

Device for wetting a carrier medium such as a paper web

The present invention relates to an apparatus for moisturizing a carrier medium, such as a paper web, a material web, a non-woven material web
5 or a fabric web or a knitted material web.

Such apparatuses are, for example, known from the EP 1450660 B1, the EP 1597993 B1 and from the WO 2010/072298.

10 While the apparatuses in accordance with the two mentioned EP documents are suitable for moisturizing paper webs by means of watery liquids, the apparatus in accordance with the mentioned WO document is intended for the moisturization by means of liquids having volatile components, such as alcohol, for the purpose of cleaning and/or sterilizing
15 hands of a surgeon or of a mechanic or of surfaces, for example in operating theatres or in clean rooms. Practical experience with the mentioned apparatuses has shown that they indeed satisfy their intended purpose and, in particular that it is possible to uniformly moisturize a paper web by means of a roller, in particular a grooved roller, without the wetted
20 paper web, which is relatively weak, tearing during the dispensing and/or the removal. The apparatus in accordance with the said WO document moreover avoids the occurrence of interfering evaporation losses also then when the liquid having volatile components is present in a bath over a longer period of time of days or weeks, into which bath the underside of
25 the grooved roller is immersed.

It is a little problematic having regard to the mentioned apparatuses, however, that these have a design which is demanding in effort and cost, in particular for the variant in accordance with the WO 2010/072298 in
30 which a sealed lid is required above the bath. Furthermore, in dependence

on the application, for example, for the moisturizing of toilet paper with water or the moisturizing of paper webs for the purpose of sterilization, different constructions are required such that different designs are required for the different purposes.

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The object of the present invention lies therein in providing a novel and compact apparatus for the moisturization of carrier media which can be used for different purposes of moisturization and with regard to different properties of the liquids, such as the viscosity or the volatility, by means
10 of only a few minor adaptations, which apparatus is relatively simple and cost-effective in its manufacture, but still enables a uniform, evaporation-free or at least substantially evaporation-free moisturization and avoids undesired losses of the liquid to be applied.

15 In order to emphasize the object on which the present invention is based it is also indicated that approximately 3 g of isopropanol have to be distributed onto the surface of the sheet of paper on use of a paper web having individual sections of approximately A4 size for the purpose of sterilization. This presents critical requirements on the dispensing of the liquid
20 when this has to be distributed full area-wise and to some extent uniformly on an A4-sized section.

However, it is not necessarily required to achieve an absolute uniform distribution of the liquid, since liquid applied point-wise onto the carrier
25 medium will distribute itself in a relatively short space of time both in the longitudinal direction and in the transverse direction for a strongly absorbing carrier medium. Nevertheless a regular dispensing of the liquid should take place in such a way that a comparatively uniform distribution is present directly after the discharge of the sections. An excess moisturi-
30 zation of the carrier medium has to be avoided by all means in most cases,

since wet positions can decrease the strength of the material web so far that an undesired tear of the web has to be feared for materials, such as paper.

5 In order to satisfy this object an apparatus for the moisturization of a carrier medium, such as a paper web, a material web, a non-woven material web, or a fabric web, or a knitted material web is provided in accordance with the invention having an injection unit comprising an elongate hollow member and/or an injection tube having an opening, preferably
10 having a plurality of openings spaced apart from one another in the longitudinal direction and comprising a pump connected to the elongate hollow member which pumps the moisturizing liquid through the elongate member and through the opening and/or the openings and hereby injects a single jet or multiple-jets into the carrier medium.

15 By means of this apparatus the jet is applied into the carrier medium or directly onto the carrier medium in a homogeneous and compact manner and indeed without a finely distributed spray mist arising during a spray process which leads to a loss of liquids. In this manner a controlled, completed atomization-free and completely evaporation-free or substantially
20 evaporation-free uniform liquid impingement onto different carrier medium results.

Furthermore, the carrier medium can hereby be impinged in a uniform
25 manner with a constant amount per unit area. Furthermore, none or only very small amounts of the contents of the liquid volatilizes during the impingement process. The carrier medium can always be impinged in a manner completely covering the surface thereof. The guidance of the carrier medium in the region of the injection unit allows the loss-free and
30 complete impingement of the same.

