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(54) Apparatus for printing a textile web

Vorrichtung zum Drucken einer Textilbahn

Appareil pour imprimer une bande de textile

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(56) References cited:
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- **PATENT ABSTRACTS OF JAPAN vol. 1998, no. 01, 30 January 1998 (1998-01-30) & JP 9 240022 A (TORAY IND INC), 16 September 1997 (1997-09-16)**

EP 1 591 258 B1

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Description

[0001] The invention relates to an apparatus for printing a web of textile, which apparatus comprises:

a main frame;
an endless conveyor belt which is guided over a driven roller and a reversing roller disposed parallel thereto and which is driven by motor means at a chosen constant speed;
glue dispensing means for applying a glue layer upstream of the upper active part of the conveyor belt such that the web is temporarily fixed non-movably relative to the conveyor belt;
supply and feed means for feeding the textile web from a supply to the upper active part of the conveyor belt;
printing means for printing the passing textile web in the zone of the upper active part of the conveyor belt in a number of colours in accordance with an adjustable pattern for selecting; and
discharge and storage means for removing the printed textile web from the conveyor belt and subsequent storage thereof;
in which
the printing means comprise a number of, for instance 2-8, frame beams extending in transverse direction above said upper active part at determined mutual longitudinal distances along the direction of transport, each of which frame beams carries an array of inkjet heads and each of which is immobile during operation relative to the plane defined by the upper active part;
control means are present, said control means storing a chosen printing pattern by means of inputting pattern information, for instance from a scanner and energizing the inkjet heads, also in relation to the chosen set speed of the conveyor belt and the mutual distances in the direction of transport between successive inkjet heads for the respective colours, such that each head sprays droplets of ink of the relevant colour onto the web at the positions on the web determined by the control means;
the discharge means comprise drying means for drying the ink applied to the textile web.

[0002] Such an apparatus is known from e.g. EP-A-0 666 180 and Patent Abstracts of Japan, Vol. 1998, no. 01 & JP-A-9 240022.

[0003] It is desirable to make the heads, which are arranged on a necessarily very rigid beam, easily accessible. In view of the desired very high mechanical precision of the apparatus, it is deemed desirable according to the invention to be able to move the beams laterally out of the apparatus and to be able to replace them again with a very high positioning accuracy without any calibration being necessary after such an intervention.

[0004] In respect of the above, the invention provides a specific embodiment of the apparatus which has the feature that each beam can be positioned in a fixed position relative to the main frame by means of positioning means, comprising three sets of recesses, for instance V-grooves, and associated protrusions, for instance balls, present on the main frame respectively the beam, and that each beam can be lifted out of the position defined by these positioning means and in the thus obtained free position can be pushed to the outside, for instance for repair or maintenance.

[0005] It will be apparent that diverse embodiments of such positioning means are possible which allow a very precise positioning in both the horizontal plane and in the height, thus x, y, z.

[0006] According to the invention the apparatus has the special feature that each beam is supported by a sub-frame with the general form of a lying U which is laterally displaceable in and out of the apparatus such that, if desired during operation of the apparatus, any sub-frame whose inkjet heads are temporarily not in use can be displaced to the outside, for instance for repair or maintenance.

[0007] Furthermore the apparatus according to the invention may be characterized by washing means placed downstream relative to the upper active part for removing the glue from the conveyor belt.

[0008] The summary review below may serve to elucidate the possibilities of the invention.

[0009] Use can be made of a desired number of colours and a corresponding number of beams with units of inkjet heads. The number of colours can amount for instance to a maximum of 12, while the beams are placed at mutual distances of 10-100 cm. Printing speeds can be realized of 1-40 m/min. A printing width of for instance 1 cm to 50 m can be realized according to the invention. Given the use of high-quality inkjet heads, the resolution of the finally obtained printed image can amount to 120-400 dpi. It will be apparent that this resolution is also determined by the precision with which the mutual distance between nozzles of the inkjet heads can be maintained relative to the textile web to be printed.

[0010] It will be further apparent from the above description that one colour is sprayed per stationary array of nozzles.

[0011] It must be ensured that the points of impact of the ink droplets must lie with great precision at a determined distance relative to the inkjet heads. It is of the greatest importance in this respect that the conveyor belt passes the inkjet heads in very stable manner and without notable height difference at the position of these heads. The maximum height variation between the nozzles and the textile surface for printing amounts to about 10 μm.

[0012] Printing can take place with different colour systems.

(1) Printing in accordance with the process colour principle.

[0013] Here a design is printed with the classical colour graduations (cyan, magenta, yellow, black) or dilutions thereof. The colour image is created by differently coloured droplets which together provide a colour graduation.

[0014] In order to obtain a maximum efficiency of colour space for improvement of the printed image, the system can also be used by working with colour graduations other than the traditional ones. Specific colours are then mixed and used instead of the above stated colours.

(2) Printing in accordance with the spot colour principle.

[0015] Here a colour separation of a design is made. Each colour separation is printed with a so-called spot colour, i.e. a specific proposed colour.

(3) Combined printing with process colour(s) and spot colours.

[0016] The colours which it is wished to print in accordance with the spot colour principle are separated. The remaining part of the design is printed with process colours.

[0017] The invention will now be elucidated with reference to the annexed drawings, wherein:

Fig. 1 shows a cut-away schematic perspective view of an apparatus according to the invention;
Fig. 2 shows a schematic side view of the apparatus of Fig. 1;
Fig. 3 is a schematic side view of a conveyor with an active upper part which is straight;
Fig. 4 is a view corresponding with Fig. 3 of a conveyor with an active upper part which has a generally curved form;
Fig. 5 shows a more detailed side view of the conveyor according to Fig. 4;
Fig. 6 shows a schematic perspective view of the conveyor according to Fig. 4 and 5;
Fig. 7 is a front view along the direction of transport of a U-shaped frame which can be moved in and out of the apparatus;
Fig. 8a, 8b and 8c show respective stages of the positioning and removal from the apparatus of a beam carrying an inkjet array;
Fig. 9 shows a schematic perspective transparent view of the beam according to Fig. 8 with the associated positioning means;
Fig. 10 is a schematic view of the adjustment in a vertical plane of rollers forming part of the conveyor according to Fig. 3, 4, 5 and 6; and
Fig. 11 is a perspective view of the construction enabling a vertical angular setting of the roller according to Fig. 10.

