(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 403 845 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90110292.1**

(51) Int. Cl.5: **B05C 11/10, B05C 5/02**

(22) Date of filing: **30.05.90**

(30) Priority: **20.06.89 JP 71241/89 U**

(43) Date of publication of application:
27.12.90 Bulletin 90/52

(84) Designated Contracting States:
DE FR GB IT SE

(71) Applicant: **MITSUBISHI JUKOGYO KABUSHIKI KAISHA**
5-1, Marunouchi 2-chome Chiyoda-ku
Tokyo(JP)

(72) Inventor: **Yamamoto, Mitsuo, c/o Mihara Machinery Works of**
Mitsubishi Jukogyo K.K., 5007 Itozaki-cho
Mihara-shi, Hiroshima-ken(JP)
Inventor: **Shiromoto, Takehiko, c/o Mihara Machinery Works of**
Mitsubishi Jukogyo K.K., 5007 Itozaki-cho
Mihara-shi, Hiroshima-ken(JP)
Inventor: **Miura, Hiroshi, c/o Mihara Machinery Works of**
Mitsubishi Jukogyo K.K., 5007 Itozaki-cho
Mihara-shi, Hiroshima-ken(JP)

(74) Representative: **Henkel, Feiler, Hänzel & Partner**
Möhlstrasse 37
D-8000 München 80(DE)

(54) Coating apparatus.

(57) Herein disclosed is a coating apparatus for coating a thin sheet of paper, film or metal. The coating apparatus comprises a web for continuously running to apply a coating liquid, and a blade for scraping off the excess of the coated liquid to form a coated liquid layer. A slot is formed with an exit having a width matching that of the web for spraying the coating liquid from the exit to apply the same to the web. A premetaling blade is disposed downstream of the slot and upstream of the blade in the running direction of the web for controlling the amount of the coated liquid applied to the web with its surface pressure. A pressure tube is mounted along the widthwise direction of the premetaling blade for applying the surface pressure to the premetaling blade.

EP 0 403 845 A2

Coating Apparatus

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a coating apparatus for coating the surface of a sheet of paper, film, metal or the like.

Description of the Prior Art

Before entering into the detailed description of the present invention, cursory review will be made on the prior art with reference to Figs. 5 and 6. Fig. 5 is a section showing a flooded nip type coating apparatus of the prior art, and Fig. 6 is a perspective view for explaining the operations of this coating apparatus. In Fig. 5, a backing roll 2 has its outer circumference covered with a resilient member 1 such as rubber. A web 3 is made to run on the outer circumference of the resilient member 1. Below the backing roll 2, there is disposed an applicator roll 9 which is dipped ip a coating liquid pan 10 for applying a coating liquid 4 under pressure upward to the lower face of the web 3. A blade 7 is disposed downstream of the applicator roll 9 in the feeding direction of the web for removing the excess coating liquid 4 to form a constant coating liquid layer 6 over the surface of the web 3. Incidentally, reference numeral 8 designates a holder for the blade 7.

If the number of revolutions of the backing roll 2 of the coating apparatus of the prior art is so increased that the coating speed is as high as about 800 m/min or more, the coating liquid 4 becomes so irregular depending upon its properties that ring patterns 11 and splashes 5 caused by the centrifugal force are overlapped, as shown in Fig. 6. Even after the coating liquid has been scraped off by the blade 7, the thickness and the thickness of penetration of the coating liquid layer 6 are influenced by the irregularities. As a result, there arises a problem called the "wet streak" in which the coating irregularities have a pitch of 5 to 10 mm.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a coating apparatus which is freed from the above-specified problem.

According to the present invention, there is pro vided a coating apparatus comprising: a web for continuously running to apply a coating liquid; and a blade for scraping off the excess of the coating liquid to form a coating liquid layer, wherein the improvement comprises: a slot formed with an exit having a width matching that of said web for spraying said coating liquid from said exit to apply the same to said web; a premetering blade disposed downstream of said slot and upstream of said blade in the running direction of said web for controlling the amount of said coating liquid applied to said web with its surface pressure; and a pressure tube mounted along the widthwise direction of said premetering blade for applying said surface pressure to said premetering blade.

