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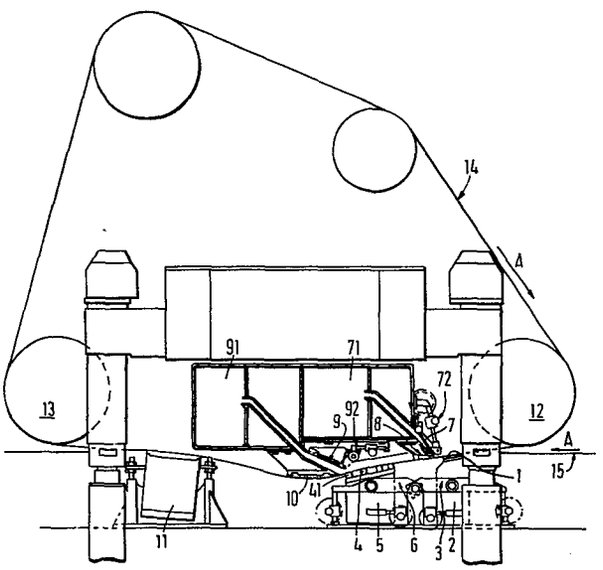
(54) Paper-forming machine.

(57) In a twin wire paper forming machine an endless top wire (14) passes round a lead-in roll (12) and meets a bottom wire (15) in the region of a lead-in-foil cover (1). The two wires pass over a secondary foil cover (4) which presents alternately solid and open areas to create pulsating pressure on stock between the wires, and then below a secondary trailing cover (10) whose leading edge doctors water on the top wire into an autoslice (9), and the top wire (14) is separated from the bottom wire (15) in the region of a sheet transfer box (11) to pass round a drive roll (13) and return to the lead-in roll. The leading edge of the transverse bars (41) or blades of the secondary foil cover (4) doctor water off the bottom wire. The secondary foil cover (4) and the secondary trailing cover (10) establish successively sharper downwardly forwardly and upwardly forwardly convex paths for the wires which promote dewatering. A primary trailing cover (8) and a primary autoslice (7) can additionally be disposed above the top wire between the lead-in-foil cover (1) and the secondary foil cover (4). The lead-in-foil cover and the secondary foil cover can form parts of a composite adjustably mounted unitary structure.



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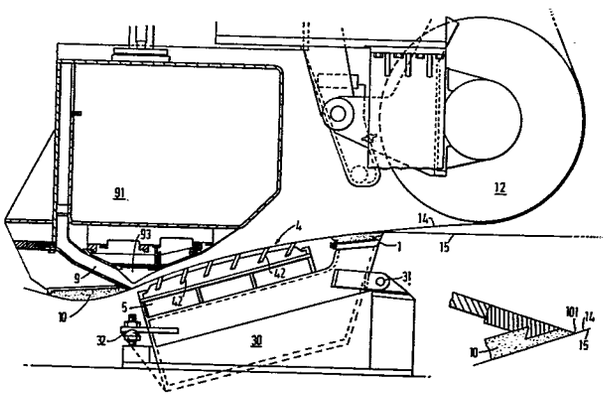
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DESCRIPTION

"IMPROVEMENTS IN OR RELATING TO PAPER FORMING MACHINES"

The present invention relates to twin wire paper forming machines and in particular to dewatering apparatus therefor.

In a two-wire paper forming machine a bottom wire passes over a lead-in-foil and moves along a path towards and over a sheet transfer box. In the region of the lead-in-foil an endless top wire after passing round a lead-in roll is brought into contact with the top wire and is subsequently separated from the bottom wire in the region of the transfer box and is passed round a drive roll whence it returns to the lead-in roll. Stock on the bottom wire is contained between the top and bottom wires and water is expelled from the stock during passage of the wires between the lead-in-foil and the sheet transfer box.