[0018] Corresponding elements and components are designated with the same reference numerals in all the figures to be described hereinbelow.

[0019] Fig. 1 shows an apparatus 1 for printing a textile web 2 (see also Fig. 2). The apparatus comprises a main frame 3 placed on the ground or a shop floor.

[0020] As is particularly apparent from Fig. 3, 4, 5 and 6, apparatus 1 comprises an endless conveyor belt 6 which is guided over a driven roller 4 and a reversing roller 5 disposed substantially parallel thereto and which is driven by motor means (not shown) at a chosen constant speed as according to arrow 7.

[0021] The apparatus further comprises glue dispensing means 8 for applying a glue layer upstream of the active upper part 9 of conveyor belt 6 for temporary light adhesion of textile web 2 to this active part 9 such that web 2 is fixed non-movably relative to the conveyor belt during transport by said upper part 9.

[0022] A washing device 10 shown in Fig. 5 contains sponge means 11 and a scraper 12 for removing glue residues from conveyor belt 9. These washing means 10 are placed downstream of the active part 9.

[0023] Fig. 2 shows a supply and feed unit and a pressure roller 15 which co-acts with roller 4 and which provides an intimate and adhering contact between the active upper part 9 and textile web 2.

[0024] A printing unit 16 comprises eight U-shaped frames 17, 18, 19, 20, 21, 22, 23, 24, which are each adapted to generate, under the control of a control unit (not shown), a very small droplet of coloured ink at any point in time determined by the control unit by means of an inkjet head unit added to each frame, one colour for each frame. Printing means 16 are operative in the zone of the active part 9 of the conveyor belt. The printing takes place in accordance with an adjustable pattern to be selected.

[0025] Connecting onto printing unit 16 is a dryer 25 which is finally followed by a discharge and storage unit 26 in which the dried web, otherwise than in the infeed unit 13, is not rolled up onto a roll but, swinging back and forth as according to arrow 27 in per se known manner, comes to lie under its own weight in layers of the now printed textile web 28 on a stack 29.

[0026] The printing means, of which frames 17-24 form part, comprise frame beams which are added to the respective frames and supported thereby, and each of which carries an array of inkjet heads. During operation each of these arrays is immobile relative to the upper surface defined by the active part.

[0027] As shown in Fig. 3, conveyor belt 6 is supported over active part 9 by support surfaces, drawn in this case as rollers 31, 32, 33, 34, 35, 36, 37, 38, where the support positions for the conveyor belt correspond with the zones of the inkjet arrays situated thereabove. Rollers 31-38 are incorporated in the structure such that during operation they have a substantial difference in speed from that of conveyor belt 6. The rollers can for instance be driven or braked or, in the simplest case, be fixed.

[0028] Fig. 4, 5 and 6 show an embodiment in which the rollers are ordered in an arc such that active part 9 of conveyor belt 6 is deflected by each roller through an angle in the order of 1°.

[0029] Conveyor belt 6 is arranged under tensile stress over rollers 4 and 5.

[0030] Fig. 7 shows the U-shaped frame 22 which can be displaced laterally out of apparatus 1 in the manner shown in Fig. 1. The U-shape leaves clear an opening 41 such that with a lateral displacement as according to arrow 42 the frame 22 can be moved to the right in the drawing without disrupting the operation of the rest of the apparatus. During normal operation with seven colours for instance one beam corresponding to a colour not in use can thus be removed for service lines.

[0031] The upper leg of the U bears a beam 43 which carries an inkjet array in a manner not shown. Beam 43 can be positioned very precisely relative to lower leg 44 by means of respective recesses and protrusions.

[0032] Reference numeral 71 designates a supply station for coloured ink. As shown particularly clearly in Fig. 2, this station 2 contains two containers 72, 73, each with its own colour, between which it is possible to switch, or with the same colour for continuation of the printing process when one container is completely empty.

[0033] Fig. 8a shows that beam 43 is positioned as according to an arrow 45 such that it comes to lie in its nominal position with great precision in three independent directions.

[0034] Fig. 8b shows that by means of a drive 46 the beam 43 can be lifted out of positioning means 47, thus becomes freely suspended and can then be pushed as according to Fig. 8c to the right out of the frame in the direction of arrows 48.

[0035] Fig. 9 shows by way of example a beam 43 which is provided on its underside with three V-shaped grooves 51, 52, 53 which co-act with respective balls 54, 55, 56.

[0036] Fig. 10 shows the manner in which roller 5 can be tilted in a vertical plane, whereby a certain torsion is created in conveyor belt 6 which has the consequence that the belt undergoes a force whereby it leaves the transverse position it occupies and undergoes a gradual lateral displacement. By appropriate control it is thus possible to achieve that conveyor belt 6 retains it nominal transverse position with very great precision. In this example, not drawn to scale, the □z displacement can amount for instance to a maximum of 0.1 μm. The indicated displacement □y depends on the length of roller 5. This displacement is a second order effect compared to □z, and is therefore wholly negligible.

[0037] In the exemplary embodiment of Fig. 10, a tilting takes place around the centre of axis 51 to the position 51'. Where this tilting takes places is wholly unimportant. What is important is that the belt undergoes a certain torsion, whereby the side edges of the belt acquire a helical shape with a very small angle.

