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(54) CONTINUOUS INK JET FABRIC PRINTING APPARATUS

KONTINUIERLICHES TINTENSTRAHLTEXTILDRUCKGERÄT

APPAREIL D'IMPRESSION DE TISSUS PAR JET D'ENCRE EN CONTINU

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Description

Field of the technique.

[0001] This invention is relative to an apparatus for continuous printing by ink jet on fabrics, canvas, cloth, or on a transferable support.

Summary of the invention

[0002] Printing is carried out directly on the fabrics; it is done by an ink jet print head that sprays ink directly onto the fabric from the nozzles. The fabric is unrolled by a roller and is rolled up on another roller; it is moved by having it adhere temporarily to a mat furnished with an adhesive surface. The printing head moves in a direction perpendicular to the advancement of the fabric. The nozzles are set out on a plate that is parallel to the movement of the cloth. The plate contains the printing head and its height can be regulated. An ink supply system for the ink at the printing heads consents the supply of ink to the printing heads via the principal and intermediate tanks without creating air bubbles.

State of the art

[0003] The use of ink jet printing heads has been introduced recently. The patent JP-B-56-75870 presents a printing surface rolled on a roller that is not perfectly flat. Consequently, the row of nozzles present in the printing head is not all at the same distance from the cloth. The ink sprayed from the nozzles furthest away from it form a larger cone than that of the ink sprayed from the nearer nozzles. The design, therefore, is distorted, the precision of the printed image diminishes and the intensity of colour is subject to undesired variations.

[0004] Furthermore, the roll of fabric is unrolled from one roller and rolled, after printing, onto another roller that pulls the fabric from one side, causing a stretching of the fabric during printing and the successive slackening after printing. Consequently, the design printed on the fabric results as being distorted.

[0005] The patent US-B-5345863 describes an apparatus for continuous printing on fabrics. It gives a partial answer to the drawbacks listed above. In fact, the patent US-B-5345863 resolves the problem of the distortion of the fabric by temporarily fixing it onto a non-deformable mat. A print head has the possibility to move itself in a direction that is transversal to the direction of movement of the fabric. If the thickness of the fabric varies then the distance between the same fabric and the nozzles varies, taking this distance beyond the permitted limits. To bring the distance back within the permitted limits the mat is brought nearer to the support and the fabric nearer to the ink jet head nozzles, using a protruding rule with a length equal to the width of the fabric and with a width slightly larger than the width of the printing head in the direction of movement of the fabric. As the author of the patent

US-B-5345863 has already recognised (see series 5, lines 32-40), the movement of the protruding rule 2, in some way changes the tension of the endless mat 7, but, according to the author, does not influence the accuracy of the transport given that the entity of the movement of the member 22 is less than 1mm. Furthermore, the protruding rule 21 has a width, in the direction of transport, greater than the width of the ink jet head 3 in the same direction, thus it ensures the glide ability of the surface to be sprayed with drops of ink from the ink jet head 3.

[0006] To obtain a certain accuracy of transport for each print head, the author of patent US-B-5345863 foresees an adjustable protruding rule. It is evident that with this system it is not possible to use numerous print heads since more protruding rules would be necessary. Each protruding rule must be adjusted to guarantee an optimal distance of the fabric from the print nozzles, but, given that they have to be adjusted individually, the possibility that the distance of each rule from the nozzles of the single print heads is different increases notably. Given that the number of print heads determines the velocity, if few print heads are used they will have a low velocity of printing.

[0007] The number of the print heads poses the problem, however, that the possibility increases that some of them do not function, and must therefore be substituted.

[0008] All this poses a series of problems and inconveniences such as, for example: the substitution of one or more print heads, in as much as it is difficult to obtain a rapid and precise alignment between the individual heads themselves with respect to the geometry of the printing system. Along the direction of the run of print (horizontal), it is possible to foresee a correcting software that acts on the emission timings of the pixels of the individual heads, but this presupposes that a perfect alignment in the other print direction (vertical) is guaranteed, and also that of the perfect perpendicularity of the heads themselves. At present, the operation of aligning the heads is carried out directly on the machine via specific systems with micrometric adjustments that allow the orientation of each individual head in the various directions. Besides being very complex, this operation involves a notable expense of time (especially when one has an elevated number of heads), and almost always necessitates the intervention of qualified personnel, with inevitable added costs.

[0009] On the printing apparatus that use ink jet technology, one of the most important parts regards the ink feed system. Inside the hydraulic system it is necessary to guarantee the complete absence of air particles that prejudice the quality of printing, inhibiting the correct ejection of the single drop of ink. For this reason almost all the ink jet apparatus are fed through 'cartridge' systems that, keeping the ink in vacuum, minimize the problems of air drainage at the moment of their substitution. This solution, frequently used in common printers or office plotters, becomes limiting when the ink jet printing technology is used in printers or plotters applied in industry

(fabrics, serigraphy, etc.), where the production cycle necessitates a high consumption of the inks used. This is because the limited capacity of the cartridges containing the ink means the almost continuous substitution of the cartridges, especially if the number of colours present in the printers is high. The use of cartridges of greater dimensions does not solve the problem, in as much as at the moment of substitution it is necessary to interrupt the printing in progress to avoid the partial or total emptying of the hydraulic circuit.

[0010] The nozzles of the printing head become dusty passing over the fabric, and hairs can be deposited on them. After periods of repose, due for example to unforeseen events or at the end of a shift, the nozzles can result as being partially or totally obstructed, partially or totally diminishing their printing capability.

[0011] The fabric rolled badly on the support means that the fabric, while it is being unrolled, does not result as being centred when it is laid on the mat.

[0012] The different thickness of the fabric to be printed provokes the bringing nearer or the drawing away of the nozzles from the surface to be printed.

[0013] The printing head is not protected during the printing operations and the presence of foreign bodies on the fabric can damage the nozzles.

[0014] The resolution of existing machines is not high, because of the presence of motors and transmission mechanisms that influence the print quality.

[0015] An apparatus according to the preamble of claim 1 is disclosed in US 5,782,184.

[0016] The present invention is aimed at overcoming the difficulties and inconveniences present in the machines, including those described as state of the art and at present on sale.

[0017] The principal aim of the present invention is to create an apparatus for continuous ink jet printing on fabrics, composed of a steel housing with the functions of a support for a feed mat and the positioning of the fabric, said mat for feeding and positioning the fabric is rolled on two rollers; one tautening roller, and one motor roller; of an apparatus for unrolling the fabric, on said apparatus for unrolling the fabric the fabric carrying spool is mounted on transversal running guides and is equipped with a system for tautening the fabric, said fabric is therefore made to adhere to the mat which is treated with an adhesive material on the side in contact with the material; of a device for vacuuming and/or cleaning the fabric; of an ink jet fabric printing apparatus; of an apparatus for drying the fabric; of a mat washing system, characterised by the fact that the print heads, through the plates, are mounted on a main supporting plate of stainless steel on which the housings for all the print heads foreseen on the machine have been created, the print head housings are placed obliquely in respect to the sides of the plate; said plates of stainless steel present two oblong holes at the extremities for fixing them to the main plate with specific screws, and internally there is a third oblong hole and a rectangular cut for introducing the print head and

two holes for fixing the print head with specific screws; in said oblong hole the regulating block constituted of two parts is fixed, that united by use of a specific screw it is fixed to an extremity of the print head supporting plate in an opportunely regulated position; said housings of the individual heads on the main supporting plate are created with a workmanship capable of guaranteeing that the spacing between the housings and the width dimensions of these have a tolerance of ± 1 hundredth of a millimetre with respect to the relative measurements; that said ink jet fabric printing apparatus is activated by a linear motor; that the plate that supports the mat is equal in width to the width of the mat and has a greater length than the length of the ink jet print head carrying apparatus; that it has a system for feeding ink of various colours with a main tank and intermediate tanks; that it has a print head cleaning unit.

[0018] Another characteristic is given by the fact that said apparatus is activated by a linear motor; that said motor roller is activated by a power motor, fitted directly onto said retro-activated motor roller through a high resolution absolute encoder.

[0019] Another characteristic comes from the fact that the movement axle of the ink jet print head carrying apparatus in a direction perpendicular to the direction of advancement of the mat is built by assembling, with recycling ball rollers with a long-life self-lubricating system, a linear motor and an inductive transducer with a resolution inferior to $1\mu\text{m/m}$.

[0020] Another characteristic comes from the fact that said feed system for inks of various colours is basically constituted of three distinct groups: the main tank group, intermediate tank group and the print head group, sustained on the main supporting plate of stainless steel.

[0021] Another characteristic comes from the fact that said main tank is constituted of a small aluminium bag containing the ink in a vacuum.

[0022] Another characteristic comes from the fact that said main tank is inserted into a specific pneumatic container and is connected, through an apparatus with a needle, to a hydraulic circuit furnished with an electro valve, which connects it to the intermediate tank.

