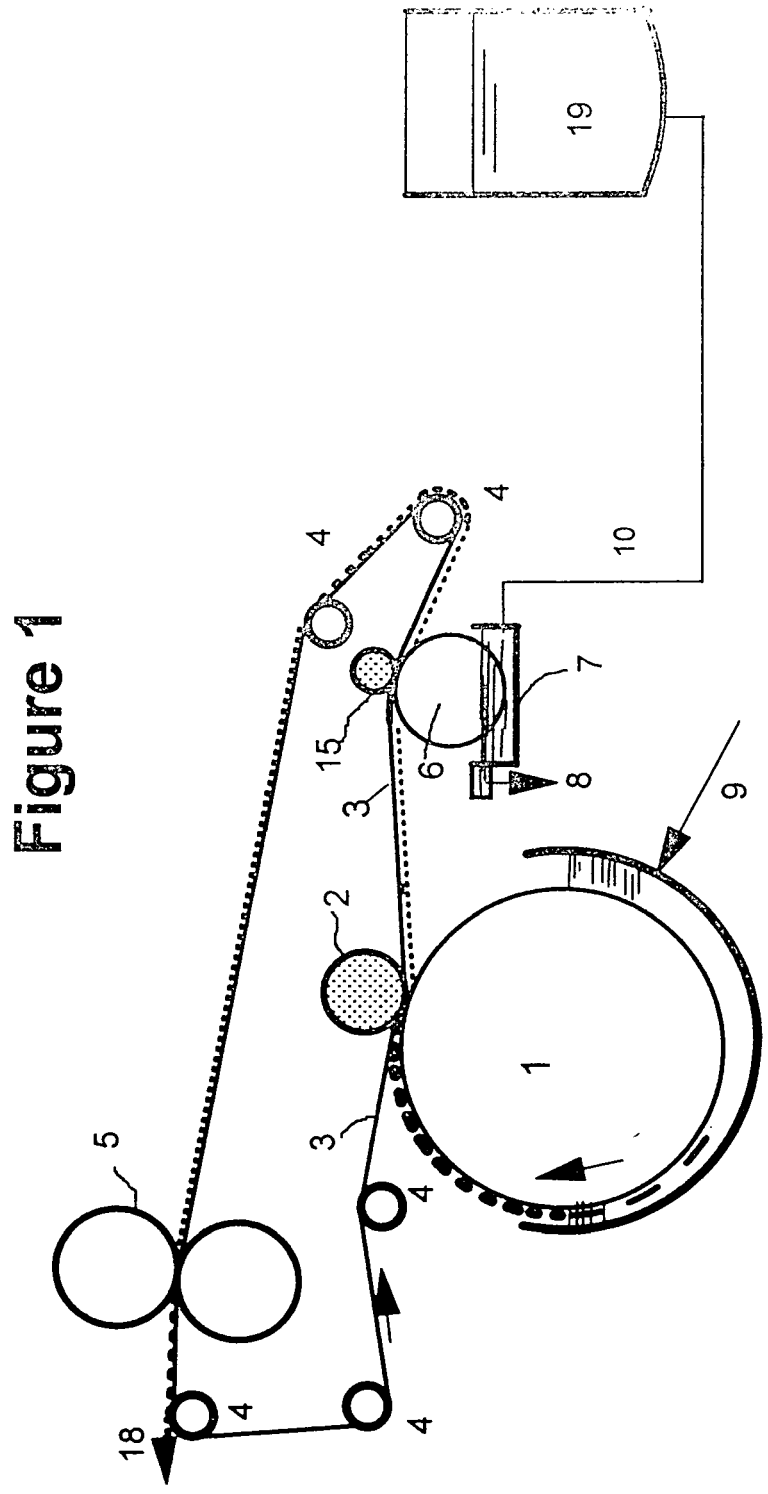
6. A method of making security paper that includes the use of coloured auxiliary stock and in which the coloured auxiliary stock is concentrated only on the areas representing the watermark.

