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(54) **Method and apparatus for treating synthetic playing surfaces having particulate material spread on it**

Verfahren und Vorrichtung zur Behandlung von mit teilchenförmigem Material bestreuten, synthetischen Spielflächen

Procédé et dispositif de traitement de surfaces de jeu synthétiques ayant des matériaux particuliers répandus

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US-A- 4 207 650 **US-A- 4 594 749**

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Description

[0001] The invention relates to a device according to the preamble of claim 1.

[0002] In a prior art device of this kind, the air block, which is reciprocable by a driving means, is provided with a number of longitudinally spaced nozzles and is formed as an air chamber, such that air can be ejected along the full length of the air chamber if the displacement stroke is at least equal to the distance between adjacent nozzles (see, e.g., AT 387 139B).

[0003] Moreover, a cleaning device for carpets is known from US 4 207 650A. Some of the air jets described therein, however, are inevitably directed again onto the same place transverse to the direction of travel a plurality of times, while the described valve rotor rotates.

[0004] The invention aims at improving the device of the kind mentioned in the preamble.

[0005] For this purpose, the device according to the invention has the characterizing features of claim 1.

[0006] By providing these measures the periodically reciprocating movement is being avoided and replaced by the opening and closing of parts of the air exhaust means. Thus, for example by means of a large number in transverse direction closely spaced nozzles, the full length of the air block can be covered on the one hand, while the air consumption is being kept limited without a reciprocating movement of the air block on the other hand.

[0007] Advantageous embodiments of the invention are defined in the dependent claims.

[0008] The invention also comprises a method for treating synthetic playing surfaces having particulate material spread on it, according to claim 8.

[0009] Hereafter the invention will be elucidated further, while reference is being made to the drawings showing very schematically embodiments of the invention.

[0010] Fig. 1 is a very schematic transverse section of the air chamber of a first embodiment of the device according to the invention.

[0011] Fig. 2 is a perspective view of the element which is rotatable around the air chamber of Fig. 1.

[0012] Fig. 3 is a very schematic section of the air chamber having nozzles according to a second embodiment of the device according to the invention.

[0013] Fig. 4 is a section along the line IV-IV in Fig. 3.

[0014] Fig. 5 is a schematic longitudinal section of a third example of an embodiment of the device according to the invention.

[0015] Figs 6 and 7 are sections along the line VI-VI, VII-VII respectively in fig. 5.

[0016] The present invention is intended for cleaning synthetic playing surfaces, such as for example tennis courts or hockey fields or the like, where a particulate material, such as sand or gravel is spread on a plastic fibre mat between the filaments. After some time this

material sticks and sets causing the field to become hard and impervious to water and less good usable. In order to make the playing field better usable air is being ejected against the surface in small jets and with great force, causing the particular material to loosen, the material thereby being blowing upwards. If the particulate material is now being caught, it can be cleaned and a separation can for example be made between possibly re-usable coarse particles and finer dust and dirt particles, which particles are being collected and discharged. If thereupon clean, new or cleaned particulate material is spread on the playing surface, the playing surface is again good usable.

[0017] Not shown in the drawing is, that the device is provided with a frame of a self riding vehicle or a towed vehicle, which frame is provided with a chassis. This vehicle is provided with an air compressor or is connected to an air compressor through a long hose of for example 120 meters for supplying compressed air of for instance approximately 10 bar. This compressed air is supplied to the inlet of an air block, which is shown in Fig. 1, and which is embodied as an air chamber 1 mounted substantially horizontally and more or less transverse to the direction of movement of the vehicle. The air chamber 1 has a circular cross section and is in this case provided with a slit-like air exhaust 2 pointed downwards and preferably at an angle of approximately 15 degrees relative to the vertical. The air chamber 1 can have a length of for example 100 cm and can be of a diameter of approximately 2 inch. One or more air chambers can operate next to each other in order to improve the working width.

[0018] Around the air chamber 1 there is provided a rotatably drivable element, which is provided with plurality of nozzles 4, acting as air passage means spaced along both the length and the circumference of the air chamber 1, or as the case may be extended along the rotating element 3, for example in one or more rows along a helical line across the wall of the rotatable element 3 (see Fig 2.). By the rotation of the rotatable element 3 along the center line of the air chamber 1, every time only those nozzles 4 are being used which are aligned with the air exhaust 1. Upon the further rotation, the circumferentially next nozzles 4 are brought in line with the air exhaust, and these nozzles 4, as seen in axial direction of the air chamber, and thus transverse to the direction of movement, are slightly offset relative to the preceding nozzles, in this way enabling a full treatment of the playing surface A to be treated if the vehicle is moved forward at a relatively low speed transverse to this air chamber 1.

