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CA 2107277 C 2006/03/21

(11)(21) 2 107 277

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1993/09/29

(41) Mise à la disp. pub./Open to Public Insp.: 1994/05/04

(45) Date de délivrance/Issue Date: 2006/03/21

(30) Priorité/Priority: 1992/11/03 (924960) FI

(51) Cl.Int./Int.Cl. *D21H 19/84* (2006.01), *D21H 23/70* (2006.01), *D21H 23/56* (2006.01)

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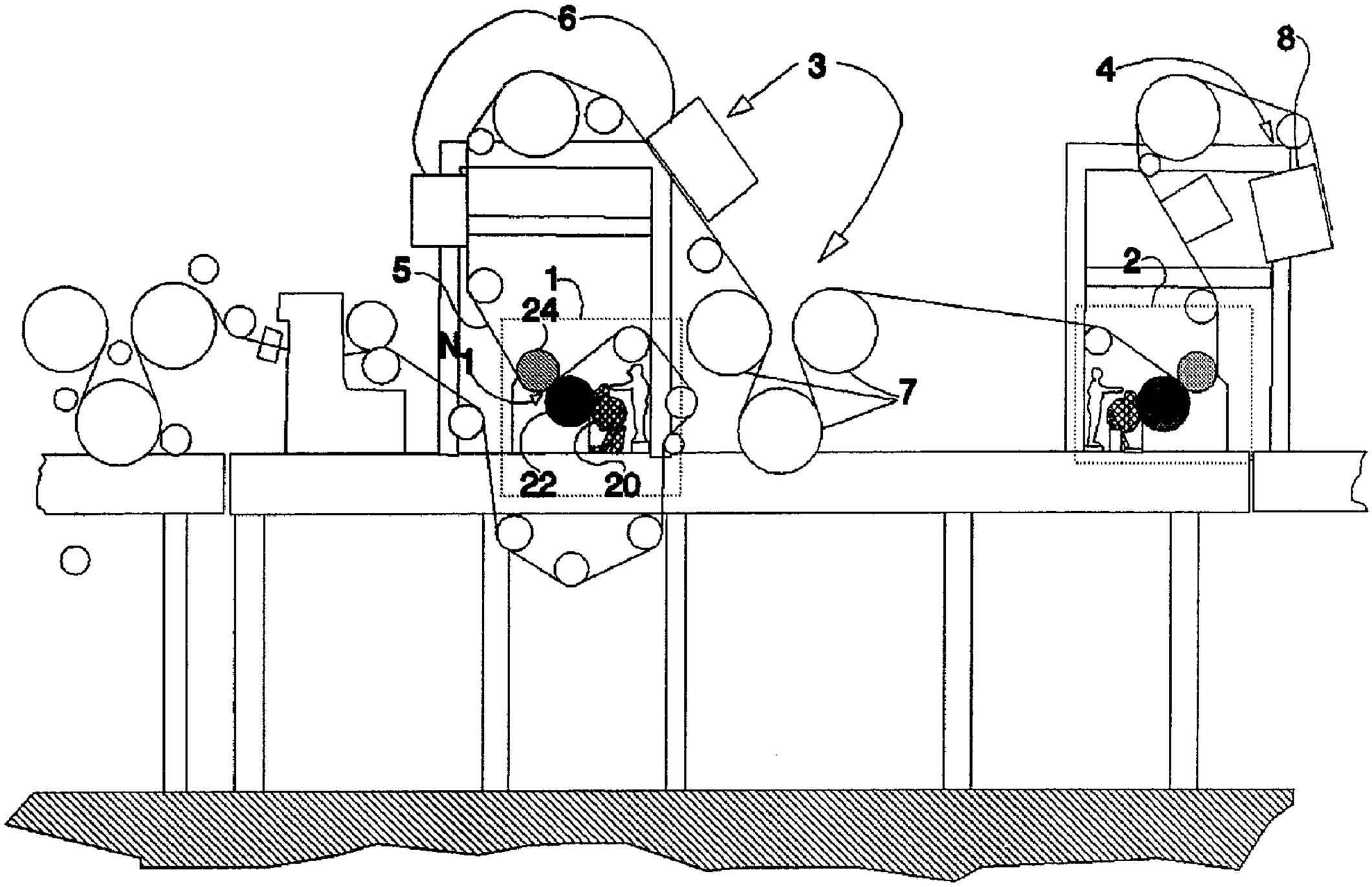
(54) Titre : APPAREIL SERVANT A COUCHER DES DEUX COTES UNE BANDE MINCE DE PAPIER D'IMPRESSION OBTENU A PARTIR DE PATE MECANIQUE, ET METHODE CONNEXE