The carrier medium is guided through a suitable guide apparatus in accordance with the invention completely or partly around the elongate hollow body, this means around the injection tube without a defined spacing or at a defined spacing.

In this manner, the liquid can be brought into the carrier medium directly or can at least be brought substantially directly onto the carrier medium which likewise ensures that losses hardly arise.

The apparatus has an output mechanism which is, in particular arranged at the inlet side of the elongate hollow body and enables the collection of a sheet-like part, which can be output, of the web of the carrier medium in the wet state without a subsequent part being moisturized.

The output of the carrier medium is preferably controlled by means of an electronic pulse generator.

It is particularly advantageous when the elongate hollow member of the injection unit cooperates with a hollow slider which is configured for carrying out a relative movement with respect to the elongate hollow member which slider serves for a release and/or a closure of the said openings.

In this connection the slider can be arranged within or outside of the hollow member.

Furthermore, the slider can be configured for carrying out a linear movement or a rotational movement with respect to the elongate hollow member or a combined rotational and linear movement can take place.

It is not necessarily required that the slider moves, rather more the slider could be fixedly arranged and the elongate hollow member can be movably arranged for an opening and a closing of the said openings or both the slider and the elongate hollow member can be moved.

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Furthermore, the relative movement can be configured in such a way that the opening width of the openings can be controlled for metering the liquid dispensing.

- 10 Seals can be arranged between the slider and the elongate hollow member in order to avoid leaks, in particular in the closed state of the openings.

- It is particularly favorable when both the elongate hollow member and the slider are formed by a respective hollow tubular section, wherein one of
15 the hollow sections can have a longitudinal slot in the longitudinal direction.

- The openings of the elongate hollow member and/or the hollow tube can have an outline which is selected from the group comprising circular, oval,
20 elliptical, quadratic, rectangular, triangular and polygonal.

- The cross-sectional surfaces of the openings can be selected alike or different, the latter in particular then, when a uniform amount of liquid dispensed out of each opening should be compensated on a pressure decrease along the hollow tube by increasing the opening cross-section or
25 when a deliberate non-uniform liquid dispensing along the elongate hollow member is desired.

- The passages in the walls of the elongate member which open at the openings can have a form which, starting from the interior of the hollow sec-
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tions and going towards the outside, is selected from the group comprising converging, diverging, initially converging and subsequently diverging, initially converging and subsequently diverging, trumpet-shaped and vase-shaped. Such shapes can be generated without further ado by spark erosion, by electrochemical processing or by means of a laser beam or a water jet.

When the liquid is taken from a non-collapsible bottle, then a preferably controllable valve is installed in the line between the bottle and the injection unit which valve is opened by the pump for the liquid retrieval and output and enables an air supply into the bottle for a pressure compensation. In contrast to this, a thin walled bottle compressible by the environmental pressure, this means a collapsible bottle can be used in such a way that a breather valve is not required. The pump can possibly serve as an on/off valve.

The apparatus and/or the injection system can be used under stationary or mobile conditions.

The invention will be described in detail in the following by means of embodiments with reference to the drawings, in which is shown:

- Fig. 1 an apparatus in accordance with the invention in a sectional illustration;
- Fig. 2 an enlarged illustration of the hollow tube of the design in accordance with Fig. 1 in order to show the selectability of the length of the hollow tube;

	Fig. 3A to 3H	different possibilities of the arrangement of the openings of the hollow tubes;
5	Fig. 4	a plurality of alternatives for the circumferential shape of the opening;
	Fig. 5	different possible cross-sectional shapes of the passages which lead to the individual openings;
10	Fig. 6	a preferred design in accordance with the invention having a linear slider;
	Fig. 7	a further preferred design in accordance with the invention having a rotary slider;
15	Fig. 8A to 8D	different possible embodiments of a guide apparatus for a web-shaped carrier medium; and
20	Fig. 9A to 9F	show a preferred arrangement of the injection unit, wherein the Fig. 9A and Fig. 9B show the moisturization position of the injection tube, the Fig. 9C and Fig. 9D show the emptying position of the injection tube and the Fig. 9E and Fig. 9F show the sealing position of the injection tube each in a perspective view and in
25		an end view.