[0019] Naturally a sufficient sealing on both sides of the air exhaust 2, between the air chamber 1 and the rotatable element 3 has to be provided, such that only air can passage out through the nozzles 4 which are in line with the air exhaust 2. This causes the air consumption to be relatively low and a relatively small compressor is sufficient. Starting from a compressor having a capacity of 10,5 m³/min. at a pressure of 10 bar, only 47

nozzles 4 having a section of 1,5 mm can operate simultaneously as a maximum. The rotatable element 3 can for example rotate with 300 rpm.

[0020] In Fig. 1 it is further shown that, as seen in the direction of movement of the vehicle (right in Fig. 1), an inclined catching surface 5 is placed behind the air chamber, which catching surface catches the particulate material being ejected therein, and which further discharges it, for example through a flexible conveyer belt or shutter conveyer bringing the material through the unit to a point of discharge. From there on a further transport can take place through a vacuum hose or a motorized car.

[0021] Figs. 3 and 4 show a second example of an embodiment of the device according to the invention, whereby the housing 16 of the air block is provided with an air chamber 11, air exhausts 12, a rotatable element 13 and nozzles 14. In this case the rotatable element 13 is not journalled concentrically around the air chamber 11, but next to it in a bearing chamber of the housing 16. The rotatable element 13 is constructed as a roller and is rotatable around an axis parallel to the air chamber 11. The nozzles 14 are provided stationary in the housing 16 of the air block and are in line with the air exhausts 12 of the air chamber 11 radially relative to the rotatable element 13. This rotatable element 13 is provided with air passage channels 17, whereby adjacent air passage channels are turned through an angle around the axis of rotation, such that along the circumference of the rotatable element 13 the channels 17 show a helical line path. In two 180 degrees shifted rotational positions every channel comes in line with the air exhausts 12 of the air chamber 11 and the nozzles 14, causing air in those positions to be ejected through the nozzles. Because adjacent air passage channels 17 are angularly offset, air is ejected sequentially and it is also possible here to cover the whole surface to be cleaned without excessive air consumption. In each winding of the helical line of the channels 17 two nozzles 14 can be active simultaneously. A number of the housings 16 as shown can be coupled to each other, whereby the rotation of the rotatable elements 13 can be transferred through coupling means 18, 19.

[0022] The Figs. 5-7 show a third variant of the invention, whereby the air block for alternately opening and closing of a row of nozzles 24 is provided with or is formed as a valve block 30. Recognizable are now an air chamber or air supply channel 21, nozzles 24 and a catch surface 25. The valve block, which is positioned at an angle of 15 degrees has a number, in this case 12, of valves 31, shifting valves or other kinds of shutters which are included in channels 24' of the nozzles 24. In the case as shown each two channels 24' are connected to a valve 31 in order to reduce the number of valves 31. In a row of 6 adjacent nozzles each time a nozzle 24 is being opened sequentially, while the other five are closed. The position of the ejection of air then moves itself through this row. Naturally, all kinds of arrange-

ments of valves, channels and nozzles are possible.

[0023] From the foregoing it will be clear, that the invention provides a device and method, with the aid whereof air can be ejected every time on different closely spaced positions transverse to the direction of movement, thereby obtaining a good and reliable cleaning effect. The operating means for this selectively ejecting air or a similar medium thereby act as valves of shutters which, like in the first two embodiments, can be constructed both as rotatable elements for a large number of ejection openings, and be constructed as real valves, shutters or the like.

[0024] The invention is not limited to the embodiments as shown and elucidated. Naturally further variations are possible as defined by the appended claims.

Claims

1. Device for treating synthetic playing surfaces having particulate material, like sand, spread on it, provided with a frame, which frame is movable in a direction of propulsion, an air block connected to the frame substantially transverse to the direction of propulsion, the air block having an inlet for compressed air and downwardly directed air exhaust means (2;12) longitudinally spaced along the length of the air block, the air exhaust means for ejecting air being adapted to be displaced as to their operation in longitudinal direction of the air block and therefore transverse to the direction of propulsion with the aid of operating means (3,4;13,14,17; 24,30,31), the air block being substantially stationary with respect to the operating means **characterized in that** the operating means (3,4;13,14; 24,30,31) are equipped with passage means (4; 14,17;24,31) for alternately, in transverse direction, opening and closing of different parts of the air exhaust means (2;12) such that the air is being ejected each time on other places transverse to the direction of propulsion of the air block.
2. Device according to claim 1, whereby the passage means (4;14,17;24,31) are provided with a large number of nozzles (4;14,24) spaced along the length of the air block, only an alternating portion of the nozzles being supplied with compressed air.
3. Device according to claim 1 or 2, whereby the operating means (3,4;13,14;24,30,31) are constructed as shutters, and possibly as valves (31) capable of alternately opening and closing the channels (24') of associated nozzles (24).
4. Device according to claim 1,2 or 3, whereby the air block is constructed as an air chamber (1;11), while the operating means are constructed as a movable element, in particular a rotatable element (3;13) ca-

pable of being rotated around an axis transverse to the direction of propulsion, which element is equipped with passage means (4;17) for alternately, in transverse direction, opening and closing different portions of the air exhaust means (2;12) transverse to the direction of propulsion.

