United States Patent

Heijnis et al.

[15] **3,698,355**

[45] **Oct. 17, 1972**

[54] **APPARATUS FOR COATING AND/OR IMPREGNATING A SHEET MATERIAL**

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[22] Filed: **Nov. 17, 1969**

[21] Appl. No.: **877,140**

[30] **Foreign Application Priority Data**

Nov. 29, 1968 Netherlands.....6817090

[52] **U.S. Cl.** **118/411**, 118/410, 118/313

[51] **Int. Cl.**.....**B05c 3/00**

[58] **Field of Search**.....118/410, 411, 412, 216, 313; 117/7

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[57] **ABSTRACT**

A sheet being passed through a slit-shaped channel in a metering device is contacted on one or more sides with a coating and/or impregnating agent which is supplied through one or more feed openings in the walls of the channel. The size of the feed openings may be adjusted to vary the distribution of the coating and/or impregnating agent, and the contour of the slit-shaped channel may be adjusted e.g., to vary the pressure build-up within the channel.

2 Claims, 3 Drawing Figures

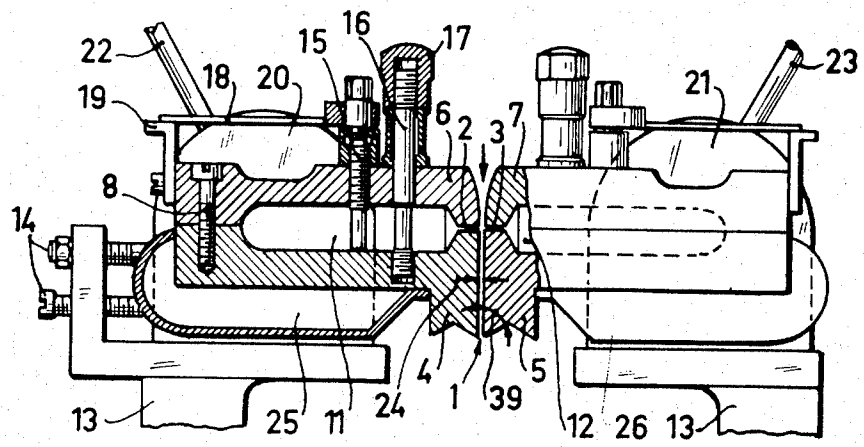


FIG. 1

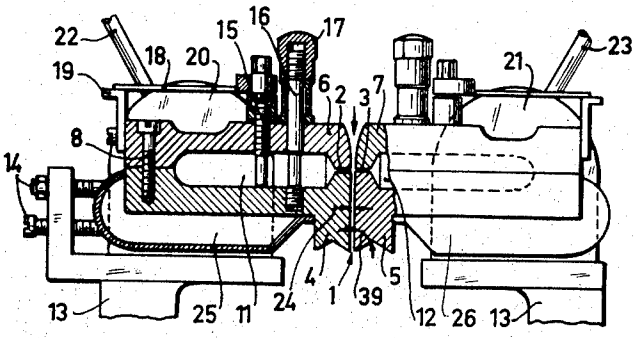


FIG. 2

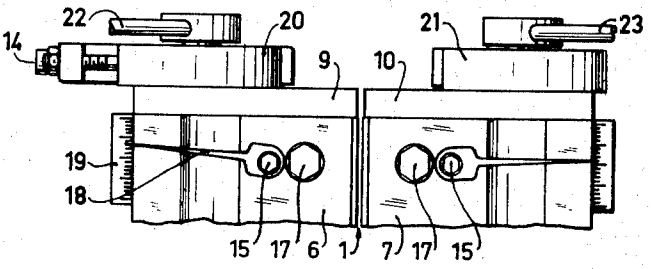
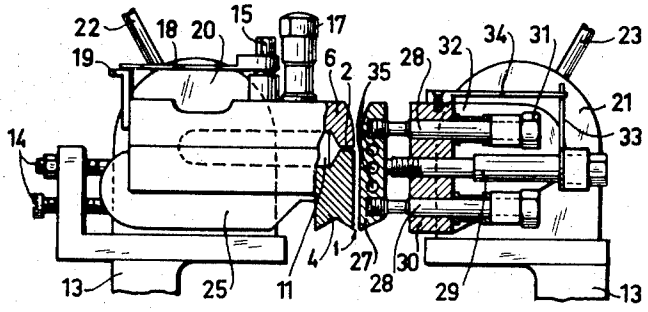


FIG. 3



APPARATUS FOR COATING AND/OR IMPREGNATING A SHEET MATERIAL

The present invention relates to an apparatus for coating and/or impregnating a sheet material. The sheet material is passed through a slit-shaped channel of a metering device in which a liquid coating and/or impregnating agent is supplied through one or more feed openings in the walls of the channel to one or both sides of the sheet material.