(54) Title: METHOD AND APPARATUS FOR TWO-SIDE COATING OF A THIN PRINTING PAPER WEB MADE OF MECHANICAL PULP



(57) Abrégé/Abstract:
The invention relates to a method and apparatus for two-side coating of a light base weight printing paper web containing mechanical pulp or recycled fiber. According to the method the first side of a web (5) is coated in a first coating station (1), the first-side coat is dried at least partially in a dryer unit (3), the second side of the web (5) is coated subsequent to the drying of the first

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(57) Abrégé(suite)/Abstract(continued):
side in a second coating station (2), and the second-side coat is dried at least partially in a second dryer unit (4). According to the invention both the first-side coat and the second-side coat are formed by applying a required amount of coating mix onto the perimeter of a soft film-coating roll (22) and subsequently transferring said coat film to the web (5) in a nip (N_1) formed between a backing roll (24) and said film-coating roll (22).

[57] **Abstract**

The invention relates to a method and apparatus for two-side coating of a light base weight printing paper web containing mechanical pulp or recycled fiber. According to the method the first side of a web (5) is coated in a first coating station (1), the first-side coat is dried at least partially in a dryer unit (3), the second side of the web (5) is coated subsequent to the drying of the first side in a second coating station (2), and the second-side coat is dried at least partially in a second dryer unit (4). According to the invention both the first-side coat and the second-side coat are formed by applying a required amount of coating mix onto the perimeter of a soft film-coating roll (22) and subsequently transferring said coat film to the web (5) in a nip (N_1) formed between a backing roll (24) and said film-coating roll (22).

(Fig. 1)

Method and apparatus for two-side coating of a thin printing paper web made of mechanical pulp

The present invention relates to a method for two-side coating of a thin printing paper web containing mechanical pulp, e.g., a paper web made of recycled fiber.

The invention further relates to an apparatus suited to two-side coating of a thin printing paper web made of mechanical pulp.

Thin printing paper webs containing mechanical pulp are conventionally coated on subsequent coating stations equipped with short-dwell coaters as the coater units. A combination of two subsequent coater stations is necessary as low base paper weight and high content of groundwood make single-run coating on both sides impossible. Two-side coating with conventional methods would excessively wet the web and thus impair its runnability. Furthermore, the measurement of coat weight in a two-side coating operation is difficult.

Despite their multiple benefits, short-dwell coaters also have several drawbacks. Air entrapped in the coat paste easily causes mottling. Owing to the small linear application pressure and short application distance, wetting of the base web and subsequent fiber swelling occurs even after the web has passed the doctor blade. This may impair the coat smoothness. As a rule, doctor blade coating methods become critical with thin webs and particularly with light coat weights.

Paper grades containing a high proportion of mechanical pulp and a high percentage of coat fillers such as, e.g., SC paper (wood containing high filler content super-calendered printing paper) make doctor blade coating impossible owing to the fragility of the base paper web.

Web defects leading to brittleness result in low production yield and inferior runnability.

Base paper grades containing recycled fiber have posed unexpected problems in doctor blade coaters: The coat is easily marked during coating by streaks caused by defective doctor blades.

Recycled-fiber containing base paper grades have a darker color, thus making the opacifying power of the coat mix more critical. Owing to its operating principle, doctor blade coating tends to give a smooth coat, not a coat of uniform coat weight. As the base paper is not necessarily smooth, the opacifying power obtained in doctor blade coating is insufficient, resulting in mottling of the coated web.

It is an object of the present invention to overcome the disadvantages of the above-described prior-art technology and to achieve an entirely novel method and apparatus for two-side coating of a thin printing paper web containing mechanical pulp such as, e.g., a paper web grade made of recycled fiber.