[0038] The bearing on the one side can for instance have a substantially fixed arrangement, while the bearing on the other side of roller 5 is vertically displaceable. This a mechanically very simple but nevertheless wholly reliable solution. Fig. 11 shows such an embodiment wherein on the side which is not drawn roller 5 is rotatable on its rotation shaft 52 substantially at a fixed position, while on the side shown in Fig. 11 it is supported by a bearing 53 which is pivotable relative to a frame beam 56 forming part of a frame by means of a pull rod 54 with a nut 55. A stepping motor 57 is provided with a rotatingly driven nut and an associated screw spindle 58 which, when driven by the stepping motor, can make a reciprocating movement as according to an arrow 59. The upper surface 60 of a cam lever 61 is hereby displaced against sub-frame 62, which can thereby undergo an upward and respectively downward directed displacement with associated adjustment of the position of the axis of shaft 52, whereby the above mentioned helix angle is changed. Not shown is that the control of stepping motor 57 takes place by a control unit which receives transverse position signals from an optical sensor situated in the immediate vicinity of the reversing roller. The embodiment is such that the optical sensor always performs a transverse position measurement at the same longitudinal point of the edge of the conveyor belt, thereby obtaining a determination of the transverse position.

[0039] Owing to the measures stated in the introduction the apparatus can display an exceptional accuracy, whereby the printed images realized with the apparatus are of a quality unknown up until now.

Claims

1. Apparatus (1) for printing a web (2) of textile, which apparatus (1) comprises:

a main frame (3);
an endless conveyor belt (6) which is guided over a driven roller (4) and a reversing roller (5) disposed parallel thereto and which is driven by motor means at a chosen constant speed;
glue dispensing means (8) for applying a glue layer upstream of the upper active part (9) of the conveyor belt (6) such that the web (2) is temporarily fixed non-movably relative to the conveyor belt;
supply and feed means (13) for feeding the textile web (2) from a supply to the upper active part of the conveyor belt (6);
printing means (16) for printing the passing textile web (2) in the zone of the upper active part (9) of the conveyor belt (6) in a number of colours in accordance with an adjustable pattern for selecting; and
discharge and storage means (26) for removing the printed textile web (2) from the conveyor belt and subsequent storage thereof;

in which
the printing means (16) comprise a number of, for instance 2 - 8, frame beams (43) extending in transverse direction above said upper active part (9) at determined mutual longitudinal distances along the direction of transport (7), each of which frame beams (43) carries an array of inkjet heads and each of which is immobile during operation relative to the plane defined by the upper active part (9);
control means are present, said control means storing a chosen printing pattern by means of inputting pattern information, for instance from a scanner and energizing the inkjet heads, also in relation to the chosen set speed (7) of the conveyor belt (6) and the mutual distances in the direction of transport between successive inkjet heads for the respective colours, such that each head sprays droplets of ink of the relevant colour onto the web (2) at the positions on the web (2) determined by the control means;
the discharge means (25) comprise drying means for drying the ink applied to the textile web (2);

characterized in that
each beam is supported by a sub-frame (17, 18, 19, 20, 21, 22, 23, 24) with the general form of a lying U which is laterally displaceable in and out of the apparatus (1) such that, if desired during operation of the apparatus (1), any sub-frame (17 - 24) whose inkjet heads are temporarily not in use can be displaced to the outside, for instance for repair or maintenance.

2. Apparatus (1) as claimed in claim 1,
characterized in that
each beam (43) can be positioned in a fixed position relative to the main frame by means of positioning means (51 - 56), comprising three sets of recesses, for instance V-grooves (51, 52, 53), and associated protrusions, for instance balls (54, 55, 56), present on the main frame and the beam (43) respectively, and that each beam (43) can be lifted out of the position defined by these positioning means (51 - 56) and in the thus obtained free position can be pushed to the outside, for instance for repair or maintenance.

3. Apparatus (1) as claimed in any of claims 1 and 2,
characterized by
washing means (10) placed downstream relative to the upper active part (9) for removing the glue from the conveyor belt (6).

Patentansprüche

1. Vorrichtung (1) zum Drucken einer Textilbahn (2), wobei die Vorrichtung (1) umfasst:

einen Hauptrahmen (3);
ein endloses Förderband (6), das über eine angetriebene Rolle (4) und eine parallel dazu angeordnete Umkehrrolle (5) geführt ist und das durch Motormittel mit einer wählbaren konstanten Geschwindigkeit angetrieben ist;
Klebstoffaufbringmittel (8) zum Aufbringen einer Klebstoffschicht stromaufwärts des oberen aktiven Teils (9) des Förderbands (6) in der Weise, dass die Bahn (2) temporär unbeweglich in Bezug auf das Förderband fixiert ist;
Vorrats- und Zufuhrmittel (13) zum Zuführen der Textilbahn (2) von einem Vorrat an den oberen aktiven Teil des Förderbands (6);
Druckmittel (16) zum Bedrucken der passiven Textilbahn (2) in der Zone des oberen aktiven Teils (9) des Förderbands (6) mit einer Anzahl von Farben zur Auswahl gemäß einem einstellbaren Muster; und Wegführ- und Speichermittel (26) zum Entfernen der bedruckten Textilbahn (2) von dem Förderband und zu deren nachfolgender Lagerung;