In the coating apparatus according to the present invention, the applicator roll for applying the coating liquid to the web is omitted from the coating apparatus of the prior art and is replaced by the slot for spraying the coating liquid to the web, and the amount of the coating liquid thus applied is controlled with the surface of the pressure of the premetering blade. The coating liquid is forced to overflow to the atmosphere side with the liquid pressure which is established upstream of the premetering blade so that the air, which has been entrained by the web into the coating liquid, is discharged to form the coating liquid layer of the coating liquid having no skip. Moreover, the amount of the coating liquid to be applied to the web with the surface pressure of the premetering blade is controlled by the combination of the premetering blade and the pressure tube so that a uniform and flat coating liquid surface can be formed all over the width of the web.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become apparent from the following description to be made with reference to the accompanying drawings, in which:

Fig. 1 is a section showing a coating apparatus according to one embodiment of the present invention;

Fig. 2(a) is a section showing a portion a of Fig. 1;

Fig. 2(b) is a perspective view showing the same portion a;

Fig. 2(c) is a section showing a portion c of Fig. 2(b);

Fig. 3(a) is a section showing an essential portion of the coating apparatus according to another em bodiment of the present invention;

Fig. 3(b) is a perspective view showing the

same;

Fig. 4 is a diagram for explaining the operations of those embodiments;

Fig. 5 is a section showing the coating apparatus of the prior art; and

Fig. 6 is a perspective view showing the operations of the same.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a section showing the coating apparatus according to one embodiment of the present invention; Fig. 2 shows the essential portion of the same in detail; Fig. 3 shows in detail an essential portion of the coating apparatus according to another embodiment of the present invention; and Fig. 4 is a diagram for explaining the operations of those embodiments. As shown in Figs. 1 and 2, the coating apparatus according to the present embodiment is equipped with a nozzle supply head 20 for applying a coating liquid 4 to the paper of a web 3, and a side sealing mechanism 30 for changing the coating width of the coating liquid 4 in accordance with the width of the web 3. The arrangement of the coating apparatus of the prior art for scooping and transferring the coating liquid with the applicator roll is replaced by an arrangement for spraying the coating liquid 4 with the nozzle supply head 20.

Specifically, the coating liquid 4 is supplied to the supply head 20 from both the operation and drive sides of the present coating apparatus and is introduced through a slot 41, which is used for spraying the coating liquid 4 uniformly in the widthwise direction of the web 3, into a liquid reservoir which is defined by a backing roll 2, a premetering blade 13, the side sealing mechanism 30 and an entrance side lip 17. The premetering blade 13 is extended in the widthwise direction of the web 3 and is clamped by a clamping tube 15 which is formed at the edge of an exit side lip 16. In contact with the lower side of the premetering blade 13, there is disposed a pressure tube 14 which is extended in the widthwise of the premetering blade 13 for applying a surface pressure to the premetaling blade 13 to control the amount of the applied coating liquid 4 with the edge of the premetering blade 13. On the other hand, the entrance side lip 17 is equipped with an easily deformable constriction 18 and a set-screw 24 for adjusting the profile of the flow rate of the coating liquid 4 passing through the slot 41. A gap of several millimeters important for determining the liquid pressure in the liquid reservoir is formed between the backing roll 2 and the edge of the entrance side lip 17, so that the coating liquid 4 entraining the air is forced to overflow from the gap until it is collected for recycles by a recovery pan 19. Around the supply head 20, there is disposed of a trisected jacket 12 which is filled with cooling water to condense the water on the outer face of the jacket 12, so that the coating liquid 4 overflowing along a guide plate 23 may not be stick on the jacket 12.

In case the paper width of the web 3 is changed, the coating width of the coating liquid 4 has to be correspondingly changed. For this change, there is provide the side sealing mechanism 30. Specifically, the change of the coating width is performed by pushing or pulling a guide rod 31. A side seal is mounted on a holder 32 which is connected directly to the guide rod 31, and a fitting 35 connected to a hose 33 for the water supply is mounted in a pad 36. The water is supplied at a constant rate to perform the liquid seal from a labyrinth groove which is formed provided on the upper surface of the side seal 34. Incidentally, this labyrinth groove may be replaced for the liquid seal by a thin metal shim 43 which is disposed over the side seal 34, as shown in Fig. 3. A guide rod 44 is attached to that shim 43 so that the shim 43 can be slid to change the coating width by controlling the guide rod 44.