In some twin wire paper forming machines a contact element has been provided above the path of the wires between the lead-in-foil and the sheet transfer box to promote dewatering. Water expelled has fallen under gravity and dewatering has been further promoted by providing the contact element or cover with a discontinuous wire engaging surface with or without suction to promote dewatering in an upward direction. However, such discontinuous surface has in practice had the disadvantage that slots or perforations forming the discontinuous surface could become plugged or blocked under certain conditions especially when used in conjunction with groundwood stock with a high fines content thereby decreasing the dewatering action and creating operating problems and rendering the production of high quality, and even uniform quality, paper difficult to attain.

According to the present invention there is provided a twin wire paper forming machine in which a bottom wire passes over a lead-in-foil and over a sheet transfer box downstream therefrom, and an endless top wire which turns over a lead-in roll and meets the bottom wire in the region of the lead-in-foil cover and is separated from the bottom wire in the region of the sheet transfer box to pass over a drive roll and return to the lead-in roll, and the bottom wire passes over a secondary foil cover which is disposed downstream of the lead-in-foil cover and has alternately solid and open bottom wire engaging areas and the top wire passes below a trailing cover which is disposed downstream of the secondary foil cover and has a continuous top wire engaging surface of which the leading edge serves to doctor water on the top wire into a secondary autoslice.

Preferably the leading edge of the sheet transfer box is immediately upstream of the point where the top wire is separated from the stock retained on the bottom wire.

The sheet transfer box preferably has a slotted or perforated cover and a vacuum is created therein so that suction is applied to the stock before and after the point of separation of the top and bottom wires which is somewhere midway of the slotted or perforated suction area.

Preferably the lead-in-foil cover has a curved surface and the tension of the wires presses the two wires together to start a first dewatering action. The lead-in-foil can have as wire engaging surface either a blank or continuous cover or a slotted cover. The slotted cover can be used with or without a vacuum created in the box below it. In the former case, when the cover can be, for example, a ceramic, only upward dewatering results, whilst in the latter case both upward and downward dewatering takes place.

The alternating solid and open areas of the secondary foil cover give rise to pulses which are beneficial to paper formation. These alternating solid and open areas can be created by a series of transverse bars or transverse blades: either arrangement imparts a pulsating pressure to the wires to expel water alternately upwardly and downwardly. A short contact time between the bottom wire and each bar or blade gives a pressure pulse to the stock which is beneficial to good paper formation.

The downward flow doctored from the bottom wire by the leading edges of the foil strips or bars, or blades, forming the secondary foil cover may be encouraged by introducing a vacuum into the secondary foil box below the cover. The water pushed upwardly through the top wire is doctored off it by the leading edge of the secondary trailing cover into the secondary autoslice and upwardly into a secondary chamber or saveall, preferably with vacuum assistance.

The secondary trailing cover is preferably blank, that is to say, it presents a continuous top wire engaging surface, and therefore stock that is pressed between the two wires is now dewatered in a downward direction. The secondary trailing cover is preferably ceramic, but can equally well be of any material conventionally used for static wire contacting elements used in a paper machine former. The radius of curvature of the secondary trailing cover is preferably smaller than that of the secondary foil cover in order to increase the pressure on the stock between the wires. The sheet transfer box preferably has a convex surface and has a vacuum applied thereto to assure transfer of the sheet of paper to the bottom wire.

Whilst all the water expelled upwardly can be doctored by the leading edge of the secondary trailing

cover and withdrawn by the secondary autoslice, a further or primary trailing cover and a further or primary autoslice can be provided above the top wire intermediate the lead-in-foil and the secondary foil cover. The primary trailing cover is preferably solid or blank, that is to say, it presents a continuous top wire engaging surface, and is preferably convex. The doctored water removed by the primary trailing cover proceeds into a primary autoslice chamber or saveall, preferably with light vacuum assistance.

The lead-in roll is provided with upward and downward movement. The lead-in-foil and secondary foil are provided with an adjusting mechanism which enables them to be moved up and down and to rotate with respect to the wire line.