worin
die Bedruckungsmittel (16) eine Anzahl von, z.B. 2-8, Rahmenbalken (43) umfassen, die sich in Querrichtung über dem oberen aktiven Teil (9) entlang der Transportrichtung (7) in vorbestimmter Längsentfernung voneinander befinden, wobei jeder der Rahmenbalken (43) eine Anordnung von Tintendüsenköpfen aufweist und jeder von ihnen während des Betriebs unbeweglich ist im Bezug auf die durch den oberen aktiven Teil (9) definierte Ebene;
Steuermittel vorgesehen sind,
wobei die Steuermittel ein gewähltes Druckmuster mittels einer eingegebenen Musterinformation, z.B. von einem Scanner, speichern und die Tintendüsenköpfe aktivieren, auch in Bezug auf die gewählte Sollgeschwindigkeit (7) des Förderbands (6) und den jeweiligen Abständen in der Richtung des Transports zwischen aufeinander folgenden Düsenköpfen für die jeweiligen Farben, und zwar in der Weise, dass jeder Kopf Tintentröpfchen der entsprechenden Farbe auf die Bahn (2) an den Positionen auf der Bahn (2) sprüht, die durch die Steuermittel bestimmt sind; und
die Wegführmittel (25) Trocknungsmittel zum Trocknen der auf die Textilbahn aufgebrachten Tinte aufweisen;
dadurch gekennzeichnet, dass
jeder Balken unterstützt ist mittels eines Hilfsrahmens (17, 18, 19, 20, 21, 22, 23, 24) mit der generellen Form eines liegenden U, der lateral in und aus der Vorrichtung derart verschieblich ist, dass gewünschtenfalls während des Betriebs der Vorrichtung (1) ein beliebiger Hilfsrahmen (17-24), dessen

Tintendüsenköpfe zeitweilig nicht in Benutzung sind, an die Außenseite verschoben werden kann, z.B. zur Reparatur oder zur Wartung.

2. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet, dass
jeder Balken (43) in einer festen Position in Bezug auf den Hauptrahmen mittels Positioniermittel (51-56) positioniert werden kann, die drei Sätze von Ausnehmungen, z.B. V-Nuten (51, 52, 53), und zugeordnete Hervorstehungen, z.B. Kugeln (54, 55, 56) aufweisen, die jeweils auf dem Hauptrahmen und dem Balken (43) angeordnet sind, und dass jeder Balken (43) aus der durch diese Positioniermittel (51-56) bestimmten Position herausgehoben werden kann und in der somit erhaltenen freien Position an die Außenseite geschoben werden kann, z.B. zur Reparatur oder Wartung.

3. Vorrichtung nach einem beliebigen der Ansprüche 1 und 2,
gekennzeichnet durch,
eine Wascheinrichtung (10), die stromabwärts in Bezug auf den oberen aktiven Teil (9) angeordnet ist, zum Entfernen des Klebers von dem Förderband (6).

Revendications

1. Appareil (1) d'impression d'une toile (2) de textile, lequel appareil (1) comprend :

un cadre principal (3) ;
une courroie de transport sans fin (6) qui est guidée sur un rouleau entraîné (4) et un rouleau de renversement de marche (5) disposé parallèlement à celui-ci et qui est entraîné par un moyen formant moteur à une vitesse constante choisie ;
un moyen de distribution de colle (8) destiné à appliquer une couche de colle en amont de la partie supérieure active (9) de la courroie de transport (6) de telle manière que la toile (2) soit temporairement fixée de manière non mobile relativement à la courroie de transport ;
un moyen d'approvisionnement et d'alimentation (13) destiné à alimenter en toile textile (2) la partie supérieure active de la courroie de transport (6) ;
un moyen d'impression (16) pour imprimer la toile textile (2) passante dans la zone de la partie supérieure active (9) de la courroie de transport (6) en un certain nombre de couleurs conformément à un motif ajustable à sélectionner ; et
un moyen d'évacuation et de stockage (26) destiné à retirer la toile textile (2) imprimée de la courroie de transport et stocker ultérieurement celle-ci ;

dans lequel
le moyen d'impression (16) comprend un certain nombre de, par exemple 2 à 8, poutres (43) de cadre s'étendant dans une direction transversale au-dessus de ladite partie supérieure active (9) à des distances longitudinales réciproques déterminées le long de la direction de transport (7), chacune parmi les poutres (43) de cadre porte un réseau de têtes à jet d'encre et chacune d'entre elles est immobile au cours d'un fonctionnement relativement au plan défini par la partie supérieure active (9) ;
un moyen de commande est présent, ledit moyen de commande stockant un motif d'impression choisi au moyen d'informations de motif d'entrée, par exemple, à partir d'un dispositif de balayage et en excitant les têtes à jet d'encre, également en rapport avec la vitesse réglée choisie (7) de la courroie de transport (6) et les distances réciproques dans la direction de transport entre des têtes à jet d'encre successives pour les couleurs respectives, de telle manière que chaque tête pulvérise des gouttelettes d'encre de la couleur appropriée sur la toile (2) au niveau des positions sur la toile (2) déterminées par le moyen de commande ;
le moyen d'évacuation (25) comprend un moyen de séchage destiné à sécher l'encre appliquée sur la toile textile (2) ;
caractérisé en ce que
chaque poutre est supportée par un cadre auxiliaire (17, 18, 19, 20, 21, 22, 23, 24) ayant la forme générale d'un U allongé qui est déplaçable latéralement dans et hors de l'appareil (1) de telle manière que, si on le souhaite, au cours d'un fonctionnement de l'appareil (1), un quelconque cadre auxiliaire (17 à 24) dont des têtes à jet d'encre ne sont temporairement pas en utilisation, puisse être déplacé vers l'extérieur, par exemple, pour une réparation ou un entretien.

2. Appareil (1) selon la revendication 1,
caractérisé en ce que
chaque poutre (43) peut être positionnée dans une position fixe relativement au cadre principal au moyen de moyens de positionnement (51 à 56), comprenant trois ensembles d'évidements, par exemple, des rainures en V (51, 52, 53) et des protubérances associées, par exemple des billes (54, 55, 56) présentes sur le cadre principal et la poutre (43), respectivement, et **en ce que** chaque poutre (43) peut être relevée de la position définie par ces moyens de positionnement (51 à 56) et, dans la position libre ainsi obtenue, peut être poussée vers l'extérieur, par exemple, pour une réparation ou un entretien.

3. Appareil (1) selon l'une quelconque des revendications 1 et 2,
caractérisé par

un moyen de lavage (10) placé en aval relativement à la partie supérieure active (9) pour retirer la colle de la courroie de transport (6).