Fig. 1 shows an apparatus 10 in accordance with the invention for moisturizing a carrier medium 12, such as a paper web 12, a material web 12, a non-woven material web 12, a fabric web 12 or a knitted material web 12. The apparatus 10 has an injection unit 14 comprising an elongate

hollow member 16 having a plurality of openings 18 spaced apart from one another in a longitudinal direction of the hollow member 16. The apparatus 10 further comprises a pump 20 connected to the elongate hollow member 16 which pumps the moisturizing liquid through the elongate
 5 hollow member 16 and through the openings 18 and thereby injects the liquid into and/or onto the carrier medium 12.

The Fig. 1 shows a guide apparatus 24 in which the web-like carrier medium 12 is guided to the injection unit 14 from a carrier medium roller 30
 10 via deflection rollers 26, 28 in such a way that the carrier medium 12 can be completely or partly guided around the injection tube 16 at a defined spacing or without a defined spacing. This has the effect that the liquid 22 can be applied directly into or substantially directly onto the carrier medium 12. Following the moisturization of the carrier medium 12, this is
 15 guided through an output mechanism 32 and/or past an output mechanism 32. The output mechanism 32 is arranged at an inlet side 34 of the elongate hollow member 16 and enables the collection of a sheet-like part 12, which can be output, of the web of the carrier medium 12 in the moisturized and/or wetted state without a subsequent part of the carrier medium 12 being moisturized. A separation device 36 is provided at the out-
 20 put mechanism 32, which can comprise e.g. a blade 36, a toothed edge 36 or a cutting apparatus 36, in order to ensure the collection of the sheet-like part 12 of the web of the carrier medium 12 in the moisturized and/or wet state. The web of the carrier medium 12 can possibly be provided with
 25 a perforation or a different point of weakness, such as lateral incisions in order to simplify the tearing of individual sections 12.

The output mechanism 32 is preferably controllable by means of an electronic pulse generator 38. Thereby the desired amount of the liquid 22 to
 30 be output and/or the precise length of the carrier medium 12 to be mois-

turized, as well as the output speed of the carrier medium 12 can be set and/or regulated in a manner known per se by means of known control and regulation units 38. The output mechanism 32 can be connected to the pump 20 which can then simultaneously serve as an on/off mechanism for the liquid supply 22 to the output mechanism 32 and for the separation from a liquid supply 40. This can be achieved particularly well when the pump 20 is configured as a positive displacement pump 20.

The injection of the liquid 22 takes place by means of an injection unit 14 and is matched to the respective liquid 22 and the respective carrier medium 12 which are to be discharged. The concentration of certain components in the liquid 22 can be measured by means of a measurement unit 42 in the injection unit 14. If this sinks below a certain minimum value, e.g. following a longer period of stand still, the injection unit 14 is emptied before the dispensing onto the carrier medium 12 takes place. The renewed pressure increase and the liquid supply then take place again via the variable metering pump 20. The amount of liquid and the pressure are then regulated, as was previously the case, by means of the electronic control 38. By means of a selected matchable design of the pump 20, a plurality of different liquids 22 and a large range of dispensed amounts of liquid 22 per unit area of the carrier medium 12 can be covered, it is merely required to match the control of the pump 20 to the respective desired metering and/or the respectively used liquid 22. In this way a wide palette of applications can be covered in a cost-effective manner using a basic design. Also the length of the injection unit 14 can be easily matched in accordance with the respective desired width of the web of the carrier medium 12 without the design of the pump 20 itself having to be changed.

The dispensable liquid 22 can be sourced from the liquid supply 40, e.g. a non-compressible bottle 40, wherein a controllable valve 46 is used in the line 44 between the bottle 40 and the injection unit 14 which can be opened on the liquid retrieval and output due to the use of the pump 20.