7. A method as claimed in Claim 6, when carried out using the watermark applicator of Claim 3.

8. A method of producing security paper that includes the use of concentrated stock for forming a watermark and in which the concentrated stock representing the watermark is transferred intact to the surface of a continuous paper web in discrete units, to then be carried into the press section of the paper machine where it is consolidated into the sheet structure by pressure and water removal.

9. A method as claimed in Claim 8, when carried out using the watermark applicator of Claim 3.

Figure 1



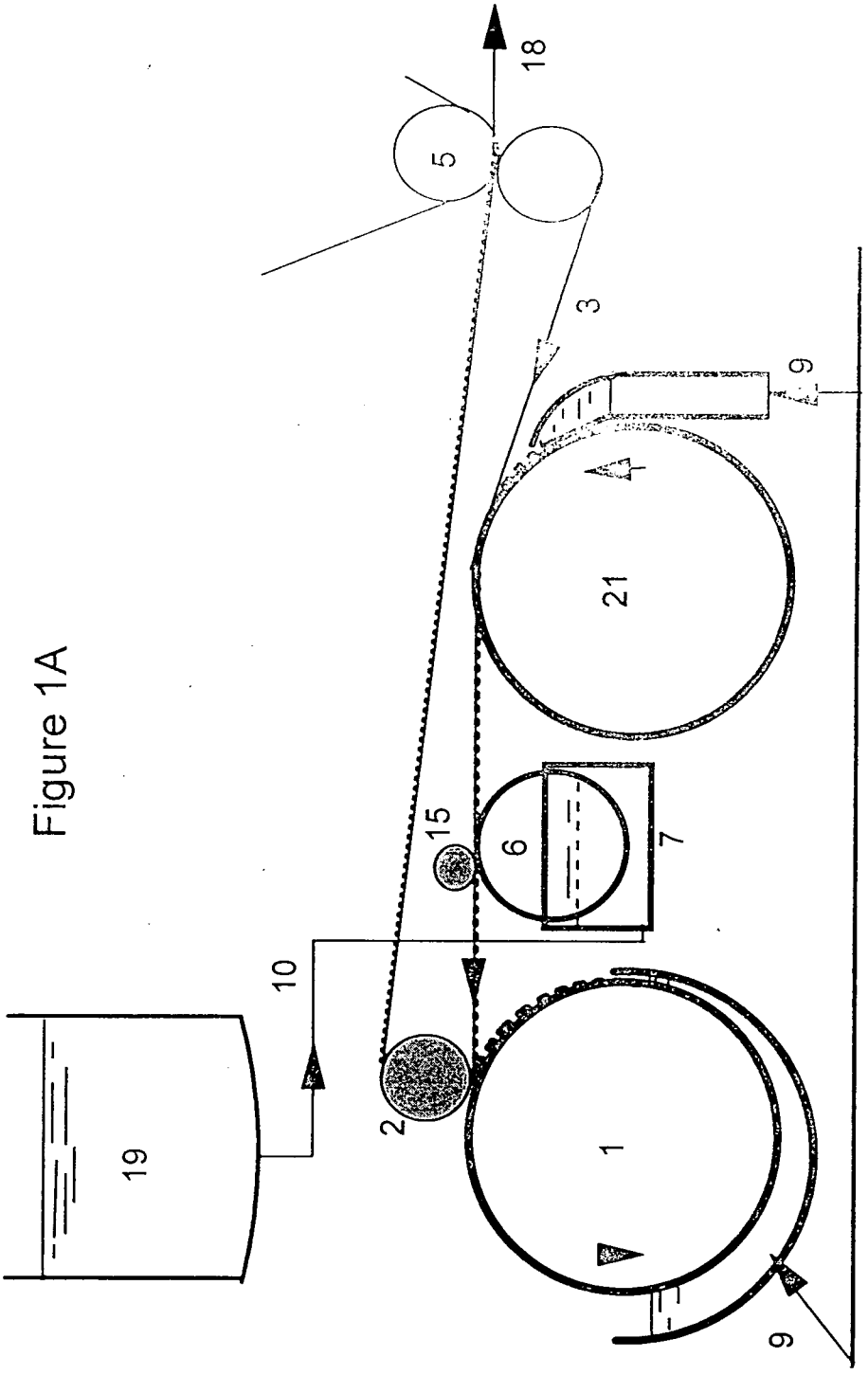


Figure 1A

Figure 2

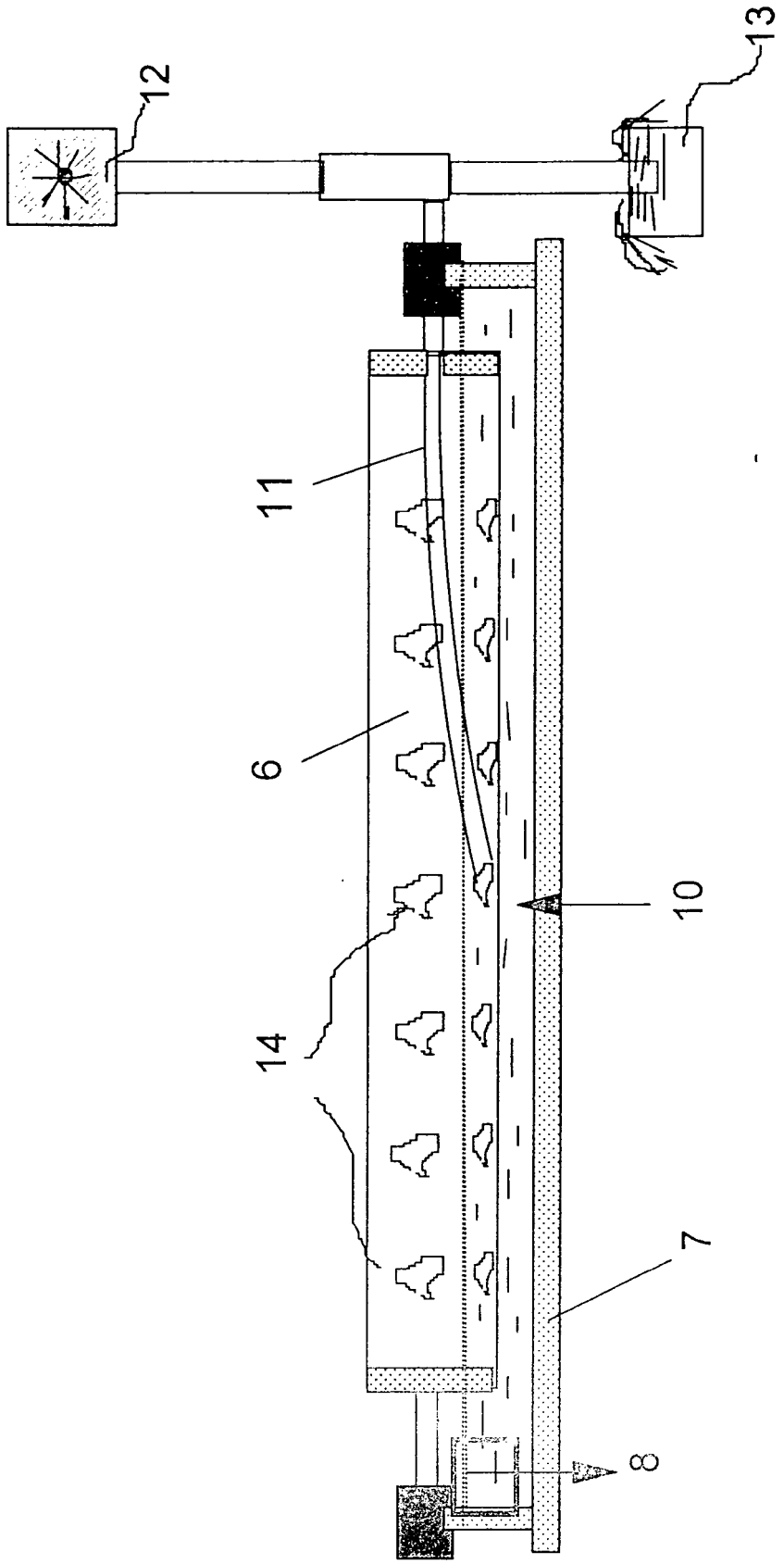


Figure 3

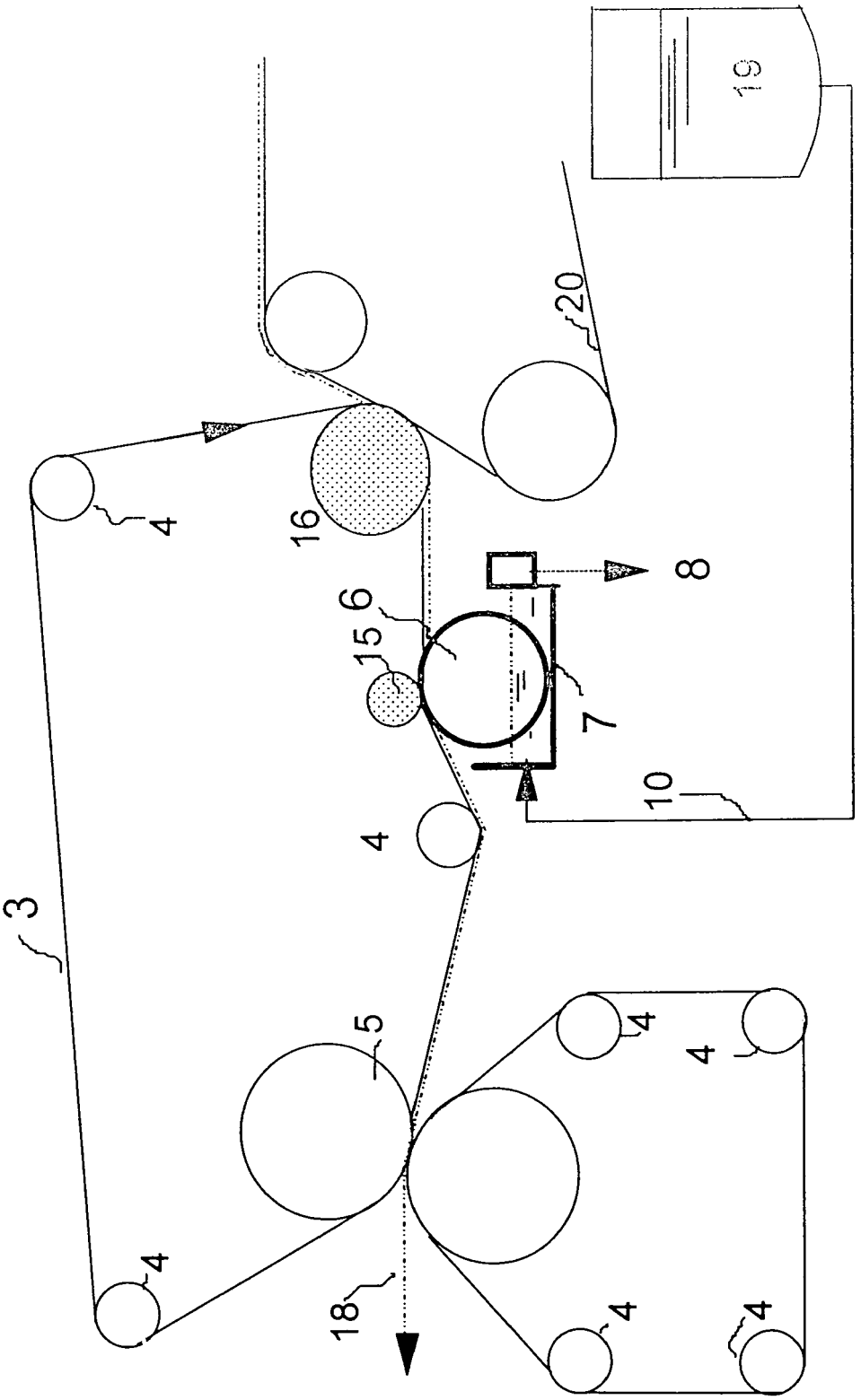


Figure 3A