[0023] Another characteristic comes from the fact that said intermediate tank is in turn connected via a hydraulic circuit to the print heads; that the ink flows towards the intermediate tank when the apposite electro valve is opened.

[0024] Another characteristic comes from the fact that said pneumatic container containing said main tank has a lid with a release mechanism, that to substitute said main tank, said lid with release mechanism is opened, said release mechanism excludes the pressurization of said pneumatic container, extracts the apparatus with a needle from the main tank and contemporarily closes the electro valve. The lid is opened by turning it around the hinge. The main tank is substituted and the lid is closed, the release mechanism is returned to the closed position, making the apparatus with a needle penetrate into the

main tank and contemporarily opening the electro valve to return the hydraulic circuit to operation, said electro valve placed between the main tank and the intermediate tank guarantees the sealing under vacuum of the entire hydraulic system at the moment of the substitution of the main tanks.

[0025] Another characteristic comes from the fact that an electronic control system manages the entire process of colour feed and that each main tank is furnished with a specific electronic memory that permits the quantity of ink present inside it to be monitored at any moment.

[0026] Another characteristic comes from the fact that the head cleaning system is lodged laterally to the printing position, constituted of 24 vacuuming heads and by the same number of rakes for scraping the heads, the group is completed by 12 vacuuming systems (one for every two heads) situated under the vacuuming group.

[0027] Another characteristic comes from the fact that the apparatus is also predisposed for the application of a conditioning station for long periods of disuse, the station provides the correct level of humidity to the printing nozzles with distilled water through conduits. Another characteristic comes from the fact that said vacuuming and/or fabric-cleaning apparatus is constituted of a bi-adhesive system laid on the rollers.

[0028] Another characteristic comes from the fact that said vacuuming and/or fabric-cleaning system is constituted of a system of Velcro laid on the rollers.

[0029] Other characteristics and advantages of the invention will become clear from the description here following of some of the ways to construct the invention, given here as non-limiting examples in the figures 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.

Figure 1 represents a lateral view of a form of construction of an apparatus for printing on fabrics, object of the invention;

Figure 2 represents a front view of one form of construction of an apparatus for printing on fabrics, object of the invention;

Figure 3 represents a plan view of one form of construction of an apparatus for printing on fabrics, object of the invention;

Figure 4 represents a lateral view of one form of construction for an apparatus for printing on fabrics, object of the invention, complete with apparatus for feeding the fabric and cleaning the fabric;

Figure 5 represents a plan view of one form of construction of the print head carrying plate, object of the invention;

Figure 6 represents a plan view of one form of construction of a print head carrying platelet, object of the invention;

Figure 7 represents a plan view of a print head;

Figure 8 represents a section of a small plate onto which the regulating block is mounted;

Figure 9 represents one section of a small plate onto which a print head and a regulating block have been

mounted;

Figure 10 represents a section of the ink feed system in the apparatus, object of the invention.

[0030] With reference to the figures 1, 2, 3 and 4 the apparatus is composed of a steel housing (2) with functions of support for the mat (3), for feeding and positioning the fabric (1); of an apparatus for unrolling the fabric (4), of a vacuuming and/or fabric-cleaning apparatus (5), of an ink jet fabric printing apparatus (6) with at least two print head groups (in the example in the figures the print head groups are oblique), activated by a linear motor, of a support plate (7) for the mat (3), of an apparatus for drying the fabric; of a washing system for the fabric; of an ink feed system (8) of diverse colours, of a head cleaning unit (9).

[0031] The fabric-carrying spool (11) mounted on transversal runners and equipped with a tautening system (12) for the fabric (1), is placed on the apparatus for unrolling the fabric (4). A continuous current motor, retro-activated by two photocells, permits maintaining the edge of the fabric aligned during the unrolling. The fabric (1) passes through the vacuuming and/or fabric-cleaning apparatus (5) constituted of a vacuuming system (13), of a system with bi-adhesive (14) laid on the rollers, of a system of Velcro (14) laid on the rollers. The vacuuming and/or fabric cleaning apparatus (5) permit the elimination of dirt or other elements that can damage or soil the nozzles of the heads of the printing apparatus. The fabric (1) is therefore made to adhere to the mat (3), which on the side in contact with the fabric is treated with a holding adhesive. The mat (2) for feeding and positioning the fabric (1) is constructed with composite materials such as polyamides and elastomers. The mat (2) for feeding and positioning the fabric (1) is rolled on two rollers, one tautening roller (16) and a motor roller (17), the motor roller (17) is activated by a power motor (18) fitted directly onto said motor roller (17) retro activated by an absolute encoder at high resolution. The direct motorisation of the positioning and feeding mat (2) avoids the introduction, via transformers and transmission couplings, of disturbances to the quality of the printing. The housing is constructed by assembling two very thick lateral plates (20) through the use of metal crosspieces (21), with the functions of stiffening and positioning the entire system, to guarantee great rigidity and dimensional stability.

[0032] The fabric (1) is kept adhered to the mat (2) by an adhesive roller (22) positioned by pneumatic activators. The fabric (1) is tautened and transported on the mat (2) in the direction of the ink jet printing apparatus (6). Underneath the mat on the side opposite to the ink jet apparatus (6) a flat plate (7) is placed in support of the mat (2). The flat plate (7) has a width equal to the width of the mat (2) and a length superior to that of the ink jet printing apparatus (6). In the area of printing the mat (2), and therefore the fabric (1) fixed to it, are perfectly flat in relation to the ink jet printing apparatus (6).

[0033] With reference to the figures 5, 6, 7, 8 and 9,

the ink jet printing apparatus is constituted of:

a) A main supporting plate in stainless steel (31), on which the print head housings that are foreseen on the machine have been created, the print head housings are placed obliquely in respect to the sides of the plate (in the example of the figures, 24 print heads).

b) A small plate in stainless steel (35) that presents two oblong holes (37 and 38) at the extremities for fixing the same to the main plate (31) with specific screws (43), and a third oblong hole (39) inside and a rectangular cut (40) for the introduction of the print head (36) and two holes (41) for fixing the print head with specific screws (42).

c) A regulating block constituted of two parts (37A and 37B) that, united by a specific screw (44) is fixed to an extremity of the print head supporting plate, in an opportunely regulated position.

[0034] The housings (32) of the individual heads on the main supporting plate (31) are constructed with a particular workmanship, capable of guaranteeing that the spacing between the housings and the width dimensions of these have the same tolerance of +/-1 hundredth of a millimetre in relation to the relative measurements.

[0035] The length dimensions of the housings have a greater measurement in respect to the dimensions of the print head, in such a way as to permit the head to be moved along in this direction.

[0036] Perpendicular to each housing (32), specifically to contain the print head, an ulterior site of opportune measurements (33) is obtained with extreme precision of positioning in respect to the same housings.

[0037] The side (34) of the site (33) serves (at the moment of mounting of each individual head) as a positioning check for the regulating block previously regulated and fixed onto the small supporting plate of the print head.

[0038] The precise positioning of the regulating block (37A, 37B) on the small positioning plate (35) of each individual head is carried out in the workshop using an electronic microscope, that permits the guarantee, with extreme precision, that each nozzle of a head has a well defined position in respect to the block itself. This therefore permits the calibration of all the print heads in the same, precise position on the corresponding small supporting plate in respect to the regulating block.

[0039] At the moment of assembly of the heads thus pre-calibrated on the main plate it is sufficient to position the small supporting plate of the head on the relative check, in order to obtain a precise alignment between them in all the directions of the heads.

[0040] This system therefore permits one to substitute one or more print heads without the necessity of proceeding with long and difficult operations of calibration on the machine, in as much as the heads are supplied to the user already assembled with the apparatus described above.

[0041] It has been established that with the disposition of the heads along parallel lines and columns there was a defect of imprecise edging on the edges of each design strip produced.

5 **[0042]** This is due to the fact that the first and last nozzles placed at the extremities of the heads are less precise in spraying onto the fabric in respect to the others.

[0043] This effect becomes increased by the fact of having all the heads of a group of eight colours aligned between themselves.

10 **[0044]** There are also two other factors that can determine ulterior printing defects:

15 1) Any eventual small error of positioning the fabric under the print heads always becomes underlined by the fact of having the heads aligned.

2) In the case of even a single head in the group having printing problems (obstructed nozzles, less power in spraying the colour, eventual deviated nozzles, etc.) the design lines produced result as being different in respect to the lines produced by the other two groups.

25 **[0045]** With the oblique disposition, each group of eight colours is disposed in such a way as to avoid these problems.

[0046] In fact, the new arrangement permits each portion of design to be produced by using all the heads.

30 **[0047]** The design is no longer produced in single strips, finished at each passage, but with more passages, using different heads.