Preferably means are provided for increasing or reducing the width of the opening of the or each autoslice. The or each autoslice is preferably inclined with respect to the wire line and preferably at an acute angle with respect thereto.

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

Fig.1 is a general sectional elevational view of a twin wire paper forming machine according to one embodiment of the invention,

Fig.2 is a detail of the machine of Fig.1 to a larger scale,

Fig.3 is a detail sectional elevation generally corresponding to Fig.2 of part of a twin wire paper forming machine according to a second embodiment of the invention, and

Fig.4 is a detail view of part of the secondary trailing cover of both the embodiments of Figs. 1 and 2, and of Fig.3, to a larger scale.

Referring first to Figs. 1 and 2, a twin wire paper forming machine comprises an endless top wire 14 entrained around rolls, including a lead-in roll 12 and a drive roll 13. The top wire 14 meets a bottom wire 15 over a convex lead-in-foil cover 1 of a lead-in-foil body 2. The wires move in a direction indicated by the arrows A. The curved surface of the lead-in-foil cover 1 and the tension of the wires press the two wires together and start a first dewatering action of stock interposed between the two wires. Where a blank cover is employed for the lead-in-foil such cover presents a continuous wire engaging surface and only upward dewatering will occur in that region. Where a slotted cover is employed both upward and downward dewatering will take place there.

A primary trailing cover 8 is positioned inside the top wire downstream of the lead-in-foil and is blank and presents a continuous top wire engaging surface. A primary autoslice 7 is disposed upstream of the primary trailing cover 8 and a leading edge of the primary trailing cover 8 serves to doctor water off the top wire 14 and into the primary autoslice 7. The doctored white water proceeds into the autoslice chamber or saveall 71 assisted by light vacuum in the chamber. The primary trailing cover is preferably convex.

A secondary foil cover 4 is disposed downstream of the primary trailing cover 8 adjacent the bottom wire 15. The secondary foil cover 4 is convex and comprises a series of spaced apart foils 41 which extend across the width of the wires. The alternating solid and open spaces of the cover generate pulses in the stock as it moves over the cover. This has a beneficial action to paper formation. The alternating pulses cause the stock between the wires to be dewatered both upwards and downwards. The downward flow is doctored from the

bottom wire by the leading edges of the foils 41, and this downward flow can be encouraged by introducing vacuum into the secondary foil box 5.

A secondary trailing cover 10 is disposed downstream of the secondary foil cover 4 and adjacent the top wire 14. A secondary autoslice 9 is disposed upstream of the secondary trailing cover 10 and a leading edge 101 (see Fig.4) of the secondary trailing cover 10 doctors water pushed up through the top wire by the secondary foil cover 4 into the secondary autoslice 9. This upward flow goes into a secondary chamber or saveall 91 and is assisted by a vacuum created in the chamber 91.

After having passed over the convex secondary foil cover 4 the two wires are pressed against the secondary trailing cover 10 which is blank, that is to say, it presents a continuous top wire engaging surface, so that the stock is pressed between the two wires and is now dewatered in a downward direction. The radius of curvature of the secondary trailing cover 10, which can be a ceramic or any material conventionally used for static wire contacting elements used in a paper machine former, is smaller than that of the secondary foil cover 4 whereby to increase the pressure on the stock between the wires. After their contact with the convex secondary trailing cover 10 the bottom wire comes into contact with the perforated surface of a sheet transfer box 11 within which a vacuum is created. Due to the resultant suction applied through the bottom wire to the paper sheet, transfer of the paper sheet to the bottom wire is ensured. The top wire separates from the sheet in the region of and preferably approximately centrally over the transfer box 11.

The lead-in roll 12 is provided with upward and downward movement which permits the top wire 14 to

cover or uncover the lead-in-foil 1. Increasing the area covered increases the drainage whilst decreasing the area decreases the drainage. The lead-in-foil cover 1 and the secondary foil cover 4 are provided with adjustable mounting as at 3, 6 respectively enabling the covers to be moved up and down and rotated with respect to the wire line.