5. Device according to claim 4, whereby said passage means (4;17) are spaced along the circumference and along the length of the rotatable element (3;13), which passage means can be aligned with separate axial portions of the air exhaust means (2;12), and possibly open into the open air through stationary nozzles (14).
6. Device according to claim 5, whereby the passage means (4;17) are divided into one or more spiral shapes around the rotatable element (3;13)
7. Device according to claim 6, whereby the rotatable element (13) consists of a roller, which roller is closely fitted in a bearing chamber of a housing (16), which bearing chamber is in connecting with the air chamber (11), while the passage means (17) consist of channels, which channels are substantially radially arranged in the roller, whereby each adjacent channels are angularly turned around the axis of rotation, and whereby the air exhaust means (12) and the nozzles (14) aligned therewith are provided in the wall of the housing (16).
8. Method of treating synthetic playing surfaces having particulate material, like sand, spread on it, whereby by means of air exhaust means compressed air is ejected onto the playing surface from an air block at the desired angle, wherein the particulate material is ejected and is caught, the air being ejected during propulsion of the air block transverse to the direction of propulsion, and wherein the air block is substantially kept still in respect of operating means, while with the aid of the operating means the air is being ejected **characterized in that** the air is ejected each time on other places transverse to the direction of propulsion of the air block by alternately opening and closing portions of the air exhaust means.
9. Method according to claim 8, whereby as an air block an air chamber is selected and whereby an element, rotating substantially continuously relative to the air chamber, enables air to be ejected through circumferentially and longitudinally spaced air passage means each time on different places transverse to the direction of propulsion of the air chamber.

Patentansprüche

1. Vorrichtung zur Behandlung von Kunstspielflächen mit hierauf verteiltem Partikelmaterial wie Sand mit einem in einer Vortriebsrichtung bewegbaren Rahmen, einem mit dem Gestell verbundenen, sich im Wesentlichen quer zur Vortriebsrichtung erstreckenden Gebläsekasten, der einen Drucklufteinlass und nach unten gerichtete Luftauslasseinrichtungen (2; 12) besitzt, die in Längsrichtung des Gebläsekastens voneinander beabstandet sind, wobei die zum Luftausstoß dienenden Luftauslasseinrichtungen daran angepasst sind, während ihres Betriebs mittels Betätigungseinrichtungen (3, 4; 13, 14, 17; 24, 30, 31) in Längsrichtung des Gebläsekastens und damit quer zur Vortriebsrichtung versetzt zu werden, wobei der Gebläsekasten gegenüber den Betätigungseinrichtungen im Wesentlichen stationär ist, **dadurch gekennzeichnet, dass** die Betätigungseinrichtungen (3, 4; 13, 14; 24, 30, 31) mit Durchlassmitteln (4; 14, 17; 24, 31) zum wechselnden Öffnen und Schließen in Querrichtung anderer Teile der Luftauslasseinrichtungen (2; 12) ausgestattet sind, so dass die Luft jedesmal auf andere Stellen quer zur Gebläsekastenvortriebsrichtung ausgestoßen wird.
2. Vorrichtung nach Anspruch 1, in der die Durchlassmittel (4; 14, 17; 24, 31) mit einer großen Anzahl an Düsen (4; 14, 24) versehen sind, die entlang der Länge des Gebläsekastens beabstandet sind, wobei nur ein wechselnder Anteil der Düsen mit Druckluft versorgt wird.
3. Vorrichtung nach Anspruch 1 oder 2, in der die Betätigungseinrichtungen (3, 4; 13, 14; 24, 30, 31) als Verschlüsse und möglicherweise als Ventile (31) ausgebildet sind, die dazu in der Lage sind, die Kanäle (24') der zugehörigen Düsen (24) abwechselnd zu öffnen und zu schließen.
4. Vorrichtung nach Anspruch 1, 2 oder 3, in der der Gebläsekasten als Luftkammer (1; 11) ausgebildet ist, während die Betätigungseinrichtungen als bewegbares Element konstruiert sind, insbesondere als drehbares Element (3; 13), das um eine quer zur Vortriebsrichtung verlaufende Achse drehbar ist, wobei das Element mit Durchgängen (4; 17) zum wechselnden Öffnen und Schließen in Querrichtung anderer Teile der Luftauslasseinrichtungen (2; 12) quer zur Vortriebsrichtung ausgestattet ist.
5. Vorrichtung nach Anspruch 4, in der die Durchgänge (4; 17) entlang des Umfangs und entlang der Länge des drehbaren Elements (3; 13) voneinander beabstandet sind, wobei die Durchgänge mit separaten axialen Abschnitten der Luftauslasseinrich-

tungen (2; 12) ausgerichtet werden können und möglicherweise mit stationären Düsen (14) in der Außenluft münden.