[0048] The ink jet printing head carrying apparatus (6) moves in a direction that is perpendicular to the direction of the advancement of the mat (2) and therefore the fabric (1).

35 **[0049]** The movement axle of the ink jet printing head apparatus (6), perpendicular in direction to the direction of advancement of the mat (2), is created by assembling, using recycling ball rollers with a long-life self-lubricating system, a linear motor (50) and an inductive transducer with a resolution inferior to 1 $\mu\text{m/m}$. In this way, the objective is obtained of realising a transferring axle with a transfer velocity that is absolutely linear and constant, and at the same time supplying the operating system with a very high resolution to determine the printing points so that the final result is optimal.

40 **[0050]** With reference to figure 10, the ink jet printing apparatus (6) is connected to an ink feed system (8) of different colours.

50 **[0051]** The colour feed system (8) is basically constituted of three distinct groups.

- The main tank group (55).
- The intermediate tank group (52).
- 55 - The print head group (6).

[0052] The main tank (55) substitutes the common cartridge and is constituted of an aluminium bag containing

ink under vacuum (exactly the same principle used for "phlebotomy" bags).

[0053] These tanks can have diverse forms and capacities; our system foresees the use of tanks containing 1 litre of ink.

[0054] The tank is inserted into a specific pneumatic container (51) and connected, through an apparatus with a needle (66), to a hydraulic circuit (64) furnished with an electro valve (63), which connects it to the intermediate tank (52). In turn, the intermediate tank (52) is connected to the print heads via a hydraulic circuit (57).

[0055] The intermediate tanks (52) can have diverse forms and capacities; the system, object of the present invention foresees the use of intermediate tanks (52) of 0.1 litres.

[0056] The process of colour feeding functions in the following manner:

Once the main tank (55) is inserted, the pneumatic container (51) is brought to an opportune pressure by specific instruments which, acting on the tank itself, permit the ink to flow towards the intermediate tank (52) when the specific electro valve (63) is opened. The opening and closing of the electro valve is governed by a regulating system placed on the intermediate tank. This apparatus permits the control of the level of ink present in the intermediate tank, keeping it within a determined field of predefined variation.

[0057] The drivers of the heads themselves regulate the outflow of the ink from the intermediate tank towards the print heads.

[0058] With the use of this system one has the possibility of substituting a main tank (55) even during the normal functioning of the machine, in as much as the colour feed is always guaranteed by the intermediate tank (52), that functions as a reserve.

[0059] To substitute a main tank (55), the release mechanism (68) is opened, which excludes the pressurisation of the pneumatic container (51), the apparatus with a needle (66) is extracted from the main tank (55), and contemporarily the electro valve (63) is closed. The lid (69) is opened by turning it around the hinge (70). The main tank (55) is substituted and the lid (69) is closed, the release mechanism (68) is returned to the closed position, making the apparatus with a needle (66) penetrate into the main tank (55) and contemporarily opening the electro valve (63) to return the hydraulic circuit (64) to functionality.

[0060] The electro valve (63) placed between the principal tank (55) and the intermediate tank (52) guarantees that the entire hydraulic system is maintained under vacuum at the moment of the substitution of the main tanks (55).

[0061] An electronic control system runs the entire colour feed process.

[0062] Each main tank (55) is furnished with a specific

electronic memory that permits the monitoring of the quantity of ink present inside it at any moment.

[0063] The apparatus for printing on fabrics, canvas, cloth or on a transferable support, object of the present invention, is furnished with a mat washing system that uses rolling brushes and jets of water, drying takes place with forced air.

[0064] The entire print-carrying unit (6) is vertically regulated according to the thickness of the fabrics to be printed on by the use of slanted guides that are moved by screws that are moved manually or by a stepper motor. This vertical adjustment is also used in the head cleaning operations, for the positioning of the apparatus for vacuuming and on the cleaning rakes.

[0065] The complete printing group is protected laterally, in the sense of movement of the axle, by bendable walls that are electronically controlled to avoid eventual obstacles that can damage them, or move them from the original preset positions, insinuating themselves under the printing apparatus.

[0066] The machine is also predisposed for the application of a conditioning station for long periods of repose; the station supplies the correct level of humidity to the print nozzles with distilled water through conduits.

[0067] The invention, it should be noted, is not limited to the explanation given by the figures, but may be perfected and modified by men skilled in the art, without, however, leaving the field of the patent.

[0068] The present invention permits numerous advantages, and to overcome difficulties that could not have been overcome with the systems presently on sale.

Claims

1. Continuous ink jet fabric printing apparatus composed of a housing in steel (2) with support functions for a mat (3) for feeding and positioning the fabric (1), said mat (3) for feeding and positioning the fabric (1) is rolled on two rollers, a tautening roller (16) and a motor roller (17); of an apparatus for unrolling the fabric (4), on said apparatus for unrolling the fabric (4) is placed the fabric carrying spool (11), mounted on transversal runners and equipped with a tautening system (12) for the fabric (1), said fabric (1) is therefore made to adhere to the mat (3), that the side in contact with the fabric (4) is treated with an adhesive tape; of a vacuuming and/or fabric-cleaning apparatus (5), of an apparatus for ink jet printing on fabrics (6); of a fabric drying apparatus; of a carpet washing system **characterised by the fact that** the print heads, via the small plates (35), are mounted on a main supporting plate of stainless steel (31), on which the housings (32) of all the print heads foreseen on the machine have been created, the housings (32) of the print heads are placed obliquely in respect to the sides of the plate; said small plates in stainless steel (35) present two oblong holes (37 and

- 38) at their extremities, for fixing these to the main plate (31) using specific screws (43), and with a third oblong hole (39) and a rectangular cut (40) inside for the introduction of the print head (36), and two holes (41) for fixing the print head using specific screws (42); in said oblong hole (39) the regulating block constituted of two parts (37A and 37B) is fixed, which, united by a specific screw (44), is fixed to one extremity of the supporting plate (35) of the print head in an opportunely regulated position; said housings (32) of the individual heads on the principal supporting plate (31) are created by a workmanship capable of guaranteeing that the spacing between the housings and the width dimensions of these have a tolerance of +/-1 hundredth of a millimetre in relation to the relative measurements; that said ink jet apparatus for printing on fabrics is activated by a linear motor; that the plate (7) that supports the mat (3) has a width equal to the width of the mat (3) and a length greater than the length of the ink jet print head carrying apparatus; that it has a system for feeding ink (8) of various colours with a main tank and intermediate tanks; that it has a print head cleaning unit (9).
2. Continuous ink jet fabric printing apparatus according to claim 1 **characterised by the fact that** said apparatus is activated by a linear motor; that said linear motor (1) is activated by a power motor (18) fitted directly onto said motor roller (17) retro-activated by an absolute encoder at high resolution.
 3. Continuous ink jet fabric printing apparatus according to claims 1 or 2 **characterised by the fact that** the movement axle of the ink jet print head carrying apparatus (6), in a direction perpendicular to that of the direction of advancement of the mat (2), is created by assembling, with recycling ball rollers with a long-life self-lubricating system, a linear motor (50) and an inductive transducer with a resolution inferior to 1 $\mu\text{m/m}$.
 4. Continuous ink jet fabric printing apparatus according to claims 1 or 2 **characterised by the fact that** said ink feed system (8) of different colours is constituted basically of three distinct groups: the main tank group (55), intermediate tank group (52) and the print head group (6), sustained on the main supporting plate (31) of stainless steel.
 5. Continuous ink jet fabric printing apparatus according to claim 4 **characterised by the fact that** said main tank (55) is constituted of an aluminium bag containing the ink under vacuum.
 6. Continuous ink jet fabric printing apparatus according to claim 5 **characterised by the fact that** said main tank (55) is inserted into a specific pneumatic container (51) and connected, via an apparatus with a needle (66), to a hydraulic circuit (64) furnished with an electro valve (63) that connects it to the intermediate tank (52).
 7. Continuous ink jet fabric printing apparatus according to claim 6 **characterised by the fact that** said intermediate tank (52) is in turn connected through the hydraulic circuit (57) to the print head; that the ink flows towards the intermediate tank (52) when the specific electro valve (63) is opened.
 8. Continuous ink jet fabric printing apparatus according to claim 6 **characterised by the fact that** said pneumatic container (51) containing said main tank (55) has a lid (69) with a release mechanism (68), that to substitute said main tank (55) said lid (69) with a release mechanism (68) is opened, said release mechanism (68) excludes the pressurisation of said pneumatic container (51), extracts the apparatus with a needle (66) from the main tank (55), and contemporarily closes the electro valve (63). The lid (69) is opened by turning it around the hinge (70). The main tank (55) is substituted and the lid (69) is closed, the release mechanism (68) is returned to the closed position, making the apparatus with a needle (66) penetrate into the main tank (55) and contemporarily opening the electro valve (63) to return the hydraulic circuit (64) to functionality; said electro valve positioned between the main tank (55) and the intermediate tank (52) guarantees maintaining the entire hydraulic system under vacuum at the moment of substitution of the main tanks (55).
 9. Continuous ink jet fabric printing apparatus according to claim 5 **characterised by the fact that** an electronic control system controls the entire colour feed process and that each main tank (55) is furnished with a specific electronic memory that permits checking the quantity of ink present inside it at any moment.
 10. Continuous ink jet fabric printing apparatus according to claim 1 **characterised by the fact that** the head-cleaning system, constituted of 24 vacuuming heads and the same number of rakes for scraping the print heads, is housed laterally to the printing position; the group is completed by the 12 vacuuming systems (one for every two heads) sited under the vacuuming group.
 11. Continuous ink jet fabric printing apparatus according to claim 1 **characterised by the fact that** the apparatus is also predisposed for the application of a conditioning station for long periods of disuse; the station provides the correct level of humidity to the print nozzles via conduits with distilled water.
 12. Continuous ink jet fabric printing apparatus accord-

ing to claim 1 **characterised by the fact that** said apparatus for vacuuming and/or fabric cleaning (5) is constituted of a *vacuuming* system (13).