The invention is based on performing the coating operation using a two-step compressive film-lamination technique.

The invention provides significant benefits.

The technique according to the invention halves the web wetting relative to single-run two-side coating. Thus, the invention provides good runnability. Further, good coat quality is attained at light coat weights. Particular benefit is achieved with base paper grades containing recycled fibers as the formation of streaks associated with doctor blade coating can be avoided. Since the compressive film-lamination technique forms a coat of uniform weight on the web, the coat has a high opacifying power. For the same reason, a higher burst index relative to doctor blade coating is attained. Moreover, the measurement of coat weight by means of rupturing testers is easy. The method according to the invention imposes minimal mechanical stress on the web. Two-side single-run coating requires a long path of unsupported pulling of the web prior to the web support roll to give the coat a possibility of drying prior to touching the support roll. In the technique according to the invention, the uncoated side can be supported by a roll immediately after the coating of the other side, thus achieving a significant reduction in coater unit size.

In the following the invention is described in greater detail with the help of exemplifying embodiments illustrated in the annexed drawing in which

Figure 1 is a side elevation view of a part of a paper machine incorporating a coater apparatus according to the invention.

Figure 2 shows diagrammatically an alternative coater apparatus according to the invention.

Figure 3 shows in greater detail a nozzle assembly suited to implement the coater apparatus according to the invention.

In conjunction with the present invention, the term compressive film-lamination technique is used to refer to a technique in which the web during coating is subjected to a linear pressure in a nip formed between a film-coating roll and a backing roll so as maintain the peripheral speeds of both the film-coating roll and the backing roll approximately equal to the web speed.

In conjunction with the present invention, the term light web material refers to web materials having a base weight of less than 65 g/m^2.

With reference to Fig. 1, the apparatus according to the invention comprises a first compressive film-lamination station 1 and a second compressive film-lamination station 2, having a first drying unit 3 placed between them. The web path is configured so that subsequent to the first drying unit 3 on the path of a web 5 is placed the second coating station 2, followed by a second drying unit 4. Basically, both drying units have a similar construction. The coating station 1 is comprised of a film-coating roll 22, a coater bar 20 and a backing roll 24 of the film-coating roll 22. The coater bar 20 serves for metering a desired amount of coating mix onto the film-coating roll 22, wherefrom the coating mix is subsequently transferred in the nip N_1 to the web 5. To make the coating mix adhere to the web with the greatest smoothness free from orange peel effect, the backing roll 24 has advantageously a smaller diameter than the film-coating roll, whereby the angle at which the web 5 conforming to the backing roll 24 exits the nip N_1 is maximized. In an alternative approach the web 5 is guided toward the film-coating roll 22, whereby also a good coat surface quality is obtained.

The first drying unit 3 is comprised of infra-red dryers 6 and dryer drums 7.

Basically, the coating station 2 has a similar construction to that of coating station 1. Owing to the routing of the web 5, the station 1 is mirrored from station 2. The station 2 is analogously followed by the second drying unit 4 comprising an infra-red dryer 8 with subsequent drying cylinders (not shown).

With reference to Fig. 2, the coating bar 20 can be replaced by a so-called gate roll coater in which the coating mix is transferred from a coating mix fountain 34 located above a nip N_2, which is formed by a transfer roll 30 and a metering roll 32, via said nip N_2 onto the perimeter of said metering roll 32 and further via a nip N_3 onto the perimeter of a film-coating roll 36. From the perimeter of the film-coating roll 36 the coating mix is applied to a web 38 in a nip N_4 formed between the film-coating roll 36 and a backing roll 39. According to the invention, the diameter of the backing roll 39 can be smaller than the diameter of the film-coating roll 36.

The film-coating roll 36 has a diameter of 1000 mm typical, and the backing roll 39 has a diameter of 800 mm, respectively.

Characterizingly, in both above-described exemplifying embodiments the surface of the film-coating roll is adjusted to carry an approx. 7...15 μm thick film of the coating mix, a major portion (typically approx. 80 %) of which is adhered to the web in the nip between the film-coating roll and the backing roll. Thus, the web is coated with a coat of 7...15 g/m^2 dry weight.