The primary and secondary autoslices 7, 9 are provided with an adjusting mechanism as at 72, 92 respectively for increasing or decreasing the width of the autoslice opening.

Referring now to Fig.3, in a twin wire paper forming machine according to a second embodiment of the invention, the lead-in-foil body 2 and the secondary foil body 5 are combined in a unitary structure 30. The bottom wire 15 passes over the lead-in-foil cover 1, which in this embodiment is blank or continuous and convex, and there meets the top wire 14 after passing round the lead-in roll 12. Downstream of the lead-in-foil cover is the secondary foil cover 4 which comprises a plurality of spaced blades 42, preferably about six as shown, extending transversely across the width of the wires. The blades 42 in combination establish a generally convex path for the wires and present alternately solid and open bottom wire engaging areas. Downstream of the secondary foil cover is a secondary trailing cover 10 which is solid, that is to say, it presents a continuous wire engaging surface, and establishes a further generally convex path for the wires. Upstream of the secondary trailing cover is the secondary autoslice 9 leading to the secondary autoslice chamber or saveall 91. Downstream of the secondary trailing cover 10 the wires pass along a path similar to that shown in Fig.1 to the sheet transfer box 11 which is not shown in Fig.3.

During passage of the wires over the lead-in-foil 1 a first dewatering of stock between the wires occurs and water is expelled in an upward direction, followed by expulsion in both upward and downward directions. The radius of curvature of the path over the secondary foil cover 4 is preferably shorter than that of the lead-in-foil cover 1, and, similarly, that of the secondary trailing cover 10 is shorter than that of the secondary foil cover 4: the combined action of all these wire contact elements is to press the wires towards one another and thereby press the stock therebetween to expel water therefrom.

Whilst passing over the secondary foil cover 4, the successive action of the blades 42 and the open spaces therebetween is to subject the wires to a pulsating pressure which expels water successively upwardly and downwardly. Water expelled downwardly through the bottom wire is doctored by the leading transverse edge of each of the bars 42 and descends under gravity.

Whilst water expelled upwardly through the top wire during passage of the wires over the secondary foil cover 4 collects above the top wire, it is doctored by the leading edge 101 (see Fig.4) of the secondary trailing cover 10 and flows through the secondary autoslice 9 into the secondary autoslice chamber or saveall 91 with vacuum assistance.

The unitary structure 30 comprising the lead-in-foil body 2 and the secondary foil cover body 4 is pivotally mounted at 31, and adjusting means 32 are provided whereby the position and angle of inclination can be set as desired. The secondary autoslice 9 is provided with an interchangeable mouthpiece 93 whereby the width, and if necessary, the shape of the opening, can be changed as may be desired in order to obtain optimum operating conditions in removal of all the

doctored water without inclusion of excessive air therewith. Such mouthpiece 93 may conveniently be of a high density plastics polymer such as polyethylene.

Similarly, the secondary trailing cover 10 may be interchangeable, and may be of ceramic or of any material conventionally used for static wire contacting elements used in a paper machine former. Likewise, each of the blades 42 of the secondary foil cover may be of ceramic or stainless steel, alone or covered or tipped with tungsten carbide.

The leading edge 101 of the secondary trailing cover 10 beneficially doctors off any fibres from and has a cleaning action on the upper surface of the top wire 14. Moreover, the top wire 14 has a reciprocal cleaning action on the secondary trailing cover 10.