13. Continuous ink jet fabric printing apparatus according to claim 1 **characterised by the fact that** said vacuuming and/or fabric-cleaning apparatus (5) is constituted of a bi-adhesive system (14) laid on the rollers.
14. Continuous ink jet fabric printing apparatus according to claim 1 **characterised by the fact that** said vacuuming and/or fabric-cleaning apparatus (5) is constituted of a system with Velcro (14) laid on the rollers.

Patentansprüche

1. Kontinuierlich arbeitende Tintenstrahl-Druckmaschine für Gewebe, umfassend ein Stahlgehäuse (2) mit Tragfunktionen für eine Matte (3) zum Zuführen und Positionieren des Gewebes (1), die um zwei Rollen läuft, nämlich eine Spannrolle (16) und eine Antriebsrolle (17), eine Abrolleinrichtung (4) für das Gewebe, auf der eine Gewebebandspule (11) angeordnet ist, die auf Querläufern abgestützt und mit einem Spannsystem (12) für das Gewebe (1) ausgerüstet ist, so dass das Gewebe (1) an der Matte (3) anliegt, wobei die Seite der Matte, die in Kontakt mit dem Gewebe (4) ist, mit einem Adhäsionsband versehen ist, eine Vakuum- und/oder eine Gewebereinigungseinrichtung (5), einen Tintenstrahlendrucker (6) zum Bedrucken des Gewebes, ein Trockengerät für das Gewebe und ein Belagwaschsystem, **dadurch gekennzeichnet, dass** die Druckköpfe (36) über schmale Platten (35) auf einer Haupttragplatte (31) aus rostfreiem Stahl angebracht sind, auf der die Gehäuse (32) aller Druckköpfe der Druckmaschine derart angelegt sind, dass diese Gehäuse (32) der Druckköpfe bezüglich der Seiten der Platte schräg ausgerichtet sind, wobei die schmalen Platten (35) aus rostfreiem Stahl an ihren Enden zwei Langlöcher (37, 38) für ihre Befestigung mittels Spezialschrauben (43) auf der Haupttragplatte (31), ein drittes Langloch (39) und eine rechteckige Aussparung (40) zum Einsetzen des Druckkopfes (36) sowie zwei Löcher (41) zum Befestigen des Druckkopfes mittels Spezialschrauben (42) aufweisen, wobei in dem Langloch (39) der aus zwei über eine Spezialschraube (44) miteinander verbundenen Teilen (37A, 37B) bestehende Einstellblock an einem Ende der Tragplatte (35) des Druckkopfes (36) in einer ausgerichteten Stellung befestigt ist, wobei die Gehäuse (32) der einzelnen Druckköpfe auf der Haupttragplatte (31) mittels Handarbeit angebracht sind, die gewährleistet, dass der Abstand zwischen den Gehäusen und deren Breitendimensionen eine Toleranz von +/-

einem hundertsten Millimeter bezüglich der entsprechenden Abmessungen haben, wobei die Tintenstrahl-Druckmaschine für Gewebe von einem Linearmotor angetrieben wird und die Platte (7), welche die Matte (3) trägt, eine der Breite der Matte (3) entsprechende Breite und eine Länge hat, die größer ist als die Länge der Druckkopf-Trageinrichtung, wobei schließlich ein System (8) zum Zuführen von Tinte verschiedener Farben mit einen Haupttank und Zwischentanks sowie eine Reinigungseinheit (8) für die Druckköpfe vorgesehen sind.

2. Tintenstrahl-Druckmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** diese von einem Linearmotor (1) betätigt wird, der von einen Starkstrommotor (18) angetrieben wird, der direkt auf der Antriebsrolle (17) befestigt ist, welche von einem Absolut-Codierer mit hoher Auflösung rückaktiviert wird.
3. Tintenstrahl-Druckmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Bewegungsachse des Druckkopftragapparates (6) rechtwinklig zu der Vorschubbewegung der Matte (3) **dadurch** erzeugt wird, dass ein Linearmotor (50) und ein Induktivwandler mit einer Auflösung von weniger als 1 µm/m mit Umlaufkugelrollen mit einem langlebigen Selbstschmierungssystem verbunden wird.
4. Tintenstrahl-Druckmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Tintenzufuhrsystem (8) für mehrere Farben im wesentlichen aus drei selbständigen Gruppen besteht, nämlich einer Haupttankgruppe (55), einer Zwischentankgruppe (52) und der Druckkopfgruppe (6), die auf der Haupttragplatte (31) aus rostfreiem Stahl gelagert sind.
5. Tintenstrahl-Druckmaschine nach Anspruch 4, **dadurch gekennzeichnet, dass** der Haupttank (55) aus einem Aluminiumbehälter besteht, der Tinte unter Vakuum enthält.
6. Tintenstrahl-Druckmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** der Haupttank (55) in einen besonderen Pneumatikbehälter (51) eingesetzt und über einen Apparat (66) mit einer Nadel an eine Hydraulikschaltung (64) mit einen Elektroventil (63) angeschlossen ist, der diesen mit dem Zwischentank (52) verbindet.
7. Tintenstrahl-Druckmaschine nach Anspruch 6, **dadurch gekennzeichnet, dass** der Zwischentank (52) seinerseits über einen Hydraulikschaltkreis (57) mit dem Druckkopf verbunden ist, wobei die Tinte zu dem Zwischentank (52) fließt, wenn das zugehörige Elektroventil (63) geöffnet ist.

8. Tintenstrahl-Druckmaschine nach Anspruch 6, **dadurch gekennzeichnet, dass** der den Haupttank (55) aufnehmende Pneumatikbehälter (51) einen Deckel (69) mit einem Freigabemechanismus (68) hat derart, dass zum Austausch des Haupttanks (55) der Deckel (69) durch den Freigabemechanismus (68) geöffnet wird, welcher eine Druckbeaufschlagung des Pneumatikbehälters (51) unterbindet, den Nadelapparat (66) aus dem Haupttank (55) herauszieht und gleichzeitig das Elektroventil (63) schließt; der Deckel (69) wird durch Drehung um das Gelenk (70) geöffnet; der Haupttank (55) wird ausgetauscht und der Deckel (69) wird geschlossen, der Freigabemechanismus (68) wird in seine geschlossene Position zurückgeführt, so dass der Apparat (66) mit der Nadel in den Haupttank (55) eindringt und gleichzeitig das Elektroventil (63) geöffnet wird, wodurch die Hydraulikschaltung (64) wieder in Betriebsbereitschaft kommt, wobei das Elektroventil zwischen dem Haupttank (55) und dem Zwischentank (52) gewährleistet, dass das gesamte Hydrauliksystem im Augenblick des Austausches des Haupttanks (55) unter Vakuum gehalten wird.
9. Tintenstrahl-Druckmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** ein elektronisches Steuersystem den gesamten Farbtintenzuführprozess steuert und dass jeder Haupttank (55) mit einen spezifischen Elektronikspeicher ausgerüstet ist, der eine Füllungskontrolle der in jedem Augenblick vorhandenen Tinte erlaubt.
10. Tintenstrahl-Druckmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** ein aus 24 Vakuumköpfen und derselben Zahl von Rakeln zum Abschaben der Druckköpfe bestehendes Kopfreinigungssystem seitlich von den Druckpositionen untergebracht ist, wobei diese Gruppe ergänzt wird durch 12 Vakuumsysteme (je eines für jeweils zwei Köpfe), das unter der Vakuumgruppe liegt.
11. Tintenstrahl-Druckmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die Maschine auch zur Anwendung einer Aufbereitungsstation über längere Stillstandszeiten geeignet ist, wobei diese Station mittels Leitungen mit destilliertem Wasser für einen korrekten Feuchtigkeitsgrad an den Druckdüsen sorgt.
12. Tintenstrahl-Druckmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die Gewebereinigungs- und/oder Vakuumeinrichtung (5) aus einem Unterdrucksystem (13) besteht.
13. Tintenstrahl-Druckmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die Gewebereinigungs- und/oder Vakuumeinrichtung (5) aus einem Biadhäsionssystem (14) besteht, das auf den Rollen

aufliegt.