The adsorption of the coating mix paste and the water contained therein is related to the magnitude of the nip pressure and the duration of said pressure, that is, the width of the nip. On the other hand, the nip width is solely determined by the diameters of the rolls and their

hardness, while the magnitude of the nip pressure is principally determined by the linear loading of the nip, and additionally, by the web speed. Accordingly, the good penetration of the coat into the web is achieved by means of a high linear application pressure imposed in a relatively wide nip.

The maximum nip pressure typically is 1000 kPa gauge and the nip width is in excess of 15 mm. Good results according to the invention have been obtained by keeping the nip pressure above 500 kPa and the nip width greater than 10 mm. Such desirable nip widths can be attained by means of hard rolls with diameters in excess of 600 mm. Particularly the film-coating roll must have a diameter greater than 600 mm, whereby the backing roll must also have a diameter in excess of 600 mm. To achieve the minimum pressure limit of 500 kPa, the linear nip loading must be at least 20 kN/m for a typical coating mix paste. In conventional kiss roll coating, the application pressure is only approx. 50...100 kPa, while a conventional doctor blade coater can achieve a pressure of 1000 kPa over a nip width of less than 1 mm. In a conventional short-dwell coater the encountered levels of application pressure are yet lower. The technique according to the invention is suited to web speeds of 400...1500 m/min typical. The linear nip loading is typically in the range of 20...50 kN/m, advantageously approx. 35 kN/m. The coating material of both the backing roll and the film-coating roll is polyurethane, rubber or any suitable resilient material. The P&J numbers of the rolls are typically in the range of approx. 0...40. The film-coating roll employed in the embodiments according to the invention is invariably a so-called soft roll with a surface material of polyurethane, for instance.

With reference to Fig. 3, a nozzle assembly for a film-coating roll 40 is comprised of a coater blade 42 tilted to an acute angle and mounted to a frame structure 41. Between the frame structure 41 and the blade 42 is placed a loading hose 43 suited to controlling the linear pressure and position of the blade 42. The coating mix 46 is contained in a metering fountain formed between a front wall 44 and the blade 42, wherefrom the mix is transferred in a controlled manner onto the perimeter of the coating roll 40. The front wall 44 is mounted by means of support elements 45 onto the chassis of the apparatus. Such a nozzle assembly is known in the art and its construction is described in greater detail in US patent 4,839,201, for instance. The blade 42 can alternatively be replaced by a doctoring bar.

In a preferred embodiment of the invention the backing roll has a metal surface. The metal surface can be of chromium, for instance. Also ceramic or polymer covered backing rolls are usable. A metal or ceramic covered backing roll performs initial calendering of the coated web. Such coated rolls with a steel core can also be provided with chilling, whereby condensation of moisture onto the roll perimeter is attained, which in turn aids keeping the roll clean. Owing to the improved thermal and wear resistance of a metal or ceramic covered roll, also steam and scraper blades can be used for keeping the rolls clean.

According to the invention, the nozzle assembly employed for metering the coating mix onto the film-coating roll can also be a slot-orifice die metering assembly or a spraying apparatus capable of spraying the coating mix onto the roll surface.

The table below gives exemplifying compositions of coating mixes suited for advantageous use according to the invention:

Coating color component	Coating mix composition 1	Coating mix composition 2
Calcium carbonate pigment	100 parts	
Kaolin pigment		100 parts
Starch binder	10 parts	6 parts
Synthetic binder	4 parts	6 parts
Additives	2 parts	0.5 parts
Solids content	55 %	58 %
Viscosity (Brookfield 100)	500 cP	800 cP

Claims:

1. A method for two-side coating of a printing paper web containing mechanical pulp or recycled fiber and having a base weight of less than 65 g/m^2, comprising:

applying a sufficient amount of a coating mix to only a first side of the web within a first coating station to coat the first side of the web, wherein the coating mix is pressed onto the first side of the web by applying the coating mix onto a perimeter of a first resilient film-coating roll rotated at a peripheral speed approximately equal to a speed in which the web travels and subsequently transferring the coating mix to the first side of the web in a first nip formed between a first backing roll and the first film-coating roll, the first backing roll and the first film-coating roll calendering the web;

at least partially drying in a first dryer unit the coating mix applied to the first side of the web;

applying a sufficient amount of the coating mix to only a second side of the web within a second coating station to coat the second side of the web, said step of applying coating mix to the second side of the web occurring subsequent to said step of at least partially drying of the coating mix applied to the first side of the web, wherein the coating mix is pressed onto the second side of the web by applying the coating mix onto a perimeter of a second resilient film-coating roll rotated at a peripheral speed approximately equal to a speed in which the web travels and subsequently transferring the coating mix to the second side of the web in a second nip formed between a second backing roll and the second film-coating roll, the second backing roll and the second film-coating roll calendering the web; and

at least partially drying in a second dryer unit the coating mix applied to the second side of the web;

wherein said steps of applying coating mix and at least partially drying of the applied coating mix are performed continuously in a coating apparatus.

2. The method of claim 1, further comprising chilling the first and second backing rolls.

3. The method of claim 1, wherein the coating mix has a viscosity of at least 500 cP.

4. The method of claim 1, wherein the first and second backing rolls press the coating mix onto the web with a nip pressure of at least 500 kPa.

5. The method of claim 1, further comprising steam cleaning the first and second backing rolls.

6. The method of claim 1, further comprising scraper cleaning the first and second backing rolls.

7. The method of claim 1, wherein the first and second backing rolls are metal-covered.

8. The method of claim 1, wherein the first and second backing rolls are ceramic-covered.

9. The method of claim 1, wherein the first and second backing rolls are polymer-covered.

10. The method of claim 1, wherein coating mix is applied in the first coating station onto the perimeter of the first film-coating roll with a first nozzle and in the second coating station onto the perimeter of the second film-coating roll with a second nozzle.

11. The method of claim 1, wherein the web travels at a speed of from 400 to 1500 m/min during said steps of applying

coating mix to the web and said steps of at least partially drying the applied coating mix.