6. Vorrichtung nach Anspruch 5, in der die Durchgänge (4; 17) in eine oder mehreren Spiralen um das drehbare Element (3; 13) unterteilt sind. 5
7. Vorrichtung nach Anspruch 6, in der das drehbare Element (13) aus einer Walze besteht, die in einer mit der Luftkammer (11) in Verbindung stehenden Lagerkammer eines Gehäuses (16) dicht eingesetzt ist, während die Durchgänge (17) aus Kanälen bestehen, die im Wesentlichen radial in der Walze angeordnet sind, wobei jeder benachbarte Kanal um die Drehachse in einem Winkel verdreht ist und die Luftauslasseinrichtungen (22) und die hiermit ausgerichteten Düsen (14) in der Wand des Gehäuses (16) vorhanden sind. 10 15
8. Verfahren zur Behandlung von Kunstspielflächen mit hierauf verteiltem Partikelmaterial wie Sand bei dem mittels Luftauslasseinrichtungen aus einem Gebläsekasten Druckluft in dem gewünschten Winkel auf die Spielfläche ausgestoßen wird, wobei das Partikelmaterial ausgestoßen und eingefangen wird und die Luft während des Vortriebs des Gebläsekastens quer zur Vortriebsrichtung ausgestoßen wird und der Gebläsekasten bezüglich Betätigungseinrichtungen im Wesentlichen still gehalten wird, während mittels der Betätigungseinrichtungen die Luft ausgestoßen wird, **dadurch gekennzeichnet, dass** die Luft jedesmal auf andere Stellen quer zur Vortriebsrichtung des Gebläsekastens ausgestoßen wird, indem Teile der Luftauslasseinrichtungen abwechselnd geöffnet und geschlossen werden. 20 25 30 35
9. Verfahren nach Anspruch 8, bei dem als Gebläsekasten eine Luftkammer gewählt wird und ein Element, das im wesentlichen kontinuierlich relativ zur Luftkammer rotiert, ermöglicht, dass Luft durch umfänglich und längs beabstandete Luftkanäle jedesmal auf andere Stellen quer zur Vortriebsrichtung der Luftkammer ausgestoßen wird. 40 45

Revendications

1. Dispositif destiné à traiter des surfaces de jeu synthétiques présentant, répandu sur elles, un matériau particulaire, du sable par exemple, comportant un châssis, lequel châssis est mobile selon une direction de propulsion, une centrale à air raccordée au châssis de façon sensiblement transversale à la direction de propulsion, la centrale à air ayant une entrée destinée à des moyens d'évacuation d'air comprimé et d'air orienté vers le bas (2 ; 12) longi-

tudinalement espacés sur la longueur de la centrale à air, les moyens d'évacuation d'air pour éjecter de l'air étant conçus pour être déplacés au cours de leur mise en oeuvre selon la direction longitudinale de la centrale à air et, par conséquent, transversalement à la direction de propulsion grâce aux moyens opératoires (3, 4 ; 13, 14, 17 ; 24, 30, 31), la centrale à air étant sensiblement fixe par rapport aux moyens opératoires, caractérisé en ce que les moyens opératoires (3, 4 ; 13, 14, 17 ; 24, 30, 31) sont équipés de moyens à passages (4 ; 14, 17 ; 24, 31) destinés à, de façon alternée, ouvrir et fermer, selon la direction transversale, différentes parties des moyens d'évacuation d'air (2 ; 12) de telle sorte que l'air soit éjecté chaque fois en d'autres emplacements, transversalement à la direction de propulsion de la centrale à air.