14. Tintenstrahl-Druckmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die Gewebereinigungs- und/oder Vakuumeinrichtung (5) aus einem auf den Rollen aufliegenden Klettbandsystem (14) besteht.

10 Revendications

1. Appareil d'impression continue par jet d'encre sur tissu, composé d'un logement en acier (2) avec des fonctions de support pour un mat (3) pour distribuer et positionner le tissu (1), ledit mat (3) pour distribuer et positionner le tissu (1) est enroulé sur deux rouleaux, un rouleau tendeur (16) et un rouleau moteur (17) ; d'un appareil pour dérouler le tissu (4), sur ledit appareil pour dérouler le tissu (4) est positionnée la bobine de support de tissu (11), montée sur des guides transversaux et équipée d'un système tendeur (12) pour le tissu (1), ledit tissu (1) est donc forcé à adhérer au mat (3), le côté en contact avec le tissu (4) étant traité avec une bande adhésive ; d'un appareil aspirateur et/ou de nettoyage de tissu (5), d'un appareil pour impression par jet d'encre sur des tissus (6) ; d'un appareil de séchage de tissu ; d'un système de lavage de moquette, **caractérisé par le fait que** les têtes d'impression, par l'intermédiaire de plaques de petite taille (35), sont montées sur une plaque de support principale d'acier inoxydable (31), sur laquelle les logements (32) de toutes les têtes d'impression prévues sur la machine ont été créés, les logements (32) des têtes d'impression sont positionnés de façon oblique par rapport aux côtés de la plaque ; lesdites plaques de petite taille en acier inoxydable (35) présentent deux orifices oblongs (37 et 38) à leurs extrémités, pour fixer celles-ci à la plaque principale (31) en utilisant des vis spécifiques (43), et un troisième orifice oblong (39) et une découpe rectangulaire (40) à l'intérieur pour l'introduction de la tête d'impression (36), et deux orifices (41) pour fixer la tête d'impression en utilisant des vis spécifiques (42) ; dans ledit orifice oblong (39), le bloc régulateur constitué de deux parties (37A et 37B) est fixé, qui, unis par une vis spécifique (44), est fixé à une extrémité de la plaque de support (35) de la tête d'impression dans une position réglée de façon opportune ; lesdits logements (32) des têtes individuelles sur la plaque de support principale (31) sont créés par une construction capable de garantir que l'espacement entre les logements et les dimensions de largeur de ceux-ci possèdent une tolérance de +/-1 centième de millimètre par rapport aux mesures relatives ; que ledit appareil par jet d'encre pour imprimer sur des tissus est activé par un moteur linéaire ; que la plaque (7) qui supporte le mat (3) possède une largeur égale à la largeur du

- mat (3) et une longueur supérieure à la longueur de l'appareil de support de tête d'impression par jet d'encre ; qu'il possède un système pour distribuer de l'encre (8) de diverses couleurs avec un réservoir principal et des réservoirs intermédiaires ; qu'il possède une unité de nettoyage de tête d'impression (9).
2. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 1, **caractérisé par le fait que** ledit appareil est activé par un moteur linéaire ; que ledit moteur linéaire (1) est activé par un moteur électrique (18) installé directement sur ledit rouleau moteur (17) rétro-activé par un codeur absolu à haute résolution.
 3. Appareil d'impression continue par jet d'encre sur tissu selon les revendications 1 ou 2, **caractérisé par le fait que** l'axe de mouvement de l'appareil de support de tête d'impression par jet d'encre (6), dans une direction perpendiculaire à la direction d'avance du mat (2), est créé en assemblant, avec des rouleaux à billes à recyclage avec un système autolubrifiant de longue durée, un moteur linéaire (50) et un transducteur inductif avec une résolution inférieure à 1 $\mu\text{m/m}$.
 4. Appareil d'impression continue par jet d'encre sur tissu selon les revendications 1 ou 2, **caractérisé par le fait que** ledit système d'alimentation en encre (8) de différentes couleurs est constitué fondamentalement de trois groupes distincts : le groupe de réservoir principal (55), le groupe de réservoir intermédiaire (52) et le groupe de tête d'impression (6), supportés sur la plaque de support principale (31) d'acier inoxydable.
 5. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 4, **caractérisé par le fait que** ledit réservoir principal (55) est constitué d'un sachet d'aluminium contenant l'encre sous vide.
 6. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 5, **caractérisé par le fait que** ledit réservoir principal (55) est inséré dans un récipient pneumatique spécifique (51) et raccordé, par l'intermédiaire d'un appareil avec une aiguille (66), à un circuit hydraulique (64) pourvu d'une électrovanne (63) qui le raccorde au réservoir intermédiaire (52).
 7. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 6, **caractérisé par le fait que** ledit réservoir intermédiaire (52) est à son tour raccordé par l'intermédiaire du circuit hydraulique (57) à la tête d'impression ; que l'encre s'écoule vers le réservoir intermédiaire (52) lorsque l'électrovanne spécifique (63) est ouverte.
 8. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 6, **caractérisé par le fait que** ledit récipient pneumatique (51) contenant ledit réservoir principal (55) possède un couvercle (69) avec un mécanisme de libération (68), que, pour remplacer ledit réservoir principal (55), ledit couvercle (69) avec un mécanisme de libération (68) est ouvert, ledit mécanisme de libération (68) exclue la mise sous pression dudit récipient pneumatique (51), extrait l'appareil avec une aiguille (66) à partir du réservoir principal (55), et ferme simultanément l'électrovanne (63), le couvercle (69) est ouvert en étant tourné autour de l'articulation (70), le réservoir principal (55) est remplacé et le couvercle (69) est fermé, le mécanisme de libération (68) est remis dans la position fermée, faisant en sorte que l'appareil avec une aiguille (66) pénètre dans le réservoir principal (55) et l'électrovanne (63) est ouverte simultanément pour remettre le circuit hydraulique (64) en fonctionnement ; ladite électrovanne positionnée entre le réservoir principal (55) et le réservoir intermédiaire (52) garantit le maintien du système hydraulique entier sous vide au moment du remplacement des réservoirs principaux (55).
 9. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 5, **caractérisé par le fait qu'**un système de commande électronique commande le procédé d'alimentation en couleur entier et que chaque réservoir principal (55) est pourvu d'une mémoire électrique spécifique qui permet de contrôler la quantité d'encre présente à l'intérieur dudit réservoir à tout instant.
 10. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 1, **caractérisé par le fait que** le système de nettoyage de tête, constitué de 24 têtes aspirantes et le même nombre de couteaux pour racler les têtes d'impression, est logé latéralement par rapport à la position d'impression ; le groupe est complété par les 12 systèmes aspirateurs (un pour chaque paire de têtes) situés sous le groupe aspirateur.
 11. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 1, **caractérisé par le fait que** l'appareil est également prédisposé pour l'application d'un poste de conditionnement pour de longues périodes de non utilisation ; le poste fournit le niveau correct d'humidité aux buses d'impression par l'intermédiaire de conduits avec de l'eau distillée.
 12. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 1, **caractérisé par le fait que** ledit appareil aspirateur et/ou de nettoyage de tissu (5) est constitué d'un système aspirateur (13).

13. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 1, **caractérisé par le fait que** ledit appareil aspirateur et/ou de nettoyage de tissu (5) est constitué d'un système bi-adhésif (14) disposé sur les rouleaux. 5
14. Appareil d'impression continue par jet d'encre sur tissu selon la revendication 1, **caractérisé par le fait que** ledit appareil aspirateur et/ou de nettoyage de tissu (5) est constitué d'un système avec Velcro (14) disposé sur les rouleaux. 10

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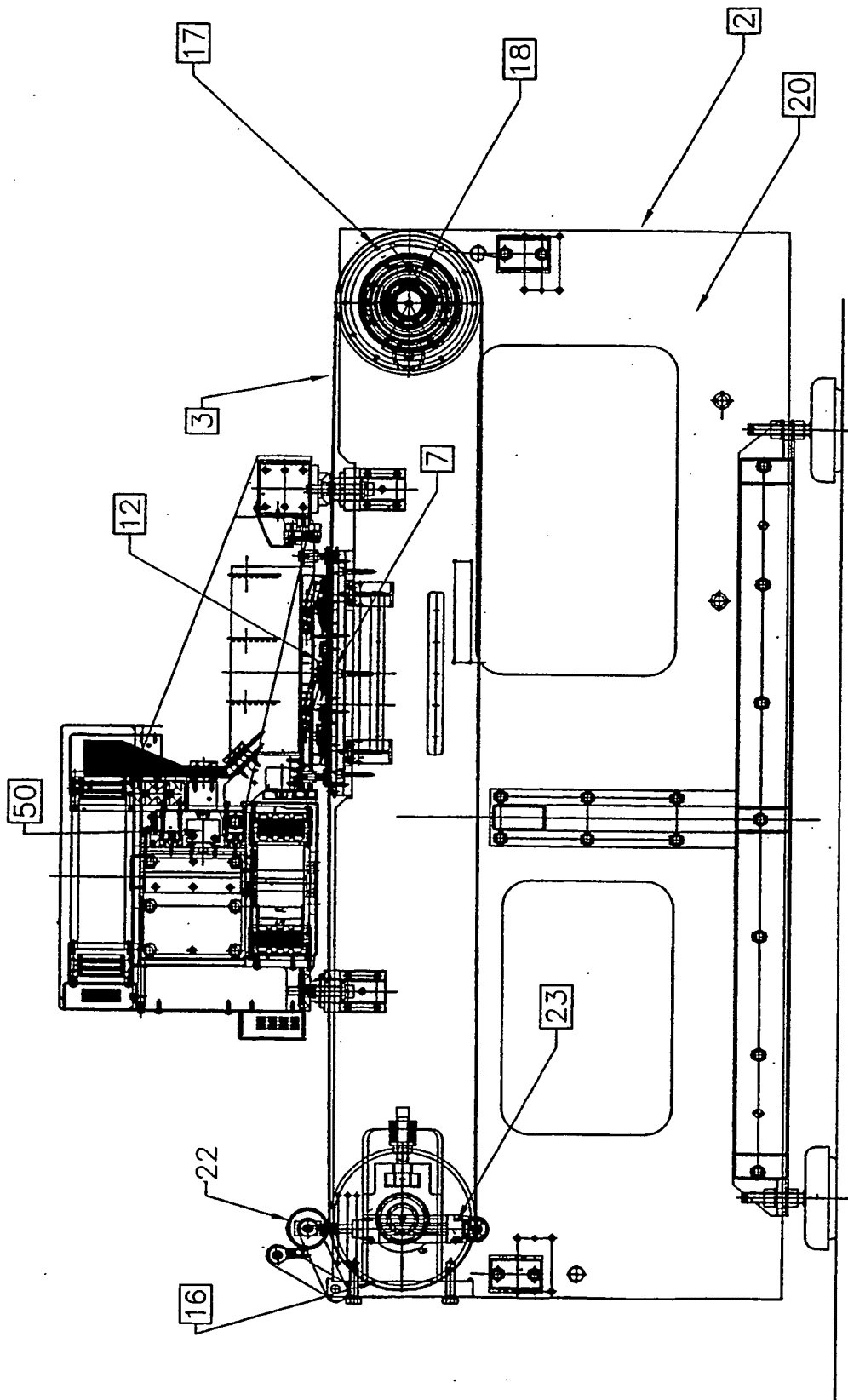