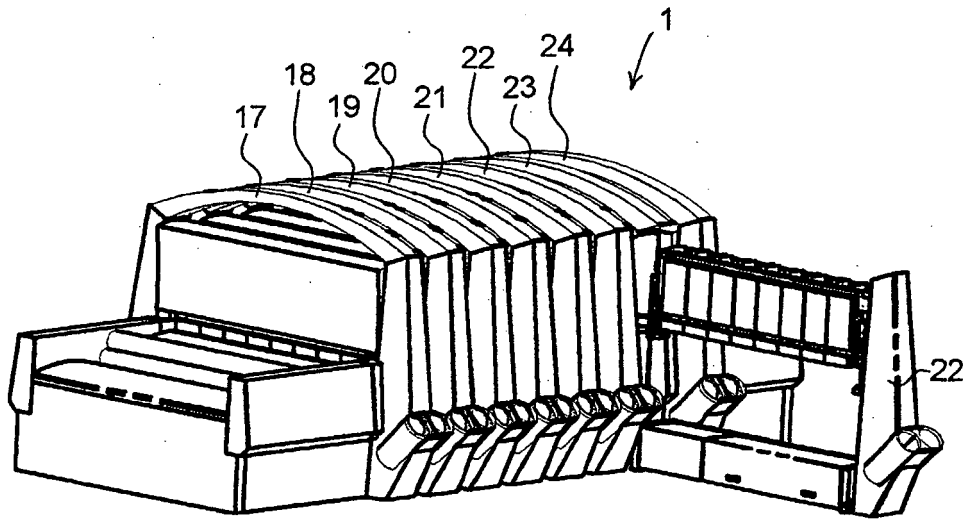

Fig. 1

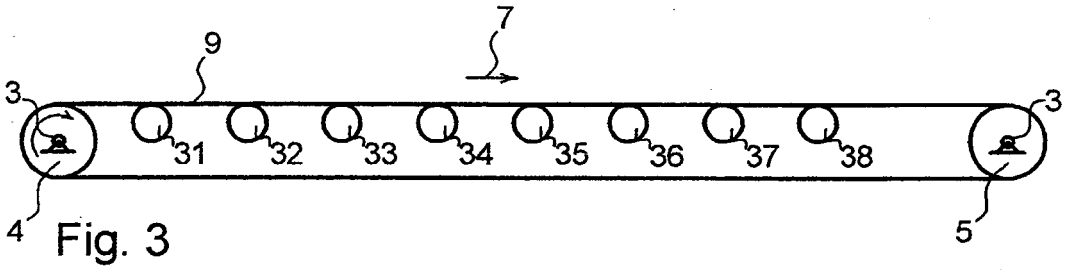

Fig. 3

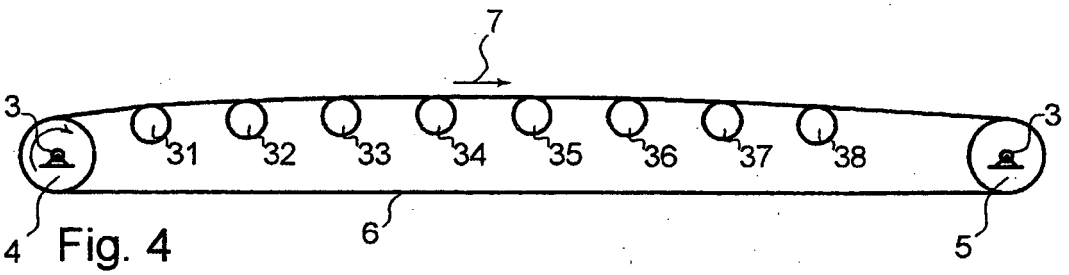

Fig. 4