- 5 The valve 46 can be connected to the liquid supply 40 by means of a line 48 which is provided between the valve 46 and the liquid supply 40 and in this way enables an air supply into the liquid supply 40 for a pressure compensation and/or a forced ventilation. The forced ventilation thus prevents the generation of a vacuum in the liquid supply 40. Alternatively,
- 10 the liquid supply 40 can comprise a thin-walled collapsible bottle 40 which can be compressed by the environmental pressure and in this way makes a ventilation line between the injection unit 14 and the liquid supply 40 obsolete. The injection system 14 is preferably designed closed and evaporation-safe. The liquid supply is closed off in front of the injection
- 15 unit 14 in the idle state by means of the valve 46. The injection unit 14 is configured in such a way that for a continuous, a cyclic and an acyclic operation, as well as during/following an idle time no loss of content arises and an ideal effect is present at any point in time. The valve 46 can also be arranged between the pump 20 and the liquid supply 40 and/or can be
- 20 integrated into the pump 20.

- The liquid 22 is injected at a pressure into the carrier medium 12 by means of a single jet or multiple jets. The jet is effected in a homogeneous (compact) manner into the carrier medium 12 or directly onto the carrier
- 25 medium 12. The apparatus 10 in accordance with the invention allows the controlled, complete, atomization-free and completely evaporation-free or substantially evaporation-free liquid impingement of different carrier media 12. The apparatus 10 allows the carrier medium 12 to be impinged uniformly with a constant amount of liquid 22 per unit area and that no
- 30 or only a very small amount of the contents of the liquid 22 can evaporate

during the impingement process. The carrier medium 12 is impinged with the liquid 22 in such a way that this distributes itself completely covering the surface of the carrier medium 12. The guidance of the carrier medium 12 in the region of the injection unit 14 permits the loss-free and complete
5 impingement of the same with a liquid 22. The carrier medium 12 is guided completely or partly around the injection tube 16 without a defined spacing or at a defined spacing. The injection system can be equipped with an electronic monitoring and reporting in order to indicate the filling level of the liquid level 22 and/or the still remaining amounts of carrier
10 medium 12 to a central (not shown) position by means of an interface 50, possibly a wireless communication option.

An emptying of the liquid, either the amount which is present in the hollow member 16 or also from the liquid supply 40 can take place through a
15 bleeder valve 52, when the used liquid 22 no longer satisfies certain minimum requirements, e.g. following longer idle times and/or because a best before date has been exceeded. Generally, the measurement apparatus 42 monitors concentration values for certain components of the liquid 22. Should these no longer correspond to the minimum requirements then the
20 bleeder valve 52 can be opened and the liquid 22 present in the hollow member 16 can in this way be emptied out at its ends 54. When the liquid supply 40 should be emptied then this can be indicated either at the apparatus 10 in accordance with the invention and/or by means of a data communication via the interface 50 to, e.g. an operating personal, in such
25 a way that these can then remove the liquid 22 via the bleeder valve 52.

The Fig. 2 is an enlarged illustration of the hollow tube 16 of the embodiment in accordance with Fig. 1. In this it is exemplified that the length of the hollow tube 16 can be freely selected and can be matched simply to
30 the desired width of the carrier medium 12.

As can be seen from the Fig. 3 the openings 18 of the hollow member 16 can be arranged in at least two rows about the longitudinal axis of the elongate hollow member 16 and/or can have different outlet angles for the liquid 22 in the longitudinal direction of the elongate hollow member 16 and/or are in radial planes with respect to the said longitudinal axis. The outlet angle is preferably oriented away from the output roller 30 in such a way that the output roller 30 at least substantially conveys a dry material web 12.

The Fig. 4 shows different alternatives for the shape of the outline of the openings 18 of the elongate hollow member 16. The shape of the outline of an opening 18 can be selected circular, oval, elliptical, quadratic, rectangular, triangular and polygonal. The precise shape of the opening 18 is generally selected in such a way that this allows an as good as possible distribution of the liquid 22 at and/or into the carrier medium 12. It would also be possible to provide different sizes and/or shapes of the openings 18 along the hollow member 16 in such a way that e.g. smaller openings 18 are provided at the edge of the hollow member 16, rather than in the middle of the hollow member 16. In other words, the cross-sectional area of the openings 18 along a hollow member 16 can be selected in such a way that these are either alike or different.