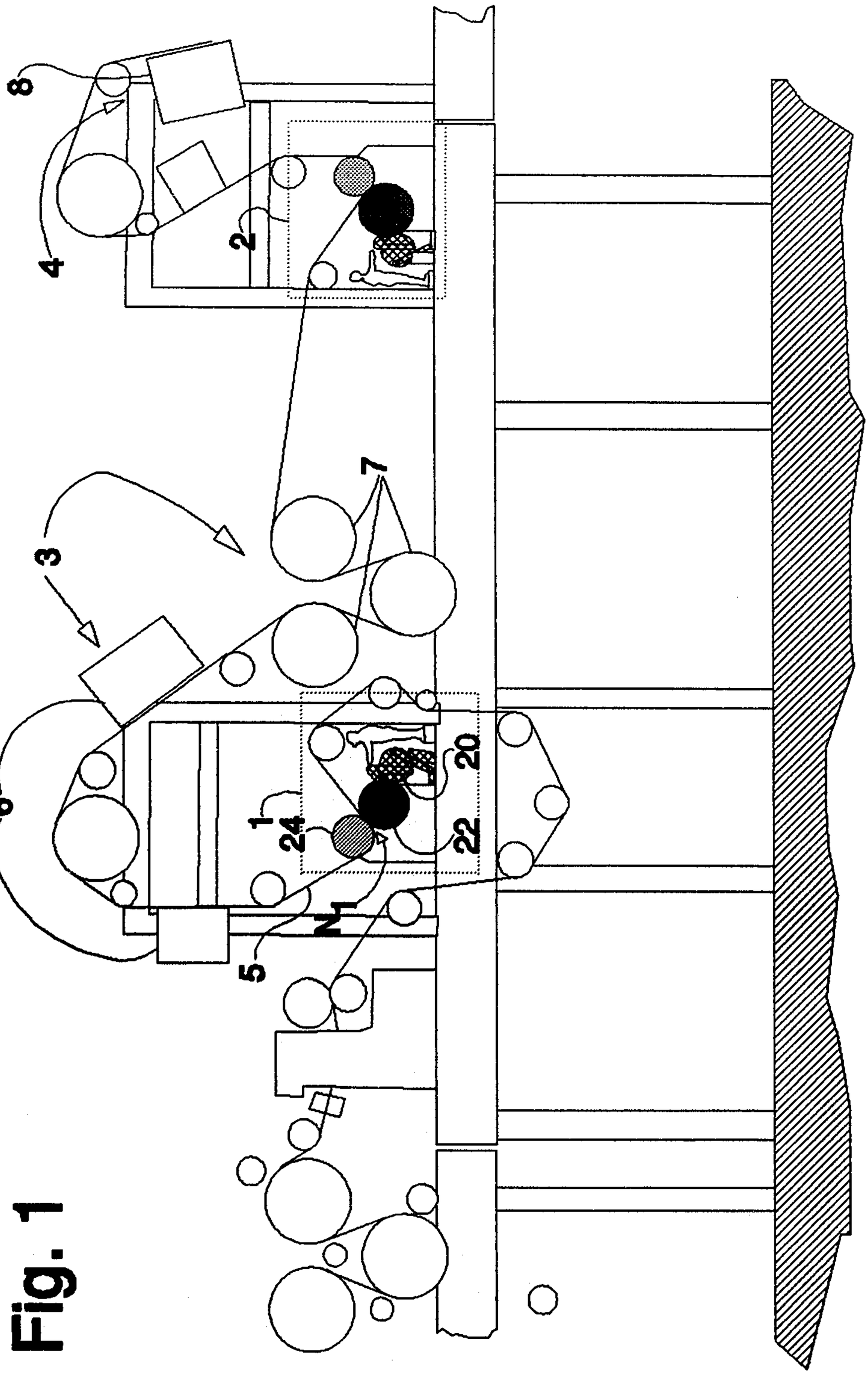

Fig. 1

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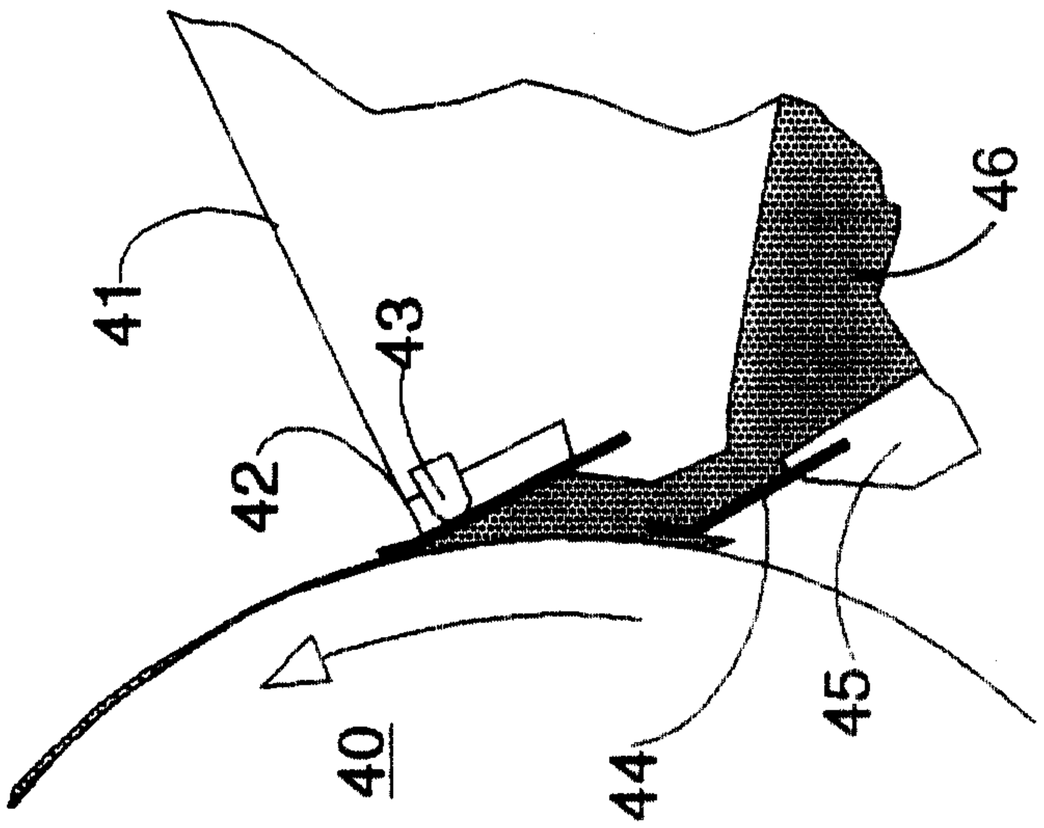