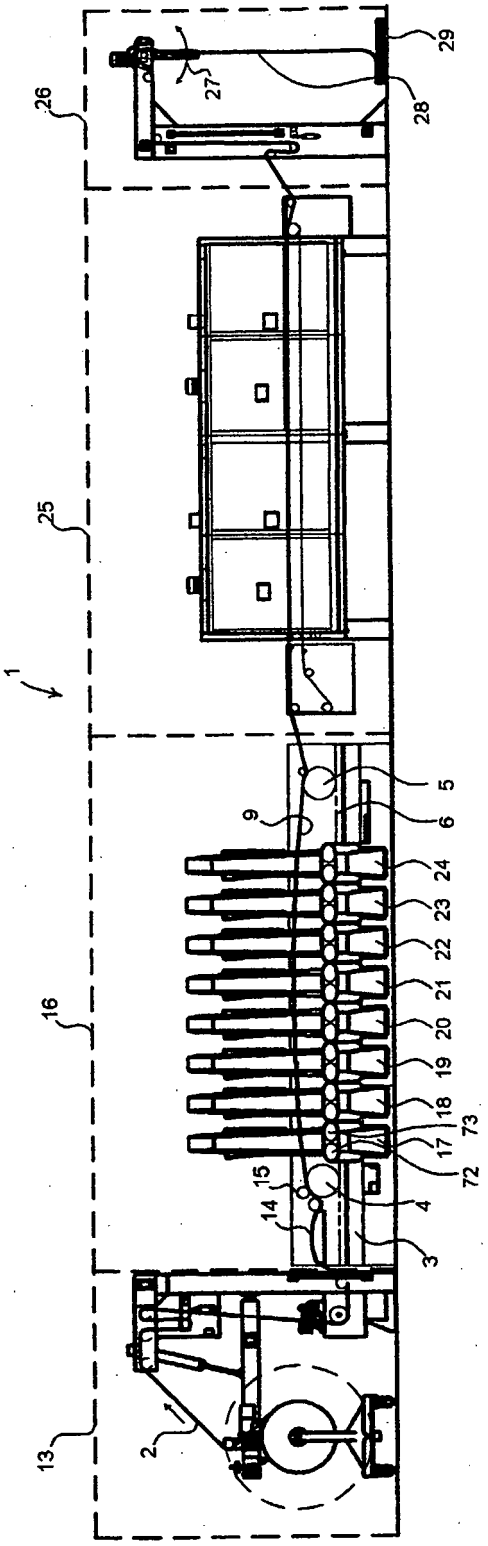

Fig. 2

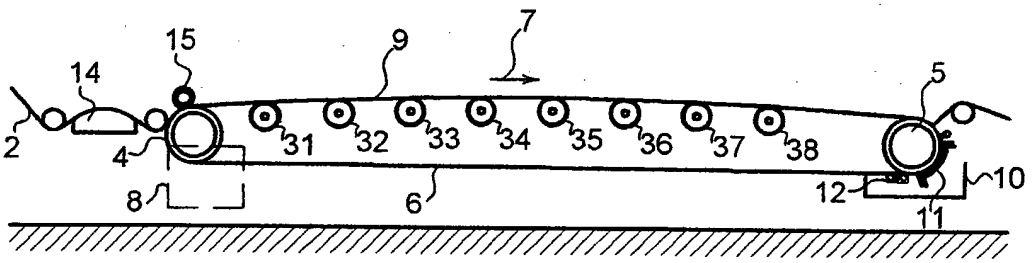

Fig. 5

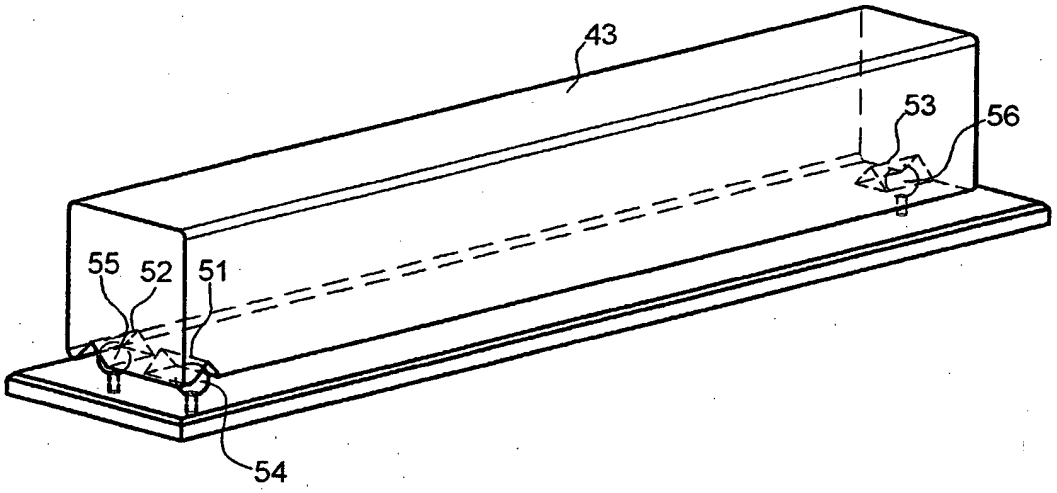

Fig. 9

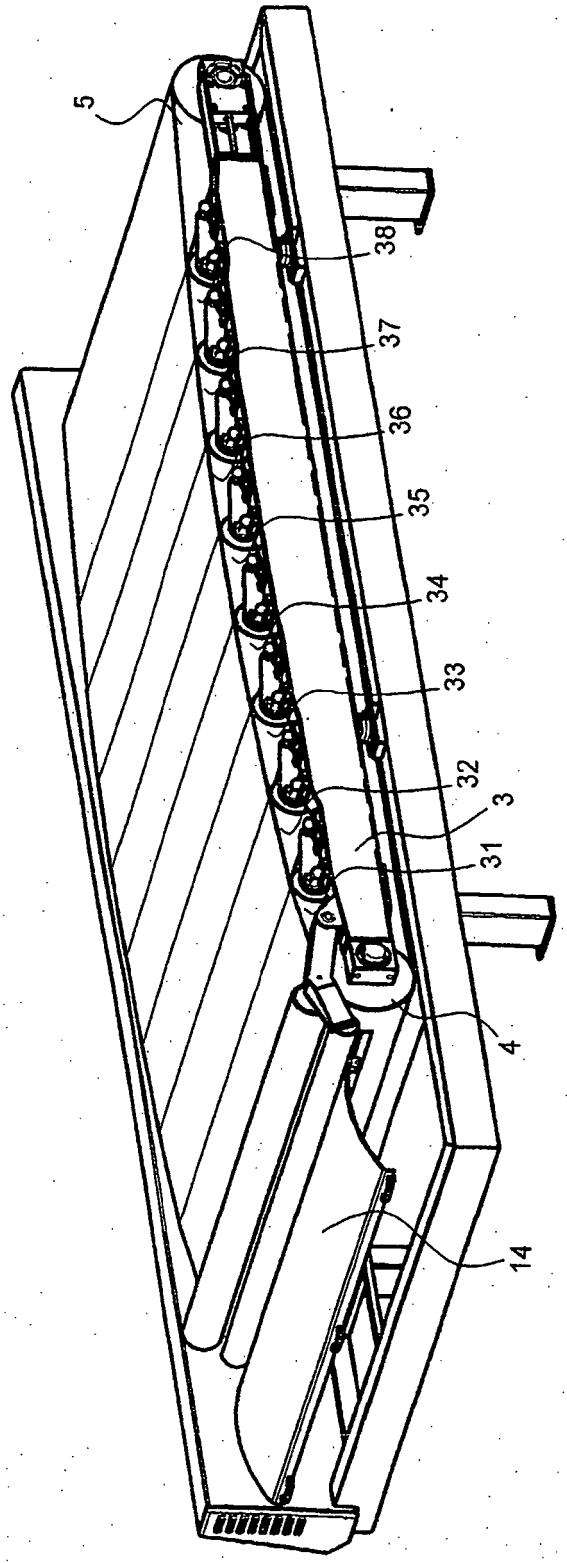