The Figs. 5A to 5H show that the passages 56 in the walls 58 of the elongate hollow member 16 which open at the openings 18 have a shape which, starting from the interior of the elongate hollow member 16 and going towards the outside, is selected from the group comprising converging, diverging, initially converging and subsequently diverging, initially converging and subsequently diverging, trumpet-shaped and vase-shaped. This different form of the passages 56 enables a more precise setting of

the distribution of the liquid 22 which exits from the openings 18 and is brought into contact with the carrier medium 12.

As is shown in Fig. 6 the elongate hollow member 16 of the injection unit
5 14 can be configured in order to cooperate with a hollow slider 60 which hollow slider 60 is configured for carrying out a relative movement with respect to the elongate hollow member 16. This relative movement serves for a release and/or a closure of the said openings 18. The slider 60 of Fig. 6 is arranged within the elongate hollow member 16 could, however, in
10 comparison be arranged outside of the elongate hollow member 16. To open and to close the opening 18 the elongate hollow member 16 could be fixedly arranged and the slider 60 could be movably arranged.

Alternatively the slider 60 could be fixedly arranged and the elongate hollow member 16 could be movably arranged. It could also be possible that
15 both the slider 60 and the elongate hollow member 16 are movable. Independent thereof of how the relative movement between the slider 60 and the hollow member 16 is brought about, this relative movement between the slider 60 and the elongate hollow member 16 can preferably be carried
20 out in such a way that the opening width of the openings 18 can be controlled for metering the liquid dispensing. Both the elongate hollow member 16 and the slider 60 of the Fig. 6 are respectively formed by a hollow tubular section, wherein one of the hollow tubular sections can have a longitudinal slot in the longitudinal direction, this means it can be of C-
25 shaped design.

The Fig. 7 shows a variant of a slider 60 which is configured for the outputting of the liquid 22 in such a way that it is configured for a rotational movement with respect to the elongate hollow member 16. However, it
30 would also be plausible to provide a slider 60 which combines the linear

movement of the slider 60 of Fig. 6 with the rotational movement of the slider 60 of Fig. 7 and in this way is configured for carrying out a combined rotational and linear movement. Seals 62 are arranged between the slider 60 and the elongate hollow member 16 in order to avoid leaks, in particular in the closed state of the openings 18 for all the variants of sliders 60 listed in this context.

Figs. 8A to 8D show the guidance of the carrier medium 12 past the elongate hollow member 16 which is configured for the output of the moisturizing liquid 22. Fig. 8A shows that the carrier medium 12 is guided to the hollow member by means of three deflection rollers 26, 28, 64 in a rest position of the apparatus 10 in accordance with the invention. A movable deflection roller 66 is present spaced apart from the hollow member 16 in a rest position. The Fig. 8B shows how this movable deflection roller 66 can be brought from its rest position into an active position during the activation of the apparatus 10 in order to guide the carrier medium 12 into direct contact with the hollow member 16.

The Fig. 8C shows a perspective top view onto the hollow member 16 in which the movable deflection roller 66 is present in an active position and the carrier medium 12 to be moisturized is guided past the openings 18 of the hollow member 16 to the output mechanism 32. Fig. 8D shows a side view of the apparatus 14 in accordance with Fig. 8C.

The apparatus 10 in accordance with the invention can be used in stationary conditions or mobile conditions. The minimum volume of the injection unit 14 depends on the amount of the carrier medium 12 to be moisturized and at a minimum amounts to 4000 m³ respectively 4 ml. The system pressure can vary between +0.005 bar and +15.00 or more. The carrier medium 12 is impinged uniformly and areally with a certain regu-

latable amount of liquid 22 by means of the injection tube 16. The output amount of liquid is determined by the system pressure, the arrangement, the design and the construction of the outlet opening 18, as well as by the volume(s) of the injection tube(s) 18.