2. Dispositif selon la revendication 1, dans lequel les moyens à passages (4 ; 14, 17 ; 24, 31) comportent un grand nombre de buses (4 ; 14, 24) espacées sur la longueur de la centrale à air, seule une partie, en alternance, des buses étant alimentées en air comprimé. 20
3. Dispositif selon la revendication 1 ou 2, dans lequel les moyens opératoires (3, 4 ; 13, 14, 17 ; 24, 30, 31) sont construits comme des obturateurs et, éventuellement, comme des vannes (31), aptes, de façon alternée, à ouvrir et fermer les canaux (24') des buses associées (24). 25
4. Dispositif selon la revendication 1, 2 ou 3, dans lequel la centrale à air est construite comme une chambre à air (1 ; 11), les moyens opératoires étant, de leur côté, construits comme un élément mobile, en particulier un élément tournant (3 ; 13) apte à être mis en rotation autour d'un axe transversal à la direction de propulsion, lequel élément est équipé de moyens à passages (4 ; 17) destinés à, de façon alternée, ouvrir et fermer, selon la direction transversale, différentes parties des moyens d'évacuation d'air (2 ; 12), transversalement à la direction de propulsion. 30 35
5. Dispositif selon la revendication 4, dans lequel les dits moyens à passages (4 ; 17) sont espacés le long de la circonférence et sur la longueur de l'élément tournant (3 ; 13), lesquels moyens à passages peuvent s'aligner avec des parties axiales séparées des moyens d'évacuation d'air (2 ; 12) et, éventuellement, déboucher à l'air libre au travers de buses fixes (14). 40 45
6. Dispositif selon la revendication 5, dans lequel les dits moyens à passages (4 ; 17) sont divisés en une ou plusieurs formes en spirale autour de l'élément tournant (3 ; 13).

7. Dispositif selon la revendication 6, dans lequel l'élément tournant (13) est constitué d'un rouleau, lequel rouleau est ajusté de façon serrée dans une boîte à roulements d'un logement (16), laquelle boîte à roulements est raccordée à la chambre à air (11), tandis que les moyens à passages (17) comprennent des canaux, lesquels canaux sont disposés de façon sensiblement radiale dans le rouleau, de sorte que les canaux adjacents sont angulairement mis en rotation autour de l'axe de rotation, et de sorte que les moyens d'évacuation d'air (12) et les buses (14) qui sont alignées avec ceux-ci sont disposés dans la paroi du logement (16). 5 10
8. Procédé de traitement de surfaces de jeu synthétiques présentant, répandu sur elles, un matériau particulaire, du sable par exemple, de sorte que, grâce à des moyens d'évacuation d'air, de l'air comprimé est éjecté sur les surfaces de jeu à partir d'une centrale à air et sous un angle désiré, dans lequel le matériau particulaire est éjecté et est piégé, l'air étant éjecté au cours de la propulsion de la centrale à air transversalement à la direction de propulsion, et dans lequel la centrale à air est maintenue sensiblement fixe par rapport aux moyens opératoires tandis que grâce aux moyens opératoires l'air est éjecté, caractérisé en ce que l'air est éjecté chaque fois en d'autres emplacements, transversalement à la direction de propulsion de la centrale à air en ouvrant et en fermant, de façon alternée, des parties des moyens d'évacuation d'air. 15 20 25 30
9. Procédé selon la revendication 8, de sorte qu'en tant que centrale à air une chambre à air est sélectionnée et de sorte qu'un élément, tournant de façon sensiblement continue par rapport la chambre à air, permet à l'air d'être éjecté au travers de moyens à passages d'air circonférenciellement et longitudinalement espacés chaque fois en différents emplacements, transversalement à la direction de propulsion de la chambre à air. 35 40

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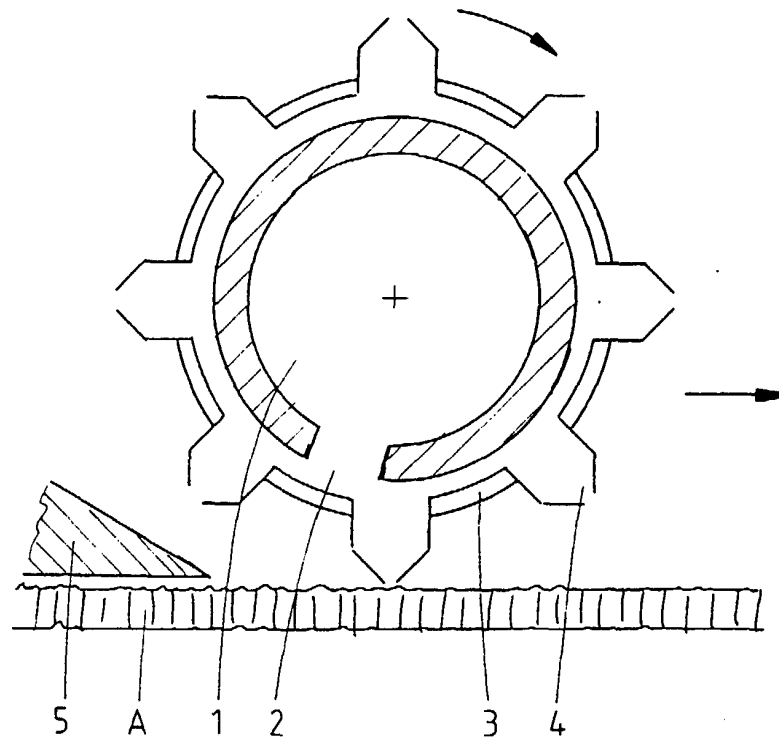