This general coating device of forming laminated or impregnated articles is known in the prior art, for example, Swiss Patent Specification No. 381,851. In this prior art method, two or more layers of a sheet material can be coated and/or impregnated on both sides and then the layers are pressed against each other. In this process, each layer of sheet material is passed through a slit shaped channel having a passage of constant height in which the coating and/or impregnating agent is applied to the layer. The liquid treating agent is supplied to the layers from openings in the channel walls with these openings being connected to a supply channel for the treating agent. This known method has the disadvantage that the distribution of the amount of treating agent across the width of the sheet material cannot be varied to compensate for fluctuations in the local take-up of the treating agent into the sheet material. Depending on the manner in which the sheet material is formed, the take-up of the treating agent may vary appreciably across the width of the sheet material, for example, in the case where the sheet material exhibits differential density across its width. Moreover, in this known method, the total amount of coating or impregnating agent to be applied can be controlled only by changing the supply pressure at the beginning of the feed channel which communicates with the feed openings. Also, the prior art device is not adaptable to obtain special effects by applying in predetermined manner to localized areas of the sheet material an increased amount of coating or impregnating agent.

It is a principal object of the present invention to provide an apparatus for coating and/or impregnating sheet material which do not have the aforementioned drawbacks of the prior art procedure. In accordance with the present invention, the amount of treating agent for coating and/or impregnating the sheet material may be adjusted by varying the size of the feed openings leading to the channel through which the sheet material passes for the purpose of either varying the total amount of treating agent supplied and/or the distribution of the treating agent across the width of the sheet material. By varying the size of the various feed openings, it is possible to ensure that the amount of treating agent flowing through each opening can be set in conformity with the requirements to be satisfied by the product. Thus, during a production run it may be decided, depending upon the results of visual and other evaluations of the evenness and appearance of the coated and/or impregnated sheet, to adjust the size of the feed openings across the sheet. In this manner, incorrect distribution of the treating agent can be remedied quickly and easily. Such adjustment of the feed openings will in general be necessary where the treating agent distribution has changed as a result of a different sheet material being treated or as a result of the sheet material exhibiting different thickness or density. In the latter situation, the total amount of treating agent supplied should be adjusted to compensate for such difference.

In the practice of the invention, favorable results are obtained if the pressure drop across the feed openings is at least 0.1 kg/cm², and preferably from 1 to 2 kg/cm². By adjusting the feed opening(s) so that the magnitude of the outflow resistance is in the above range, it is found that variations in the resistance to the passage through the impregnating channel of the sheet material have hardly any appreciable influence on the amount of the treating agent. The reason for this is that variations in resistance to the passage of the sheet through the impregnation channel are of a far lower magnitude than the outflow resistance of the treating agent so that these outflow resistances determine the amount of treating agent which issues from the feed openings.

The sheet material used in the practice of the invention preferably is formed of a sheet which substantially consists of threads or a fiber mass. The sheets may be composed of continuous filaments or fibers of thread-forming polymers such as polyamides such as nylon, polyesters such as polyethylene terephthalate, polyvinyl compound such as polyvinyl chloride, polyolefins such as polyethylene and polypropylene, cellulose derivatives, glass fibers, mineral fibers, etc.

In embodiments in which the treating material is supplied to both sides of the sheet material, it is particularly effective if the treating agent is supplied at exactly opposite points on both sides of the sheet material. This method is of particular importance if coating or impregnating agents with different properties are used on opposite sides of the sheet material. This may be the case if the two sides of the final product are intended to have different functions. Moreover, this method permits the choice of having on the sides of the sheet material different adjustments of both the amounts and outflow resistances of the treating agent. This is of particular importance where different treating agents are used, or when it is envisaged to influence the depth of penetration of the treating agent into the sheet material. Depending on the intended end use of the product, the serviceability of the product is determined by mechanical properties, for instance, its flexibility. These properties may be influenced by the depth of penetration of the treating agent.