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The outlet opening(s) 18 of the injection tube(s) 16 is/are designed in such a way that the adhesive/cohesive behavior of the liquid 22 during a pressure-free state and/or a rest state completely or partly prevents an exit or evaporation of the same. The arrangement of the outlet openings 18 is

10 symmetric, asymmetric or both in dependence on the properties of the liquid 22. The shape of the outlet openings 18 per injection tube 16 can be implemented uniformly or mixed depending on the properties of the liquid 22. The sidewalls 56 of the outlet opening 18 can be linear, convex, concave or mixed. The inlet and outlet edge of the opening 18 can taper, can

15 be provided with a radius or can be chamfered. The diameter of the outlet opening 18 can be different at the inlet and at the outlet. The inner diameter of the narrowest part of the outlet opening 18 can range from 0.005 mm to 2.00 mm or more. The narrowest or widest position of the outlet opening 18 can be arranged centrally or deviating downwardly or up-

20 wardly. Inlet and outlet angles of the outlet opening 18 can be different. The dispensing angle of the dispensing openings 18 can be at a right angle or in a deviating angular position with respect to the injection tube 16.

E.g. a paper web 12 can be used as a carrier medium 12 which weighs

25 between 10 g/m² and 200 g/m² this can be impinged with 5 ml/m² up to 100 ml/m² liquid 22.

With reference to the Figs. 9A to 9F a very particularly preferred embodiment will now be discussed.

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A first position of the injection tube 16 of an injection unit 14 in accordance with any one of the foregoing Figures, in particular in accordance with the Fig. 7, is shown in the Fig. 9A to 9B for the moisturization of the material web 12 with liquid 22, this means for the injection of the liquid
5 22 into the material web 12. The injection tube 16 is turned during the moisturization against the medium 12 to be moisturized in such a way that the outlet openings 18 are aligned in that direction. In this position the jet is incident at approximately "right angles" on the material web 12 arranged in the direct vicinity of the injection tube and preferably contact-
10 ing the injection tube. For this purpose the injection tube 16 is rotatably stored and is automatically turned between the different positions explained in connection with the Figs. 9A to 9F by means of an electric servo motor (not shown), a magnetic switch having a plurality of switching positions (not shown) or a similar drive (not shown).

15 The Figs. 9C and 9D show a second position of the injection tube 16 of the injection unit 14 in which the injection tube 16 is downwardly arranged for the purpose of the injection and/or emptying. This means that the injection tube 16 is turned about the central longitudinal axis A into a
20 position in which the jet of the liquid 22 can exit downwardly into the "free space". This position is selected for cleaning purposes and for an insufficient density of the liquids 22 which can, for example, arise due to evaporation losses. Also in this case, the control takes place automatically can, if desired, however, also be triggered by the user. The liquid 22 can be
25 caught in a suitable container (not shown).

The Figs. 9E and 9F show a third position of the injection tube 16, of the injection unit 14 in which the injection tube 16 is rotated into a stop position in which the injection tube 16 is closed and/or sealed against a liquid
30 dispensing. In this connection the injection tube can be closed and/or

sealed by a stationary hollow tube 68 partly gripping around the injection tube 16. This means that the injection tube 16 is turned into a "rest position" following the successful moisturizing process. In this position the outlet openings 18 of the injection tube 16 are closed and/or are sealed by a "contact" (hollow tubular section, bar-shaped part or seal).

The stationary hollow tubular section 68 can be provided with an elongate section which enables the moisturization of the material web 14 and the emptying of the injection tube 16 in the first and second position in an unhindered manner. Instead of using a hollow tubular section 68 partly gripping around the injection tube 16 a bar-shaped part can be arranged in parallel to the injection tube 16 which takes on the corresponding function, this means the closure of the opening and/or the openings 18 of the injection tube 16. Furthermore, the support present on the injection tube 16, can be arranged stationary or movable regardless of whether it is formed by a hollow tubular section 68 or by a bar-shaped part. Movable in the sense that it can be rotated both about the longitudinal axis A or stored in a fixed manner and can also be moved to and fro.