Fig. 3

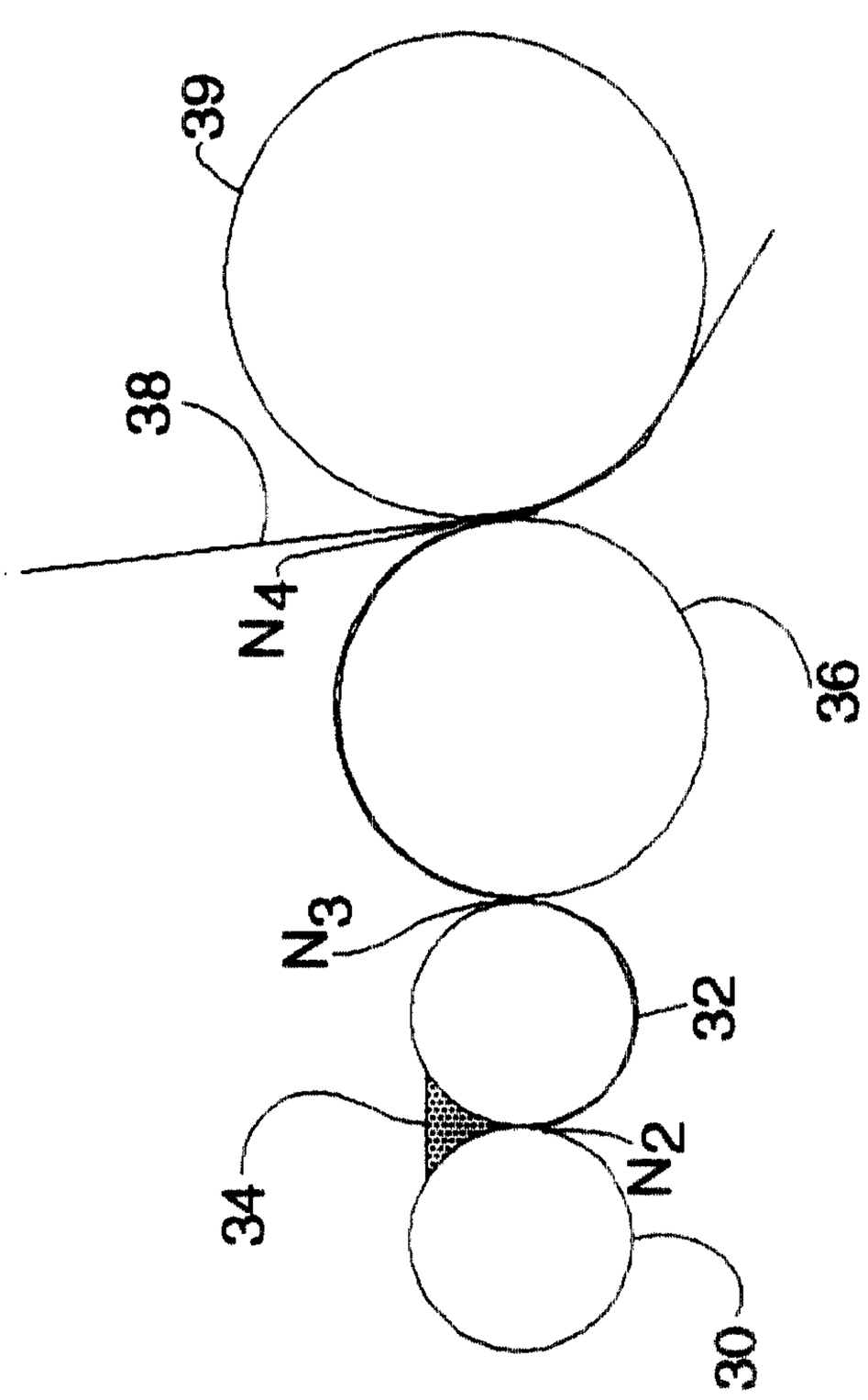
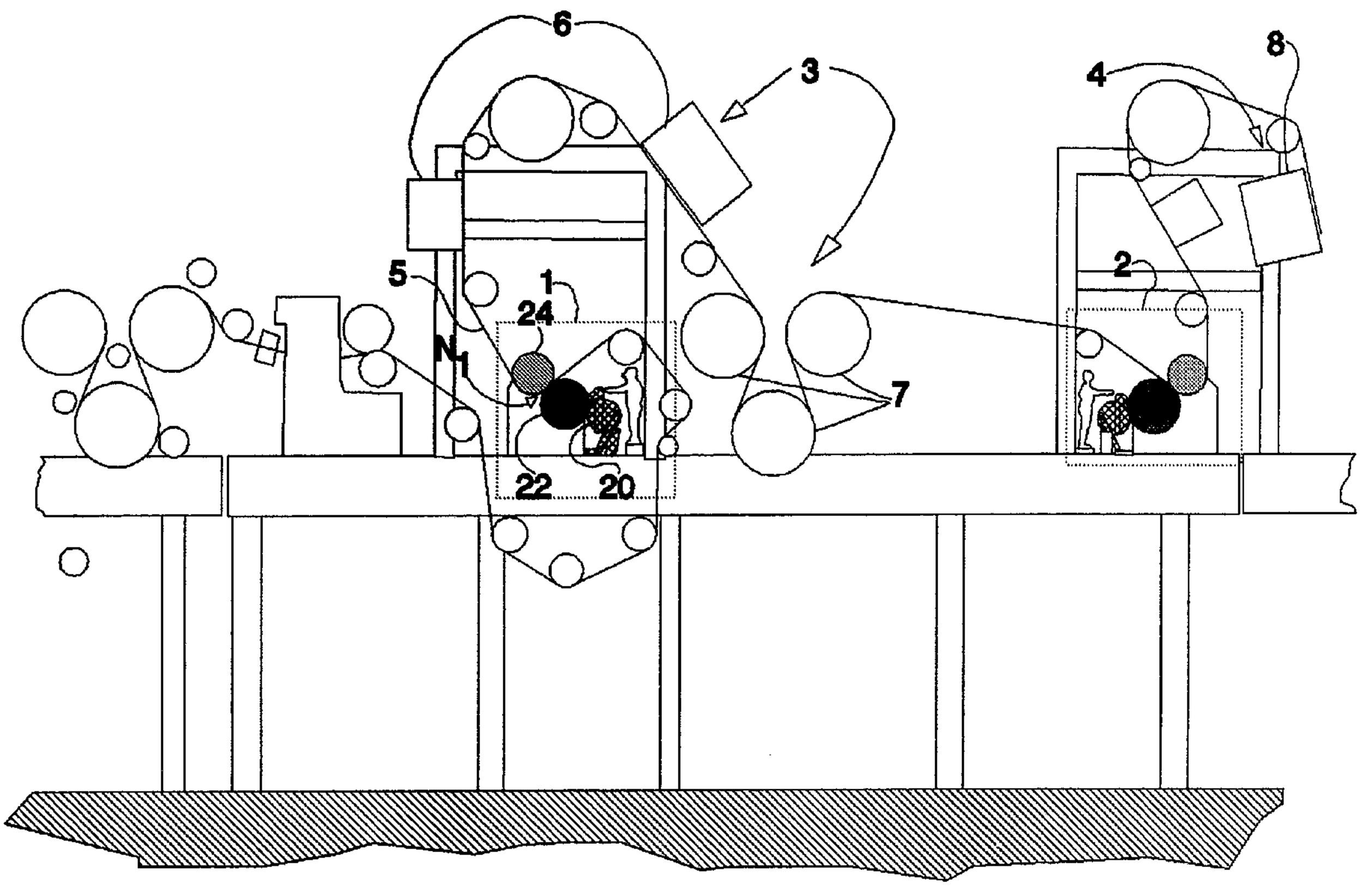


Fig. 2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