Fig.6

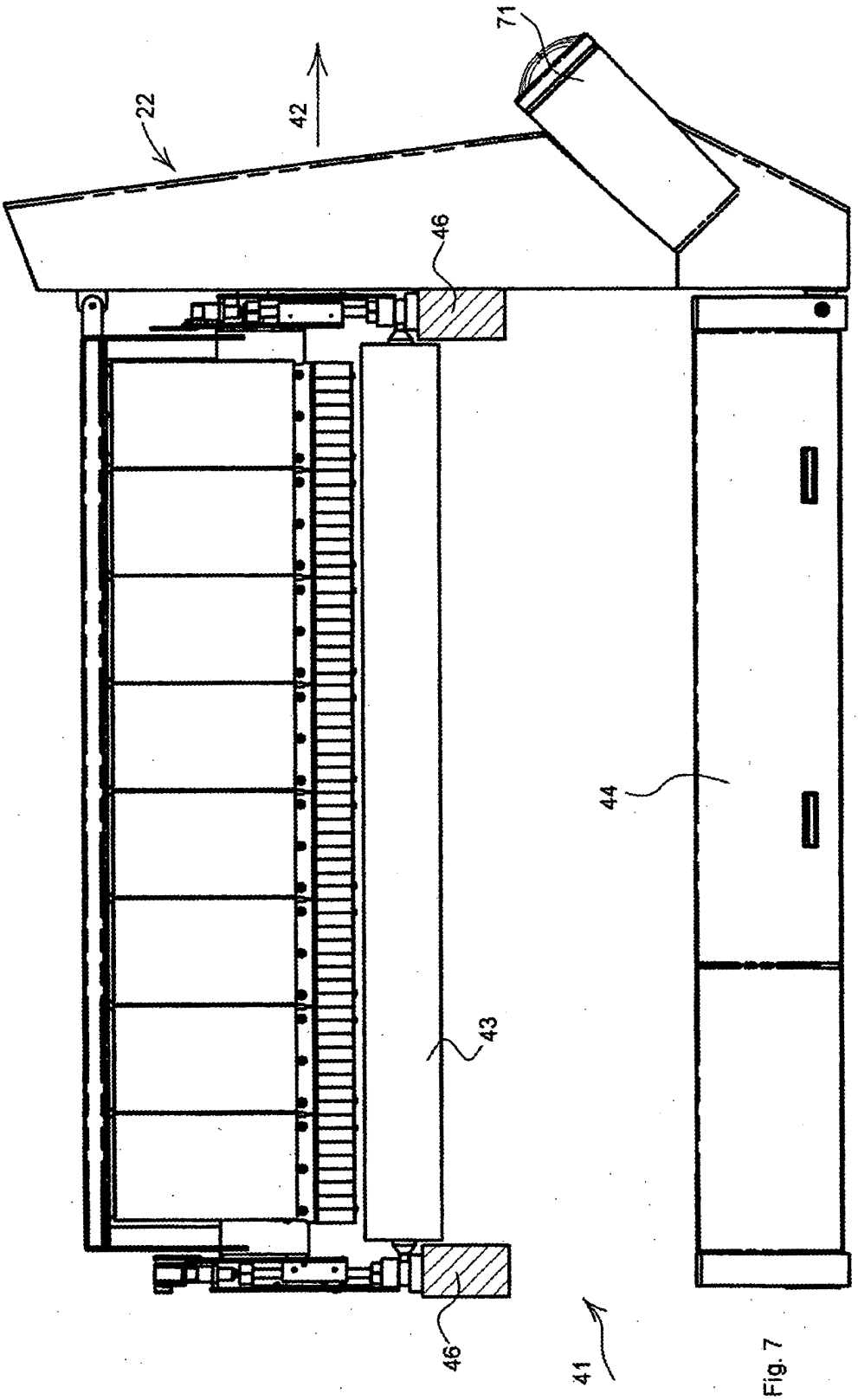

Fig. 7

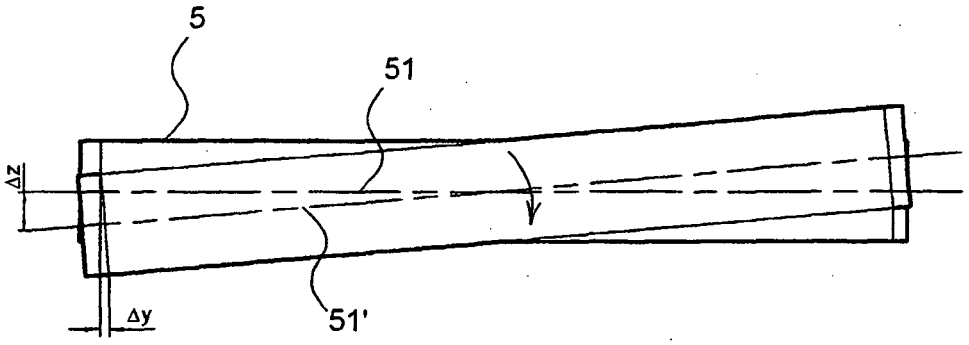

Fig. 10

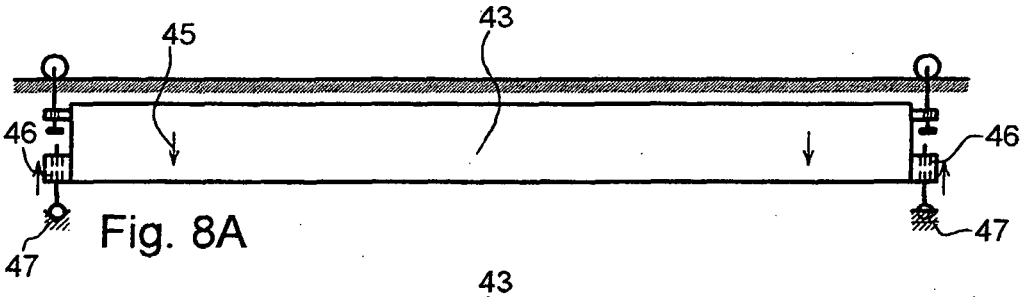