A twin wire paper forming machine embodying the present invention can have the advantage that upward dewatering is done only by means of at least one autoslice; autoslices are excellent at removing water and highly resistant to plugging. The inclination of the autoslice channel enables the speed of the dewatered stock imparted by the wires to be used to move the water into an autoslice chamber or saveall. The high water speeds in the channel promote cleanliness, and the speed of the stock carries the water upwards into the chamber or saveall, thus requiring at best only a small amount of vacuum assistance. The upward and downward pressure pulses imparted on the two wires can improve the formation of the paper produced. The adjustment provided permits use of the forming machine for a wide range of paper making applications, and renders it suitable for high and low speed and for producing both heavy and light weight paper. During all the twin wire paper formation process, the wires are in contact with stationary

elements only such as foils and covers. No rolls are in contact with the wires during the process of dewatering, and this is especially valuable at high speeds where vibration is avoided, and also at all speeds as problems caused by unclean rolls can be avoided. Having static elements only in contact with wires during the process of dewatering is especially beneficial when producing paper which must be free from pinholes. The dewatering capacity of a twin wire paper forming machine can be high as a result of the use of lead-in-foil cover and a secondary foil cover. The continuous increase of curvature of the path of the wires contributes to an increase in the dewatering capacity of the twin wire paper forming machine. Sheet transfer can be excellent due to vacuum transfer on the transfer box and due to the initial action of downward dewatering created by the secondary trailing cover.

CLAIMS

1. A twin wire paper forming machine in which a bottom wire passes over a lead-in-foil and over a sheet transfer box downstream therefrom, and an endless top wire which turns over a lead-in-roll and meets the bottom wire in the region of the lead-in-foil cover and is separated from the bottom wire in the region of the sheet transfer box to pass over a drive roll and return to the lead-in roll, characterised in that the bottom wire (15) passes over a secondary foil cover (4) which is disposed downstream of the lead-in-foil cover (1) and has alternately solid and open bottom wire engaging areas, and the top wire (14) passes below a trailing cover (10) which is disposed downstream of the secondary foil cover (4) and has a continuous top wire engaging surface of which the leading edge (101) serves to doctor water on the top wire into a secondary autoslice (9).

2. A twin wire paper forming machine as claimed in claim 1, characterized in that the secondary foil cover (4) comprises a series of foils (41) extending transversely across the path of the wires (14,15) and spaced from one another in the direction of movement of the wires.

3. A twin wire paper forming machine as claimed in claim 1, characterised in that the secondary foil cover (4) comprises a series of blades (42) extending transversely across the path of the wires (14,15) and spaced from one another in the direction of movement of the wires.

4. A twin wire paper forming machine as claimed in claim 3, characterized in that each of the blades (42) is inclined at an acute angle to the direction of movement of the wires such that its leading edge can

doctor water off the under surface of the bottom wire (15).

5. A twin wire paper forming machine as claimed in any of claims 1 to 4, characterised by means for creating a vacuum in a box (5) below the secondary foil cover (4).

6. A twin wire paper forming machine as claimed in any of claims 1 to 5, characterised by means for creating a vacuum in a secondary chamber or saveall (91) above the top wire (14) and with which the secondary autoslice (9) is in communication.

7. A twin wire paper forming machine as claimed in any of claims 1 to 6, characterised in that the secondary trailing cover (10) is blank and presents a continuous wire engaging surface to the top wire (14).

8. A twin wire paper forming machine as claimed in any of claims 1 to 7, characterised in that the secondary foil cover (4) establishes a downwardly forwardly convex path for the wires (14,15) and the secondary trailing cover (10) establishes an upwardly forwardly convex path for the wires (14,15).

9. A twin wire paper forming machine as claimed in claim 8, characterised in that the radius of curvature of the convex path established by the secondary trailing cover (10) is smaller than that established by the secondary foil cover (4).

10. A twin wire paper forming machine as claimed in claim 2 and in any of claims 5 to 9, characterised in that a further primary trailing cover (8) and an associated primary autoslice (7) are disposed above the top wire (14) downstream of the lead-in-foil (1) and upstream of the secondary foil cover (4).

11. A twin wire paper forming machine as claimed in claim 10, characterised by means for creating a vacuum in a primary autoslice chamber or saveall (71)

above the top wire (14) and with which the primary autoslice (7) is in communication.