The entrance side lip 17 is formed with liquid relief grooves 42 at the operation and drive sides outside of the side seal 34, to collect the coating liquid 4 having leaked from the side seal 34 into the recovery pan 19. A fixture 37 is provided to regulate the bulging of the pressure tube 14, and a cushion member 38 is attached to the fixture 37 so that the premetering blade 13 outside of the side seal 34 may not be excessively pushed to the backing roll 2. Those fitting 35, pad 36 and fixture 37 are made integral, and the side seal 34 is clamped from its two sides by the pad 36 to receive the pipe of the fitting 35. Incidentally, numeral 7 designates a blade disposed downstream of the premetering blade 13 for scraping down the excessive coating liquid from the web 3, and numeral 8 designates a holder for the blade 7.

Although not shown, the supply head 20 is equipped with mechanisms for mounting and demounting the same to insert the web 3 and for turning the supply head 20 to replace the premetering blade 13 or to inspect the slot 41. Moreover, the shape of the supply head 20, the structure of the side sealing mechanism 30, and the structures of the exit side lip 16 and the entrance side lip 17 should not be limited to those of the embodiments thus far described.

In the coating apparatus according to these embodiments, the air entrained by the web 3 into the coating liquid 4 is discharged to the atmosphere by forcing the coating liquid 4 to overflow in the liquid reservoir just upstream of the premeter-

ing blade 13, so that the coating liquid layer 6 is formed of the coating liquid 4 without any skip. Moreover, a uniform and flat coating liquid face is obtained all over the width of the web 3 by combining the premetering blade 13 and the pressure tube 14 to bring the edge of the premetering blade 13 into abutment against the surface of the backing roll 2. Although, moreover, the coating apparatus of the prior art is limited in the thickness of the coating liquid layer by 150 microns at a coating speed as high as 800 m/min, the film thickness can be increased to 200 or 350 microns for a constant supply of the coating liquid 4 by applying the pressure of the pressure tube 14, and the penetration power of the coating liquid 4 into the paper of the web 3 can be controlled within the range of the film thickness. By making the premetering blade 13, flexible, moreover, the deformation of the backing roll 2 and the supply head 20 can be absorbed even if they are deformed as a result of thermal expansions. Fig. 4 plots the relation between the pressure in the pressure tube 14 of the aforementioned coating apparatus and the amount of the coating liquid 4 applied. This plot is obtained in case: the web of coating base paper of 60 g/m^2 was run at a speed of 1,200 m/min; the premetering blade had a width of 73.5 mm and a thickness of 0.5 mm; and the coating liquid used had a viscosity of 650 cps and a density of 57 %. A remarkably smooth coating liquid surface could be obtained for an amount of application within a film thickness of 200 to 350 microns.

As has been described hereinbefore, according to the coating apparatus of the present invention, the coating liquid layer has no skip but is uniform and flat all over the width of the web. Thus, the coating irregularities called the "wet streak" can be eliminated even at a coating speed as high as about 800 m/min or more.

Claims

1. A coating apparatus comprising: a web for continuously running to apply a coating liquid; and a blade for scraping off the excess of the coated liquid to form a coated liquid layer,
wherein the improvement comprises: a slot formed with an exit having a width matching that of said web for spraying said coating liquid from said exit to apply the same to said web; a premetering blade disposed downstream of said slot and upstream of said blade in the running direction of said web for controlling the amount of said coated liquid applied to said web with its surface pressure; and a pressure tube mounted along the widthwise direction of said premetering blade for applying said surface pressure to said premetaling blade.

2. A coating apparatus according to Claim 1, further comprising a clamp tube on said premetering blade upstream of said pressure tube for clamping said premetering blade.

3. A coating apparatus according to Claim 1, further comprising a side sealing mechanism for changing the coating width of said coating liquid.

4. A coating apparatus according to Claim 1, further comprising a gap formed between the exit of said slot for spraying said coating liquid and said web.