Fig. 8A

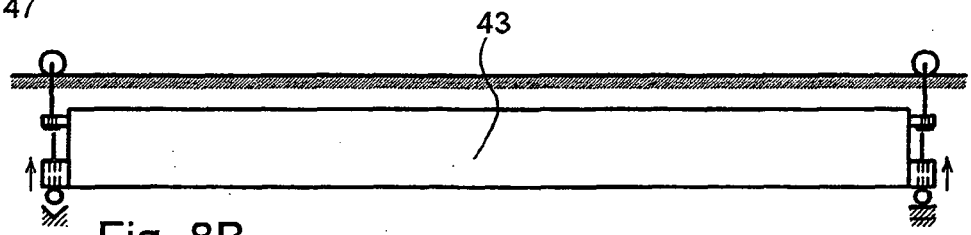

Fig. 8B

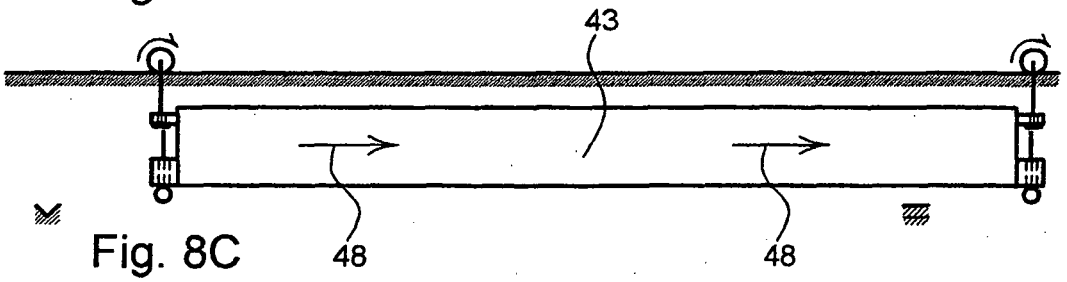

Fig. 8C

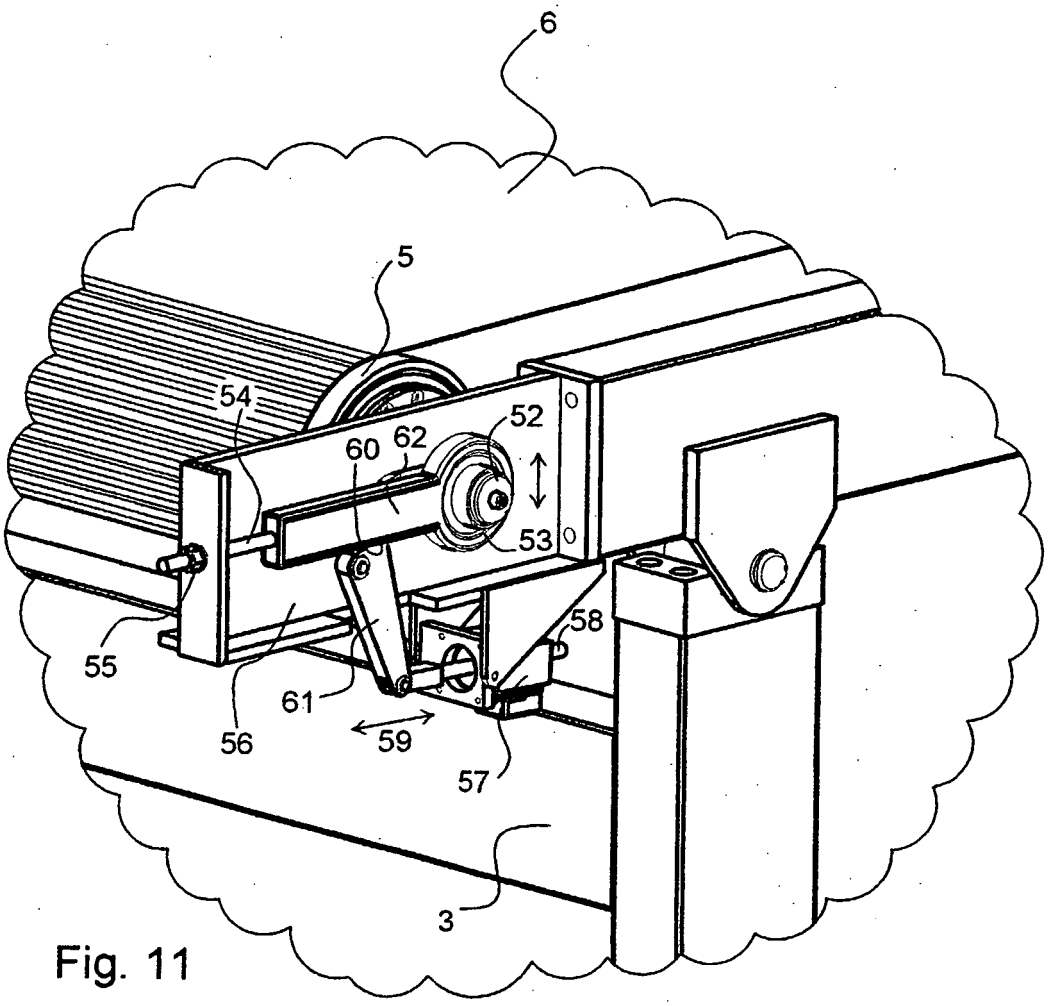

Fig. 11