According to a presently preferred very effective embodiment of the invention, the coating or impregnating agent is fed through slotted feed openings which extend across the entire width of the sheet material. The shape of the slotted feed openings which may be adjusted is capable of ensuring a substantially uniform distribution of the treating agent across the width of the sheet material. The feed opening slots extend in the transverse direction of the metering channel preferably with the adjustable slots in the channel walls positioned exactly opposite each other, and with means for independently adjusting the opening of each slot, for example, by adjustable bolts which may exert a push or pull on elastically deformable wall portions.

In accordance with another aspect of the invention, the metering device of the invention is provided with means for adjusting the sectional area of the slit-shaped channel in which the sheet material is coated or im-

pregnated. By means of adjusting members, the walls of the channel may be caused to take positions substantially parallel, converging or diverging with respect to each other. This aspect of the invention is of particular importance because it enables an adjustment of the pressure build-up within the coating or impregnating channel. When the walls of the channel converge in the direction of travel of the sheet material, the sheet material is subjected to a rapid increase in pressure just as it enters the zone of the feed slots. Air entrapped in the sheet material is driven out before the liquid treating agent which flows through the adjustable slots reaches and penetrates the sheet material in order to ensure uniform penetration across the width of the sheet material. The air can escape in a direction opposite to the feed direction of the sheet material. By changing the sectional area of the slit-shaped channel, it is possible to extend the zone of pressure build-up and also to influence the magnitude of this pressure build-up.

In accordance with another embodiment of the invention in which the treating agent is supplied to only one side of the slit-shaped channel. The members for adjusting the sectional area of the channel may be provided on the opposite side of the channel and distributed across its width to cause elastic deformation of this wall of the channel so that the shape of the channel may as much as possible be adapted to the cross sectional shape of the sheet material. In this way, the desired distribution pattern of the treating agent from its feed slot which extends across the width of the channel is maintained as much as possible while the treating agent is taken up by the sheet material. Consequently, the ratio of the amount of the treating agent to the amount of the sheet material may be maintained nearly constant across the entire width of the sheet material.

The above and other objects, features and advantages of the invention will become more apparent from the following description of the accompanying drawing wherein like reference numerals are utilized to designate like parts throughout the several views.

FIG. 1 is an elevational view partly in section of one embodiment of the present invention.

FIG. 2 is a partial plan view of the embodiment of FIG. 1.

FIG. 3 is an elevational view partly in section of another embodiment of the invention in which the treating agent is supplied to only one side of the sheet material and in which the shape of the sectional area of the slit-shaped channel is adjustable across its width.

Referring now to the drawing, and more particularly to FIG. 1, reference numeral 1 designates a slit-shaped channel through which the sheet material to be treated is passed downwardly in the direction indicated by the arrow. Within the channel an impregnating agent is supplied to both sides of the sheet material via slots 2 and 3 in opposite sides of the channel. The slots 2 and 3 extend across the full width of the walls of the slit-shaped channel 1 with the slots being bounded by lower slit walls 4 and 5 and upper slit walls 6 and 7. In this embodiment, the walls 4 and 6 which bound slot 2 are separate parts which are clamped together by bolts 8. However, it is not necessary that these walls be separate parts, and the same may be said for the walls 5 and 7 which bound the slot 3. Although the direction of flow of the impregnating agent from slots 2 and 3 is at right angles to the longitudinal direction of the channel 1, this is not essential. For instance, the longitudinal axes of the slots and the inlet portions of the metering channel may be at an acute angle to each other.

Each end of the slot 2 is bounded by a flat plate 9 which is pressed against the side faces of the wall parts 4 and 6 by means not shown to form a hermetic seal. Similarly, each end of the slot 3 is bounded by flat plates 10 which are pressed against the side faces of the wall parts 5 and 7 to form a hermetic seal.