Independent thereof which arrangement is selected, this means whether a stationary hollow tubular section 68 gripping around the injection tube 16 or whether a movable hollow tubular section 68 (which would also be possible) partly gripping around the injection tube 16 or whether a bar-shaped termination part is selected, a complete seal or at least a high quality seal can be achieved by means of suitable seals 70.

The shape and design of the seal 70 can be arbitrarily selected. It can, for example, be realized by a squashable plastic strip which is adhered within the section 68 partly gripping around the injection tube 16 such that the opening and/or the openings 18 in the injection tube 16 are completely

- bridged in the third position and for this reason seals this or can be formed by individual O-rings which respectively surround an outlet opening 18 in the injection tube 16 in the third position of the same. On use of a bar-shaped termination part also an elongate plastic strip 70 or O-rings
- 5 70 can be used or the termination part 68 itself can be formed from an elastic material and in this way take on the sealing function. The cross-sectional shape of the seal 70 can, for example, be oval, rectangular, circular or quadratic.
- 10 The injection tube 16 of the Figs. 9A to 9F can also be positioned in an axially fixed manner when the hollow tubular section 68 partly gripping around the injection tube 16 is movably arranged and is turned about the longitudinal axis of the injection tube 16 and/or is guided along the longitudinal axis A of the injection tube 16. Such an axial displacement then
- 15 comes into question when the hollow tubular section 68 is e.g. provided with slots running over a part of the circumference of the hollow tubular section 68 which in the first position align with the openings 18 of the injection tube 16 but in the third position do not align with the openings 18 and in this way achieve a seal. The hollow tubular section 68 can also
- 20 be designed both rotatable and movable in such a way that a rotation and a displacement of the hollow tubular section 68 can take place.

List of reference numerals

	10	apparatus
	12	carrier medium
5	14	injection unit
	16	hollow member
	18	openings
	20	pump
	22	liquid
10	24	guide apparatus
	26	deflection roller
	28	deflection roller
	30	carrier medium roller
	32	output mechanism
15	34	inlet side
	36	separation apparatus
	38	pulse generator
	40	liquid supply
	42	measurement unit
20	44	line
	46	valve
	48	line
	50	interface
	52	valve
25	54	end
	56	passage
	58	wall
	60	slider
	62	seal
30	64	deflection roller
	66	deflection roller
	68	hollow tubular section
	70	seal
35	A	longitudinal axis

Claims

1. An apparatus (10) for moisturizing a carrier medium (12), such as a paper web, a material web, a non-woven material web or a fabric web or a knitted material web, having an injection unit (14) comprising an elongate hollow member (16) having an opening (18), preferably having a plurality of openings (18) spaced apart from one another in the longitudinal direction, and comprising a pump (20) which is connected to the elongate hollow member (16) and which pumps the moisturizing liquid (22) through the elongate hollow member (16) and through the opening (18) or the openings (18) and hereby injects a single jet or a multi-jet into the carrier medium (12).
2. An apparatus (10) in accordance with claim 1, characterized in that a guide apparatus (24) is provided which guides the carrier medium (12) into the direct region of the injection unit (14).
3. An apparatus (10) in accordance with claim 2, characterized in that the guide apparatus (24) is configured for guiding the carrier medium (12) completely or partly around the injection tube (16) at a defined spacing or without a defined spacing.
4. An apparatus (10) in accordance with any one of the preceding claims, characterized in that the liquid (22) can be applied directly into or at least substantially directly onto the carrier medium (12).
5. An apparatus (10) in accordance with any one of the preceding claims, characterized in that an output mechanism (32) is provided which is arranged at the hollow member, in particular at the inlet side (34) of the elongate hollow member (16) and enables the collec-

tion of a sheet-like part (12), which can be output, of the web the carrier medium (12) in the wet state without a subsequent part (12) being moisturized.