Fig. 1

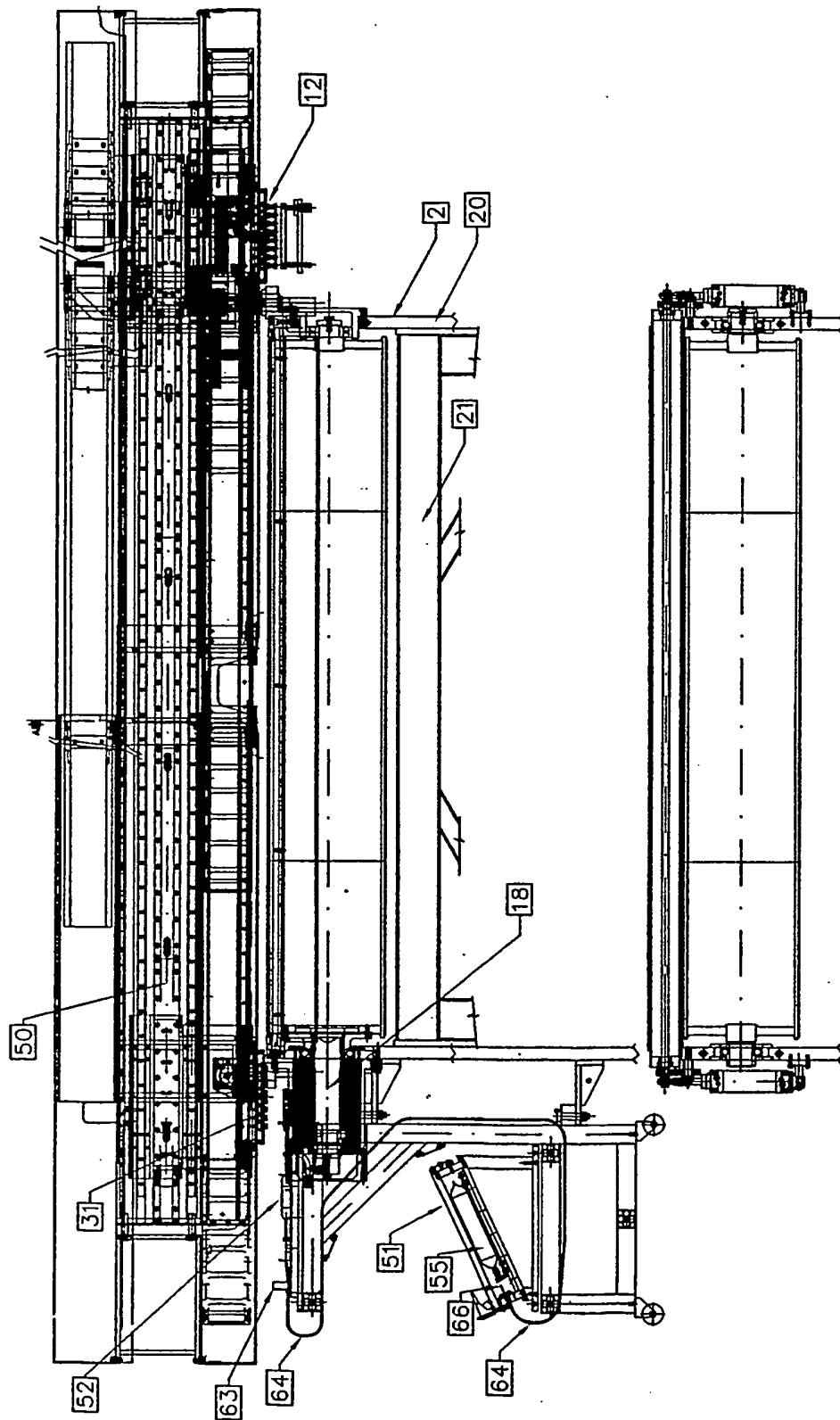


Fig. 2

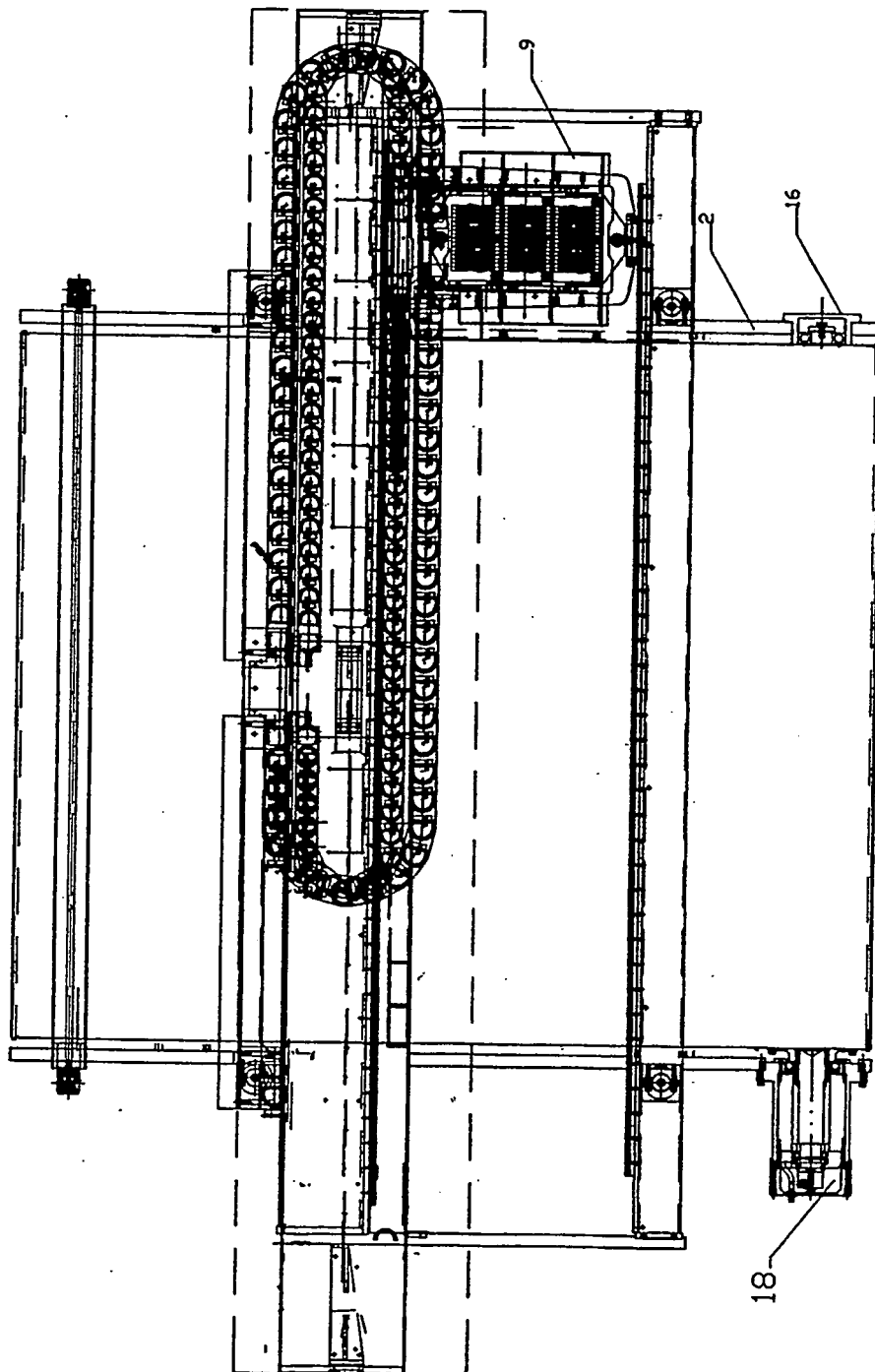


Fig. 3

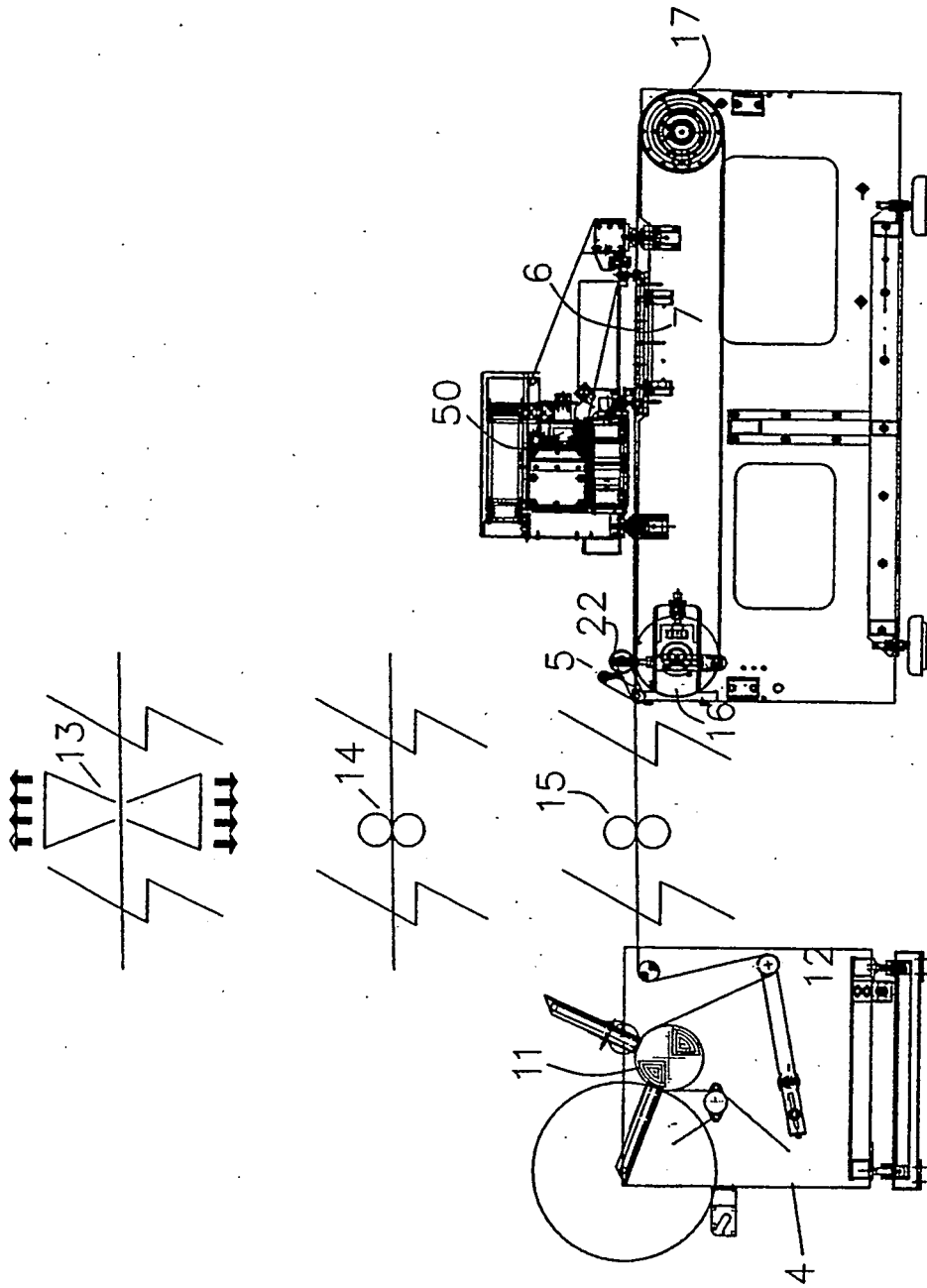
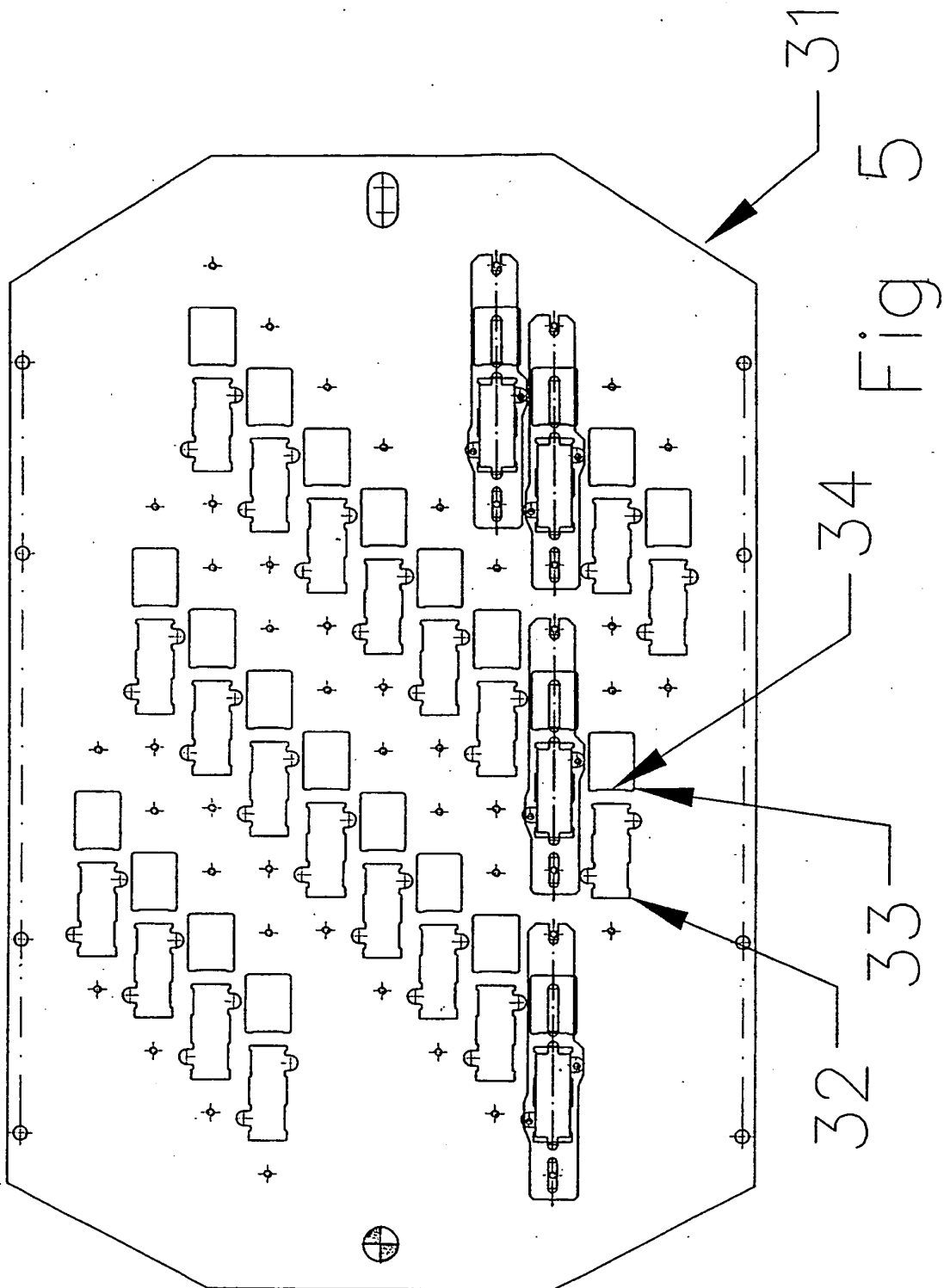