An impregnating agent is fed to the slot 2 from a channel 11 which is bounded by the slit wall parts 4 and 6 and the two plates 9, with the impregnating agent being fed to the channel through an inlet from a suitable source which is not shown. The wall parts 4 and 6 and the two end plates 9 constitute an integral unit which is pivot-mounted in supports 20. The supports may be accurately displaced relative to a stationary frame 13 for the purpose of adjusting the width 24 of the channel 1.

Adjustment of the height of slot 2 is achieved by bolts 15 which have a fine screw thread to enable close adjustment. A bolt 16 is fixedly screwed in the wall part 5 of the slit wall so that by turning the nut 17 on bolt 16 the wall parts 4 and 6 which define the slot 2 are moved either nearer together or farther apart. The elasticity of the wall parts 4 and 6 is chosen so that over the set height of the slot 2 the wall parts 4 and 6 will not be subject to plastic deformation. Adjustment of the height of slot 2 is carried out by first turning the bolt 15 to a setting constituting the chosen height which can be read by means of a pointer 18 and a scale 19, followed by turning the nut 17 to adjust the distance between the wall parts 4 and 6 until the bottom of bolt 15 contacts the wall part 4.

Adjustment of the height of the slot 3 is effected in the same way. The wall parts 5, 7 and the two end plates 10 similarly constitute an integral unit which is pivot-mounted in supports 21 which are fixedly mounted on the frame 13.

By adjusting the height of slots 2 and 3 as described above, a desired distribution of the impregnating agent across the width of channel 1 may be obtained. The elastic deformation of the wall parts 4, 5, 6 and 7 ensures that the height of the slots varies along a flowing line across this length. With the aid of levers 22 and 23 operatively associated with supports 20 and 21, the position of the walls of channel 1 may be changed so that these walls assume a parallel, a converging or diverging position relative to each other.

It is preferred that the ends of the wall parts 4 and 5 adjacent the discharge end of channel 1 be bevelled to an acute angle 39. The angle 39 should preferably be from 45 to 60° and serves to prevent the impregnating agent being left at the ends of the channel where it could decompose or repenetrate into the channel.

Heat exchange jackets 25 and 26 are provided to keep the wall parts 4 – 7 at the desired temperature.

FIG. 3 illustrates another embodiment of the present invention in which impregnating agent is fed to only one side of the sheet material via a slot 2. The other side of the channel 1 is constituted by a wall 27 which is elastically deformable across the width of the channel 1. A number of draw bolts 28 are distributed over the

width of channel 1 and are screwed into the wall 27. The draw bolts 28 can move freely in a bridge 30 and are provided with nuts 31 and spacing sleeves 32 engaging the rear side of the bridge 30. A plurality of set screws 29 are threadably connected in the bridge 30. To adjust the cross sectional shape of the channel 1, set screws 29 are turned to the desired position as indicated by pointers 33 and scales 34. Then, with the aid of the nuts 31 and the bolts 28, the wall 27 is drawn into contact with the ends of the set screws 29. The elastic deformation of the wall 27 allows a flowing sectional shape of the channel to be achieved. For temperature regulation, a heat exchange medium may be passed through bores 35 in the wall 27.

Although preferred embodiments of the invention have been shown and described with particularity, it will be appreciated that various modifications may be made therein without departing from the scope and spirit of the invention.

What is claimed is:

1. Apparatus for applying a fluid treating material to a sheet material comprising a plurality of wall parts defining a split-shaped channel through which the sheet material is passed, at least one of said wall parts being provided with at least one feed opening through which the fluid material for treating said sheet material is fed, said feed opening being in the form of a slot which extends in a direction transverse to the travel of the sheet material and being formed between one of two wall portions which is elastically deformable and a plurality of independent adjustable bolts engaging said deformable wall portion to permit deformation thereof for locally adjusting the slot along its length.

2. An apparatus for coating and/or impregnating a sheet material such as webs of filaments or fibers, which apparatus has

a slit-shaped channel through which the sheet material may be passed,

one or two channel walls being provided with a slotted feed opening through which a treating agent may be supplied, characterized in that along the slit-shaped channel there are provided several independently adjustable means for locally varying the free outlet area of the passage of a feed slot, said adjustable means consisting of

independently acting nuts which are screwed on bolts for causing a pull or push to be exerted on elastically deformable slot walls.

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