- 5 6. An apparatus (10) in accordance with any one of the preceding claims, characterized in that the output mechanism (32) can be controlled by means of an electronic pulse generator (28).
- 10 7. An apparatus (10) in accordance with any one of the preceding claims, characterized in that the elongate hollow member (16) of the injection unit (14) cooperates with a hollow slider (60) which is configured for carrying out a relative movement with respect to the elongate hollow member (16) which slider serves for a release and/or for a closure of the said openings (18).
- 15 8. An apparatus (10) in accordance with claim 7, characterized in that the slider (60) is arranged inside of or outside of the elongate hollow member (16).
- 20 9. An apparatus (10) in accordance with claim 7 or claim 8, characterized in that the slider (60) is configured for carrying out a linear movement or a rotational movement with respect to the elongate hollow member (16) or is configured for carrying out a combined rotational and linear movement.
- 25 10. An apparatus (10) in accordance with any one of the claims 7 to 9, characterized in that for opening and closing the said openings (18) either the elongate hollow member (16) is fixedly arranged and the slider (60) is movably arranged or the slider (60) is fixedly arranged

and the elongate hollow member (16) is movably arranged or both the slider (60) and the elongate hollow member (16) can be moved.

11. An apparatus (10) in accordance with any one of the claims 7 to 10,
5 characterized in that the relative movement of the slider (60) and of the elongate hollow member (16) can be carried out in such a way that the opening width of the openings (18) can be controlled for metering the liquid dispensing.
- 10 12. An apparatus (10) in accordance with any one of the claims 7 to 11, characterized in that seals (62) are arranged between the slider (60) and the elongate hollow member (16) in order to avoid leaks in particular in the closed state of the openings (18).
- 15 13. An apparatus (10) in accordance with any one of the claims 7 to 12, characterized in that both the elongate hollow member (16) and the slider (60) are formed by a respective hollow tubular section, wherein one of the hollow tubular sections can have a longitudinal slot in the longitudinal direction, this means it is of C-shaped design.
- 20 14. An apparatus (10) in accordance with any one of the claims 7 to 13, characterized in that the openings (18) of the elongate hollow member (16) and/or of the hollow tube (16) have outlines which are selected from the group comprising circular, oval, elliptical, quadratic,
25 rectangular, triangular and polygonal.
15. An apparatus (10) in accordance with any one of the claims 7 to 14, characterized in that the cross-sectional surfaces of the openings (18) are selected alike or different.

16. An apparatus (10) in accordance with any one of the claims 7 to 15,
characterized in that the passages (56) in the wall (58) of the elongate hollow member (16) which open at the openings (18) have a shape which, starting from the interior of the elongate hollow section (16) and going towards the outside, is selected from the group comprising converging, diverging, initially converging and subsequently diverging, initially converging and subsequently diverging, trumpet-shaped and vase-shaped.
- 10 17. An apparatus (10) in accordance with any one of the claims 7 to 16,
characterized in that the liquid (22) can be output from a non-collapsible bottle (40) and a controllable valve (46) is installed in the line (48) between the bottle (40) and the injection unit (14) which valve is opened by the pump (20) on the retrieval of liquid and on
15 the output of liquid and which enables an air supply into the bottle (40) for a pressure compensation.
18. An apparatus (10) in accordance with any one of the claims 7 to 16,
characterized in that a thin-walled bottle compressible by the environmental pressure, this means a collapsible bottle (40), is used.
- 20 19. An apparatus (10) in accordance with any one of the preceding claims, characterized in that the pump (20) serves as an on/off valve for the liquid supply and separation from a supply container (40).
- 25 20. An apparatus (10) in accordance with any one of the claims 7 to 15,
characterized in that the openings (18) are arranged in at least two rows about the longitudinal axis of the elongate hollow member (16) and/or have different outlet angles for the liquid (22) in the longitu-

dinal direction of the elongate hollow member (16) and/or are arranged in radial planes with respect to the said longitudinal axis.

21. An apparatus (10) in accordance with at least one of the preceding
5 claims, characterized in that the injection tube (16) can be moved between at least two positions, a moisturizing position and a sealing position and preferably also into an emptying position.