12. A twin wire paper forming machine as claimed in claim 10 or 11, characterised in that the primary trailing cover (8) is blank and presents a continuous wire engaging surface to the top wire (14).

13. A twin wire paper forming machine as claimed in any preceding claim, characterised in that the lead-in-foil cover has a curved wire engaging surface.

14. A twin wire paper forming machine as claimed in claim 13, characterised in that the lead-in-foil cover (1) is blank and presents a continuous wire engaging surface to the bottom wire (15).

15. A twin wire paper forming machine as claimed in claim 13, characterised in that the lead-in-foil cover (1) has a slotted cover, and means are provided for creating a vacuum in a lead-in-foil box (2) below the lead-in-foil cover (1).

16. A twin wire paper forming machine as claimed in claim 3 or 4, or in claim 3 and in any of claims 5 to 15, characterised in that the lead-in-foil cover (1) and the secondary foil cover (4) form part of a composite unitary structure (30) which is adjustably mounted (31,32).

17. A twin wire paper forming machine as claimed in any preceding claim, characterised by interchangeable means (93) for varying the width and/or shape of the inlet opening of the secondary autoslice (9).

18. A twin wire paper forming machine as claimed in any preceding claim, characterised in that the secondary trailing cover (10) is interchangeable.

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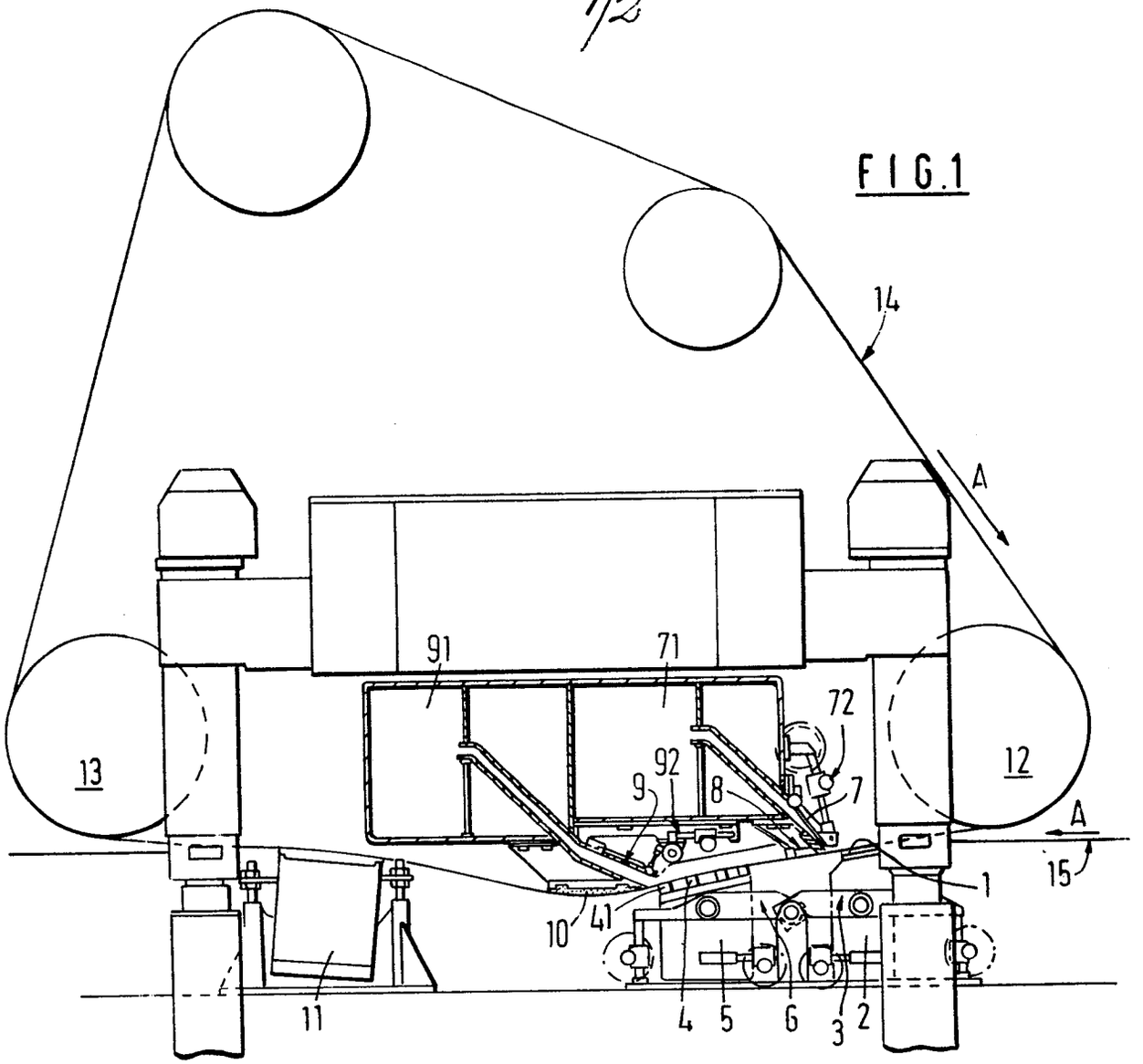
FIG.1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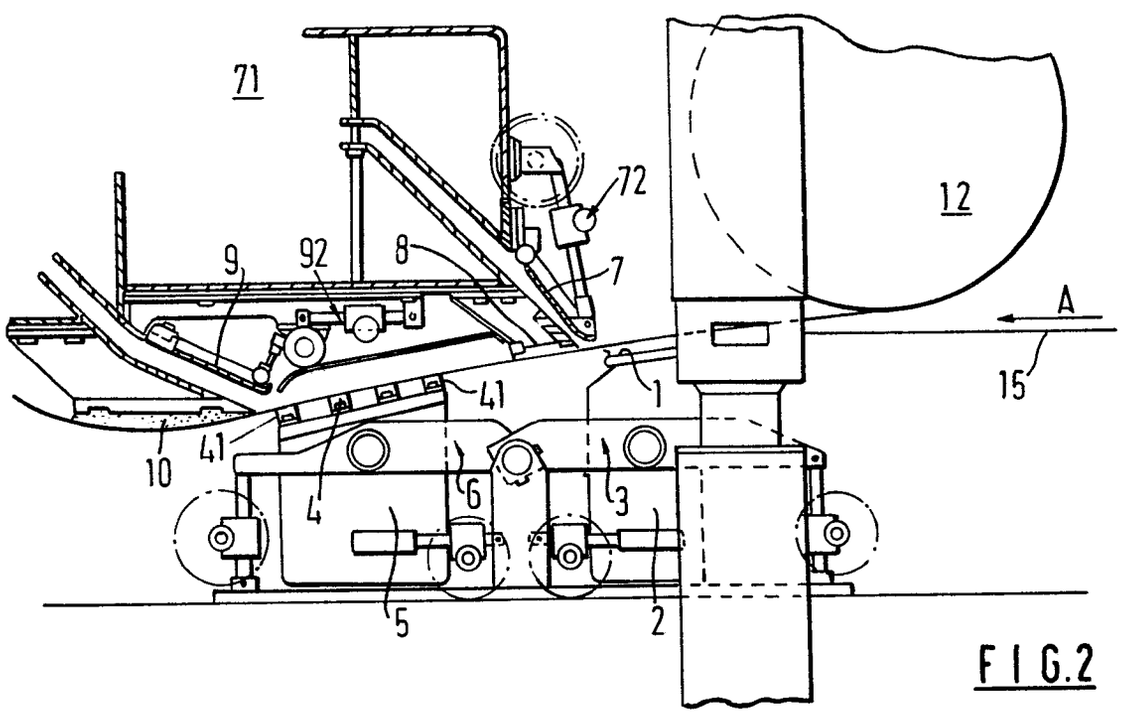
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FIG.2