Fig. 1

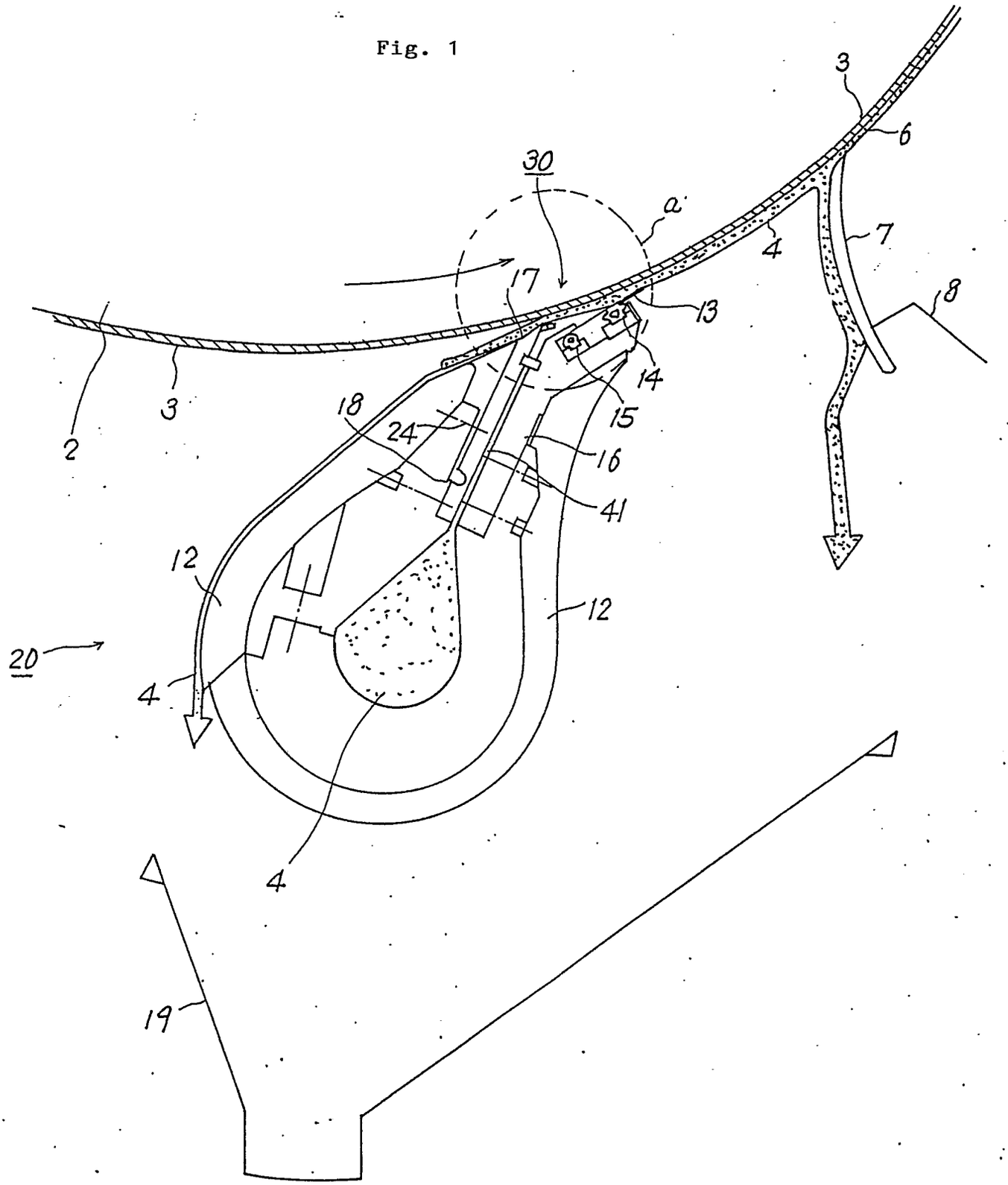

Fig. 2

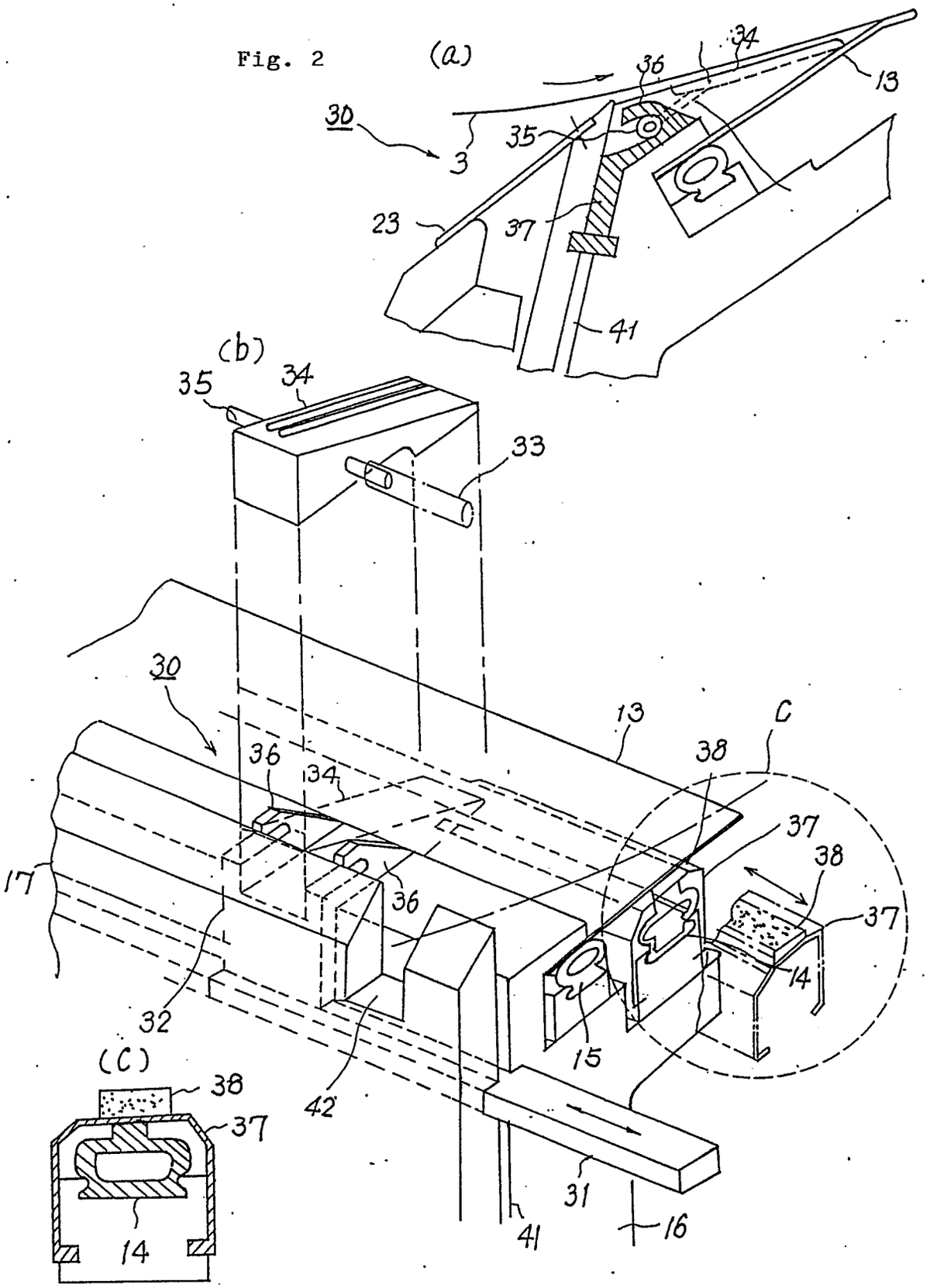
(a)
34
36
13
30
35
3
23
37
41
(b)
35
34
33
30
13
C
38
36
34
37
38
17
36
37
14
32
15
(C)
38
42
37
31
14
41
16