fig. 1

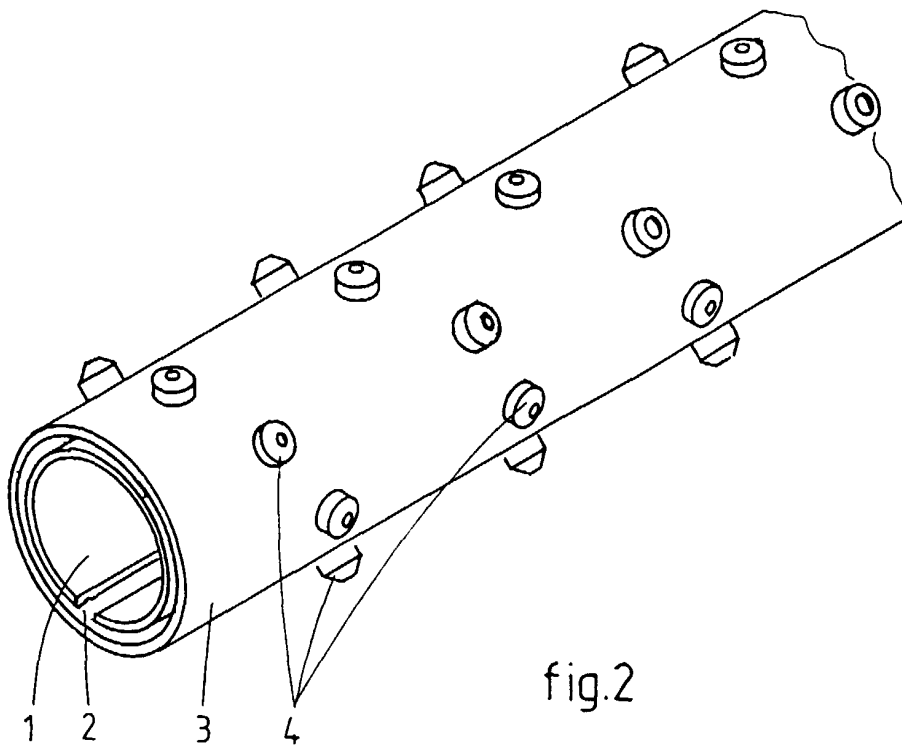


fig. 2

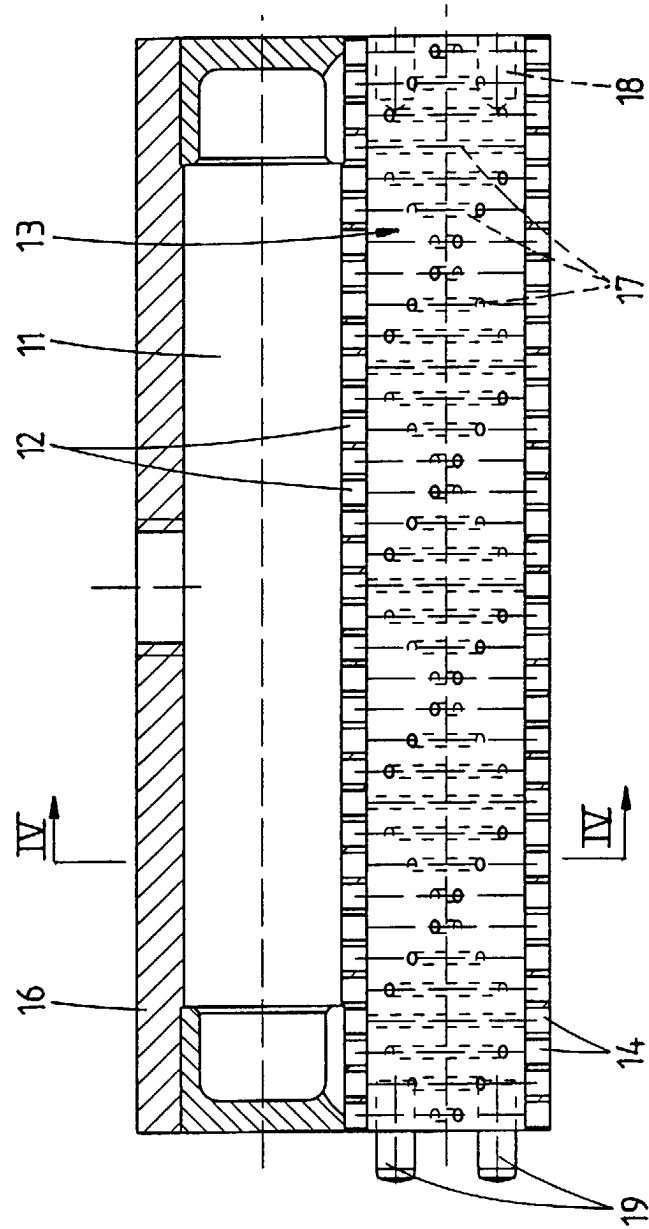