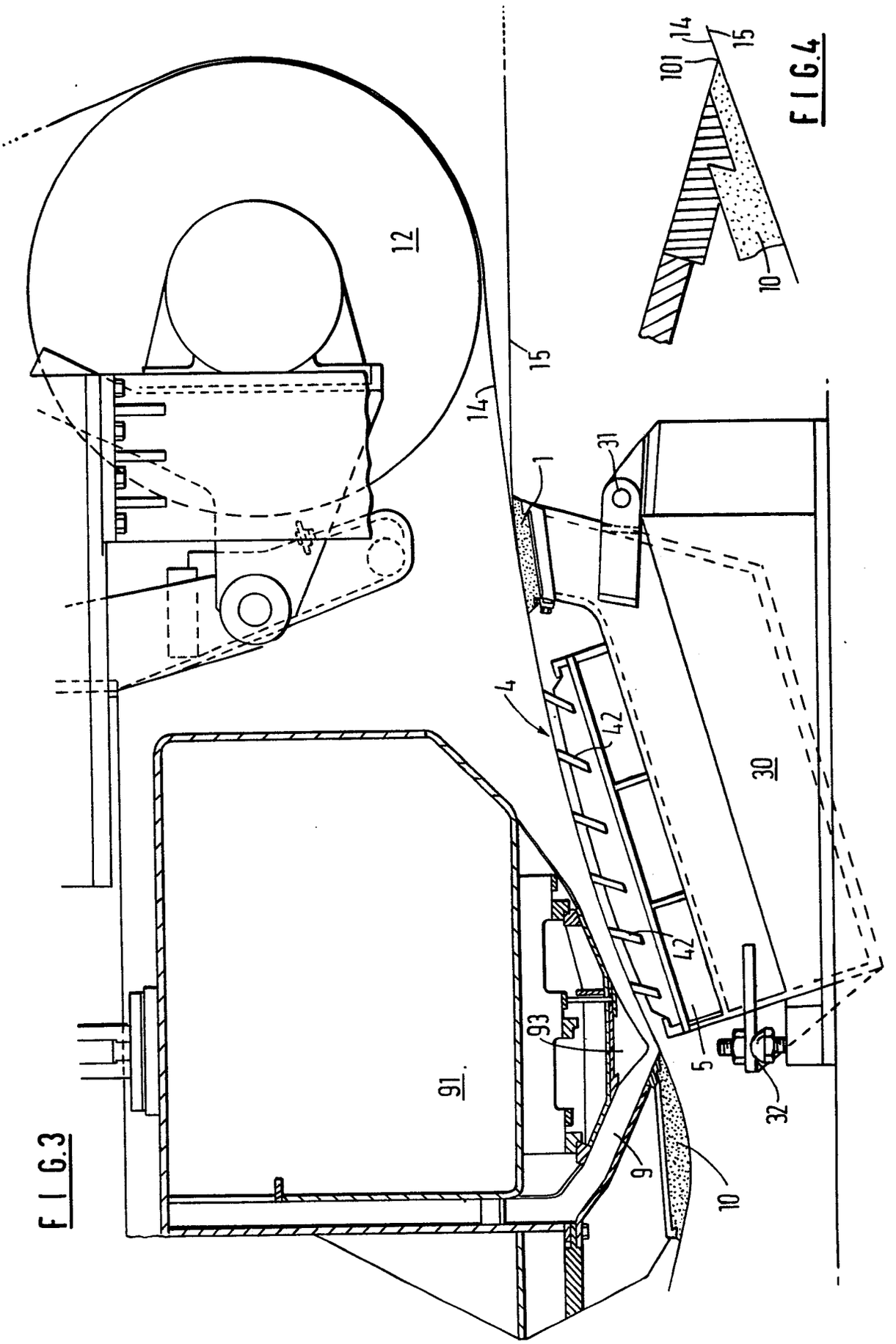

FIG.3

FIG.4