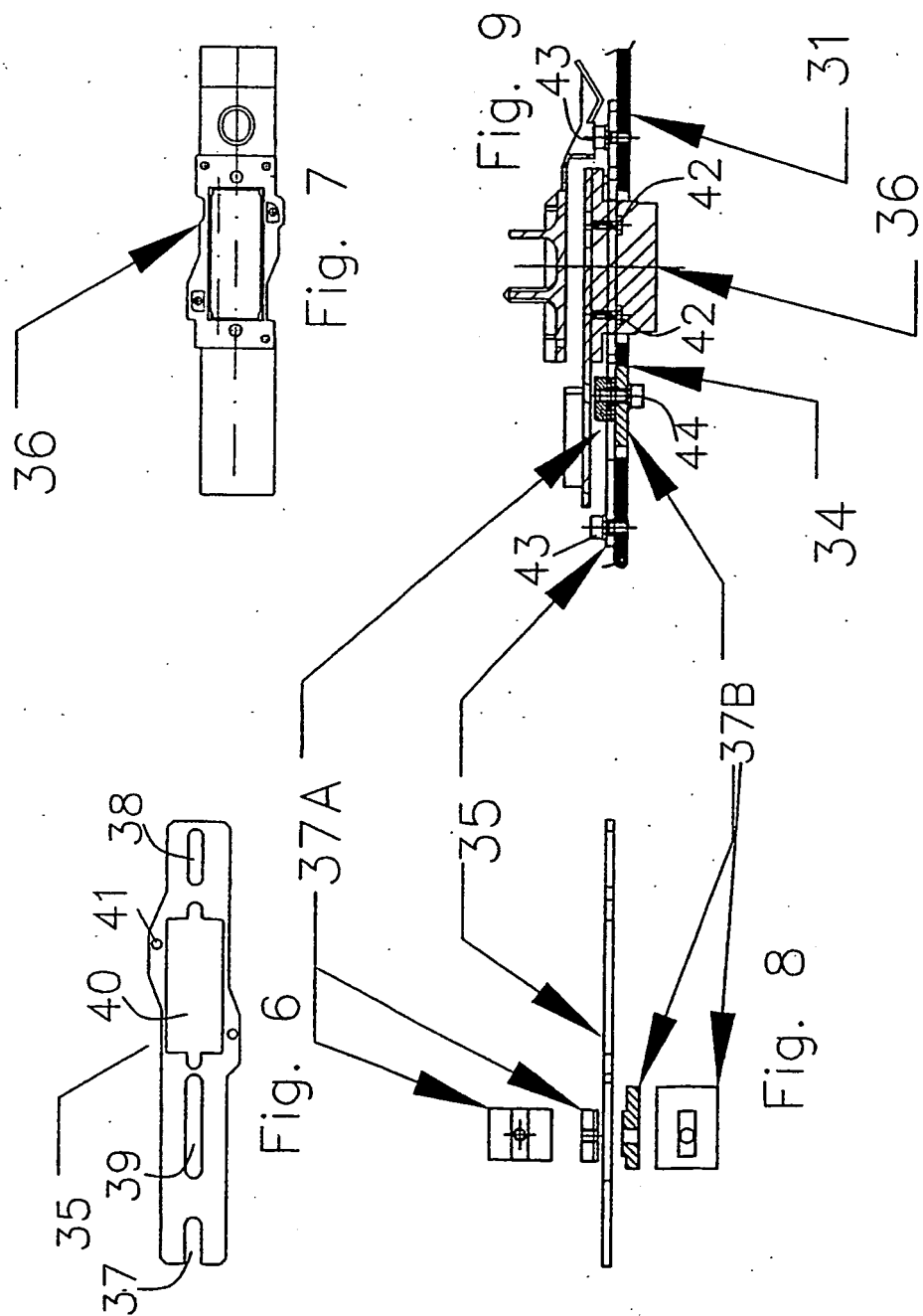
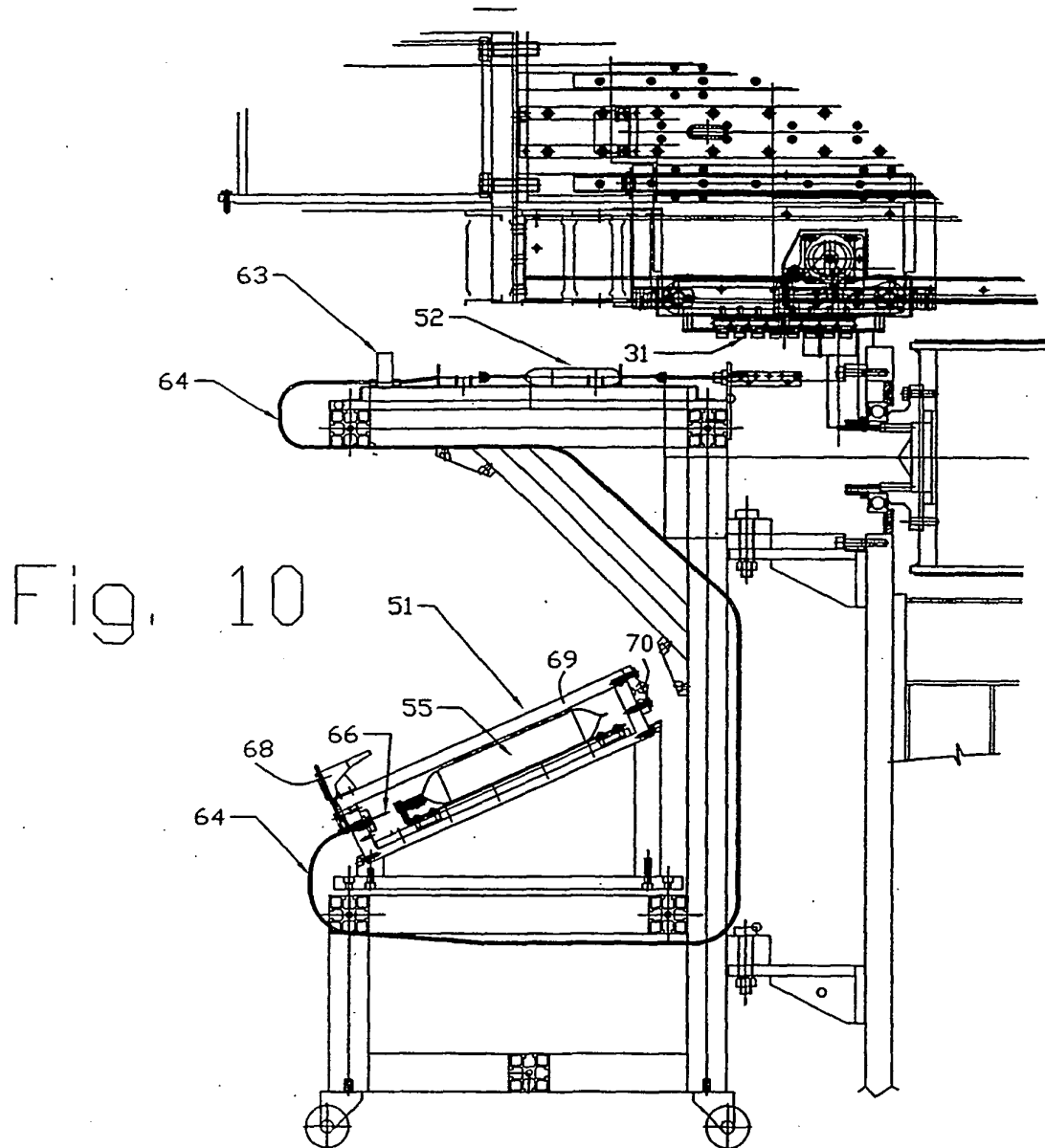


Fig. 4







REFERENCES CITED IN THE DESCRIPTION

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