fig. 3

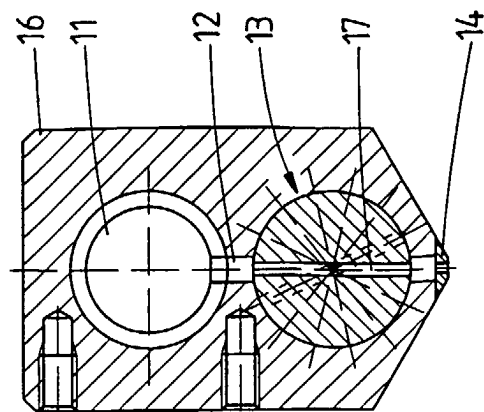


fig. 4

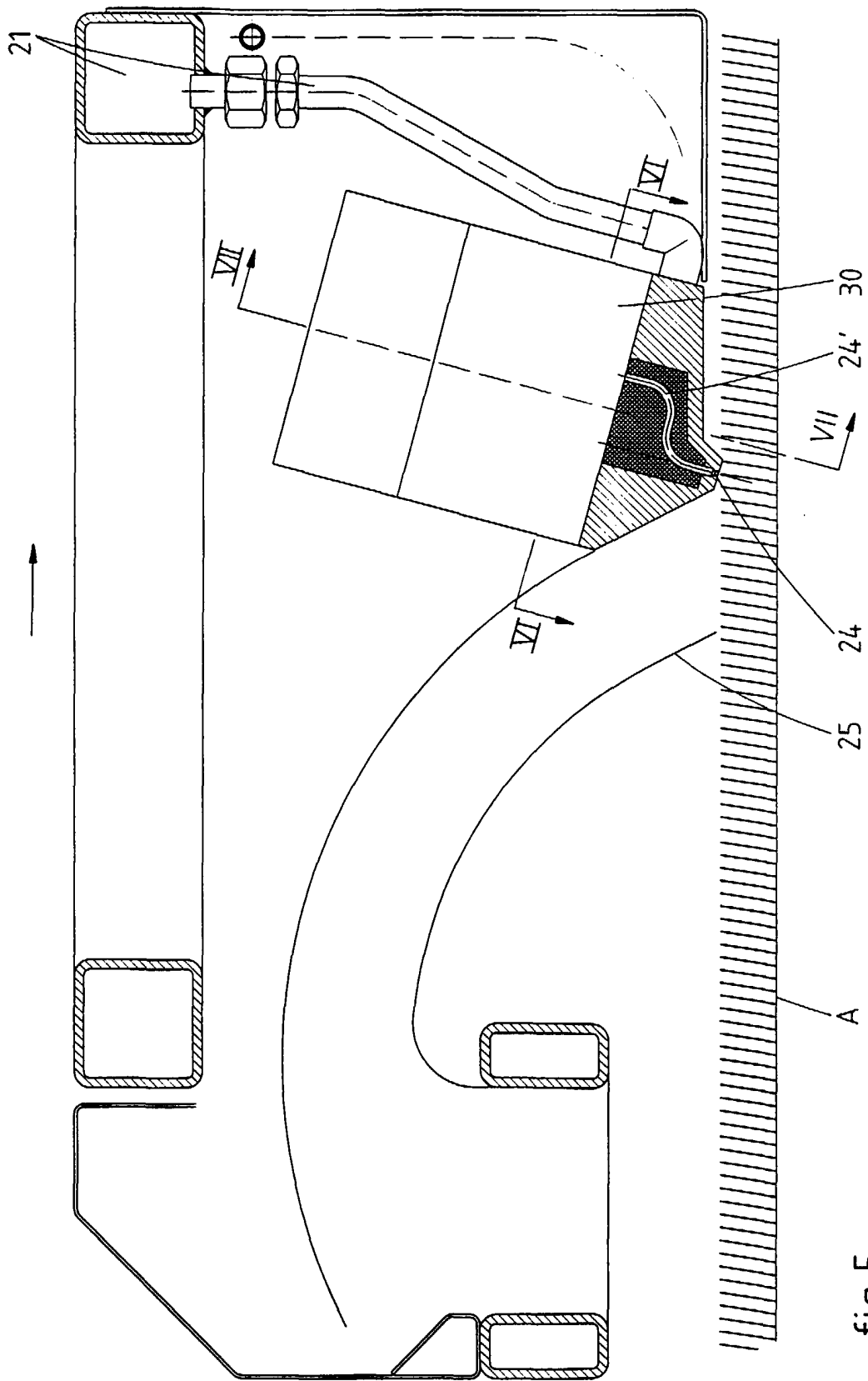