Fig. 3

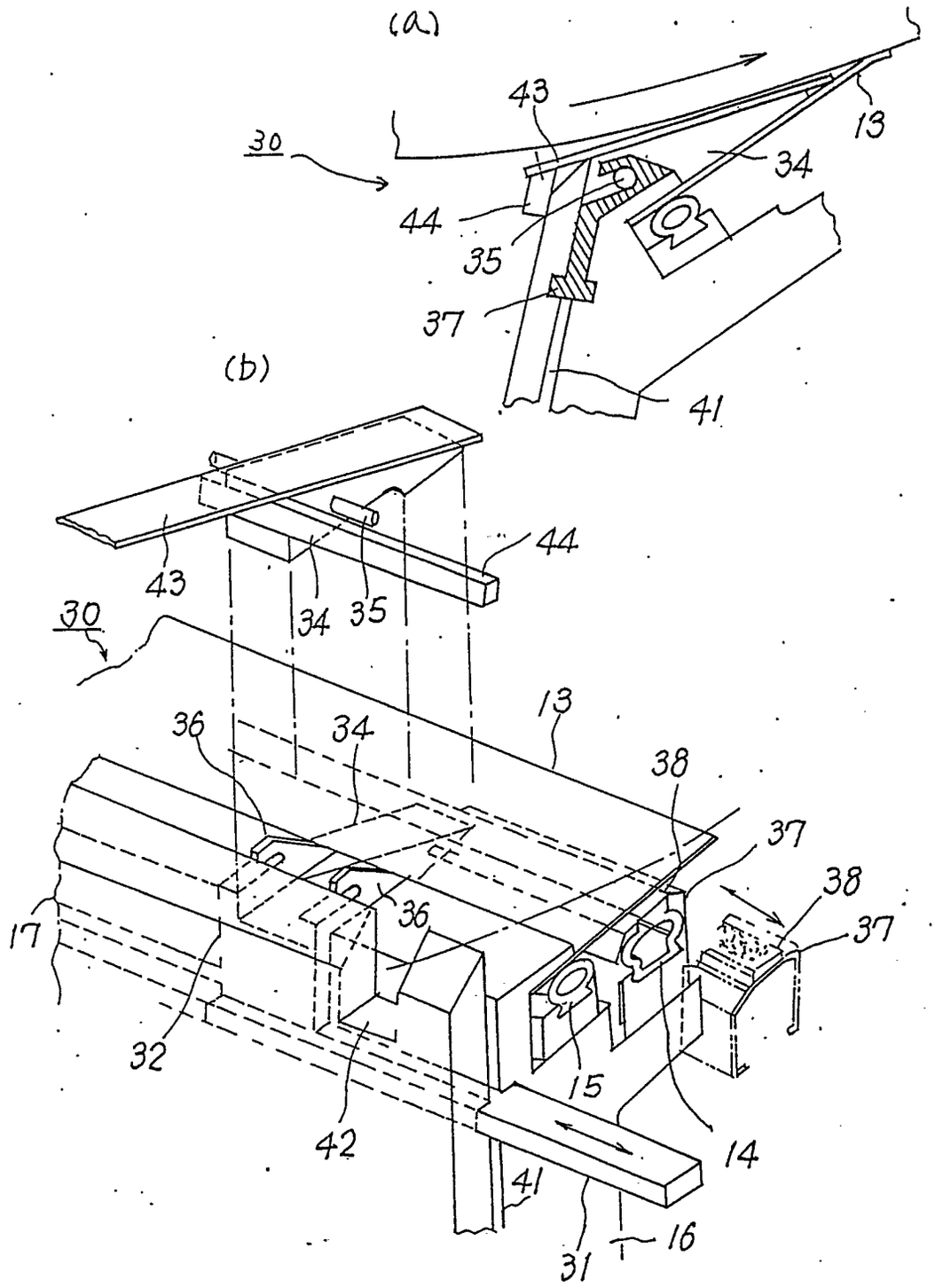
(a)
43
13
30
34
44
35
37
41
(b)
44
43
34
35
30
13
36
34
38
37
38
37
17
36
32
15
42
14
41
31
16

Fig. 4

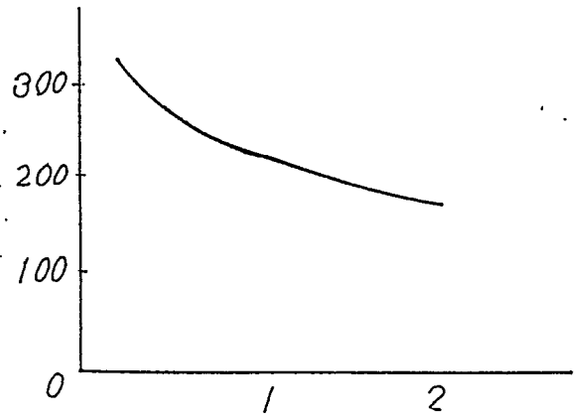

Fig. 5

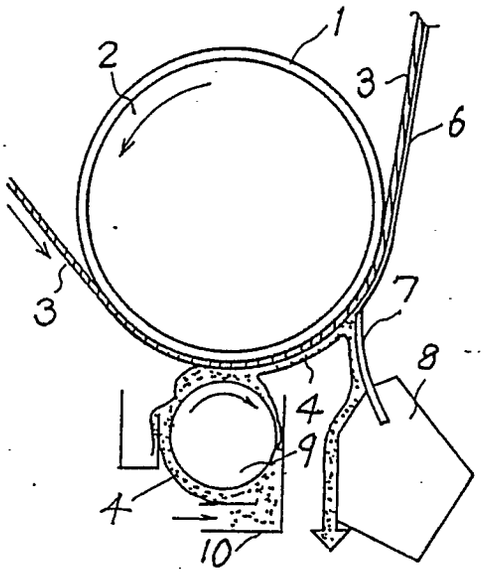

Fig. 6