fig. 5

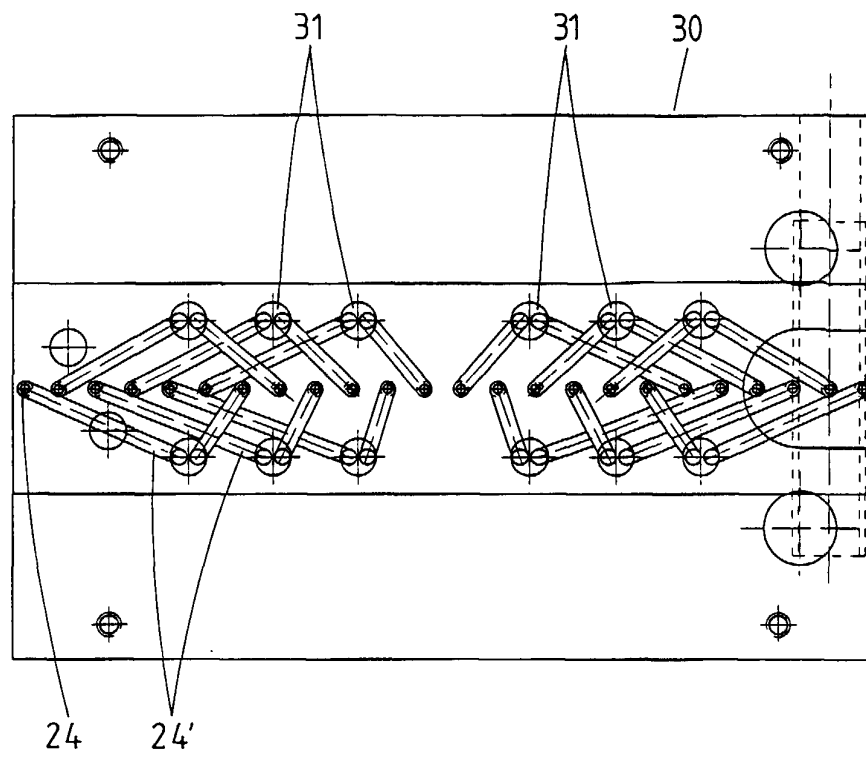


fig. 6

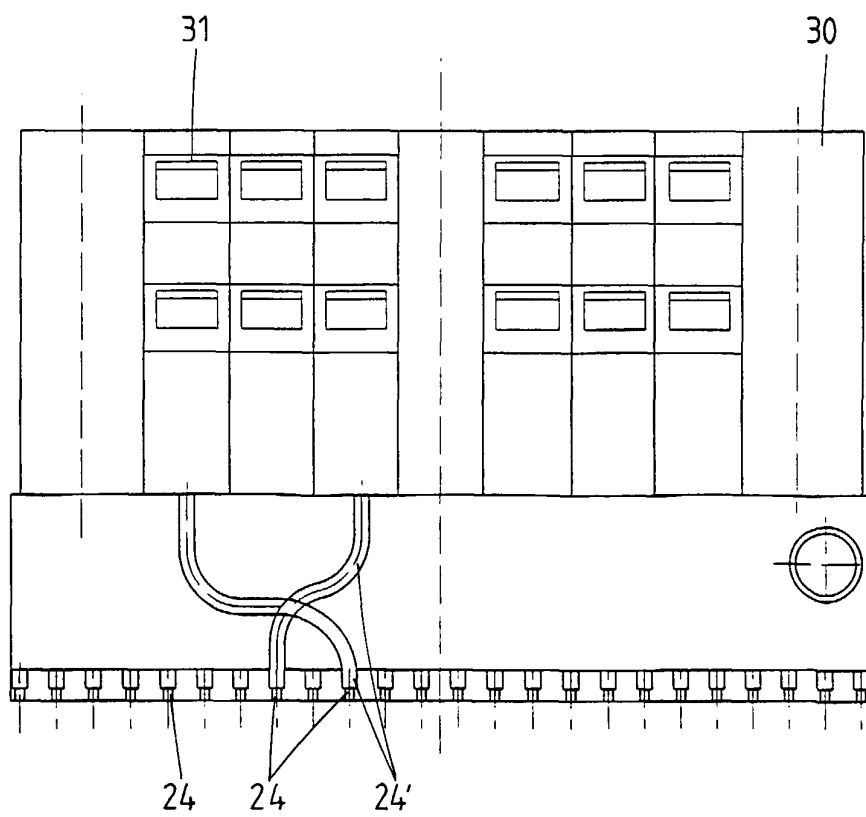


fig. 7