

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 335 864 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **02.12.92** (51) Int. Cl.⁵: **B63B 25/02, B65D 88/72**

(21) Application number: **87906027.5**

(22) Date of filing: **10.09.87**

(86) International application number:
PCT/SE87/00407

(87) International publication number:
WO 88/01963 (24.03.88 88/07)

(54) **SYSTEM FOR FLUIDISING BULK MATERIAL.**

(30) Priority: **12.09.86 SE 8603814**

(43) Date of publication of application:
11.10.89 Bulletin 89/41

(45) Publication of the grant of the patent:
02.12.92 Bulletin 92/49

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

(56) References cited:
GB-A- 1 149 185
SE-A- 200 183

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Description

The present invention relates to a system for fluidising bulk material in such spaces as ships' holds, storage and transport containers etc. according to the preamble of claim 1, said system comprising inclined slides for the bulk material on the bottom of the space, each slide having a panel with channels or openings connected to a source of pressure gas, and a gas-permeable layer covering said panel and adapted to fluidise the bulk material and move it by gravity to discharge points located at a lower level, for emptying said space.

Even though the system according to the invention may be used for many different types of spaces for storing and transporting bulk material, it is primarily intended for the holds of ships carrying bulk materials, such as cement, bentonite, byrite, starch etc., and the invention will therefore be described below with reference to this specific use.

Ships that have been purpose-built for carrying fluidisable bulk material (bulk carriers) frequently have a hold bottom sloping downwardly in V form from the fore and aft sides towards the midship line and provided with slides for the bulk material.

Consequently, these purpose-built bulk carriers can be used only for carrying fluidisable bulk material and cannot be used for carrying, for example, general cargo, unless expensive modifications to the hold bottom are carried out, and such modifications reduce the carrying capacity.

Conventional cargo-ships having a planar hold bottom are frequently chartered for a number of years for carrying fluidisable bulk material. Before they can be put into operation for this purpose, they must be taken to a shipyard and fitted with a sloping hold bottom of the type designed for purpose-built bulk carriers. This reconstruction necessitates, primarily because of the great bulk of the new hold bottom, extensive reinforcements to the hull and to this comes the very time-consuming and complicated work on the new bottom.

If and when these cargo-ships eventually are to operate again as, for example, conventional general cargo ships, the "fluidisation bottom" must either be dismantled or supplemented with a planar "general cargo bottom". Whatever the case may be, the work is time-consuming and costly.

The main object of the present invention is to provide a system of the type mentioned by way of introduction for rapidly and conveniently, and thus at far less expense, converting a cargo-ship having a planar "general cargo bottom" into a cargo-ship having a sloping "fluidisation bottom", and vice versa.

According to the invention this object is achieved by the features of the characterizing part of claim 1 whereby a number of light-weight blocks

are mounted on the bottom of the space (the hold) for rapid and convenient dismantling therefrom, each block having an upper side forming a slide, and long, short, and bottom sides.

The long and short sides are formed of thin cover plates, and the panel and said cover plates define the cavity which is filled with a body of light-weight material, such as foamed polyurethane plastic. Turned upside down, this cavity constitutes a suitable mold for producing the foamed plastic body.

One of the advantages of the system according to the invention is its high flexibility, i.e. its adaptability to the form and size of the ship's hold. As had been mentioned before, the blocks comprised by the system can be rapidly and conveniently mounted and dismantled. The only work required on the hold bottom involves the mounting of a number of attachment lugs or the like for tie rods holding the block. Each block accommodates a body of foamed plastic, which means that the weight of the construction is very low, about 50 kg/m³.

In one embodiment of the invention, the bottom side of the foamed plastic body forms the bottom side of the block and is in direct contact with the bottom of the space so that the form of the space can be followed exactly to distribute and equalise the static load across the entire bottom of the space regardless of the existing bottom structure.

Last but not least, production and mounting times are short as compared with conventional systems, and this means lower costs and less time at the yard.

The invention will be described in more detail below, references being had to the accompanying drawings illustrating an embodiment which at present is especially preferred in a cargo-ship. Fig. 1a is a schematic perspective view of an example of the basic principle of the system for installation in the hold of a ship illustrated in Fig. 1b. Fig. 1c is a section along line I-I in Fig. 1b. Fig. 2 shows, in a projection corresponding to Fig. 1a, the construction of the system in greater detail. Fig. 3 is a top plan view of the blocks comprised by the system. Fig. 4 is a lateral projection along line IV-IV Fig. 3. Fig. 5 is a section along line V-V in Fig. 3. Fig. 6 is a section along line VI-VI in Fig. 3.

The main components of the system generally designated 1 in the drawings, for fluidising bulk material, such as cement, bentonite, byrite, starch etc. in the hold 3 of a ship 2 for emptying the bulk material, are a number of dismantlable transversely and longitudinally extending blocks 5 mounted closely adjacent one another on the bottom 4 of the hold 3.

Each block 5 has on its upper side 6 a sloping slide 7 preferably in a form of a trapezoidally

corrugated sheet metal panel 8 with channels 10 communicating, via supply lines 9, with a source of pressure gas (not shown), preferably a compressed air source. In the embodiment illustrated, these channels 10 are formed by the troughs of the trapezoidally corrugated sheet metal 8.

A gas-permeable layer 11 in a form of a finemesh net and/or fabric covers the associated panel 8. Upon supply of compressed air or other gas, the air or gas flows, via the supply lines 9 and the channels 10 in the panel 8, out through the layer 11 for fluidising the bulk material and for moving the material by gravity to discharge points 12 at a lower level, for emptying the respective hold 3.

Besides the upper side 6 forming the slide 7, each block 5 has two long sides 13, two short sides 14, and a bottom side 15. The long and short sides 13, 14 are formed by thin sheet metal cover plates 16 which, together with the panel 8, form a box structure having a cavity 17. The cavity 17 is filled with a body 18 of foamed plastic which imparts strength and stability to the block 5, but does not make the block heavy. The foamed plastic body 18, can be made more or less porous according to requirements and preferably consists of polyurethane. To make the foamed plastic body 18, the cavity 17 preferably is used as a mold. More particularly, the panel 8 and the cover plates 16 constitute the mold sides in the upside down position of the block 5. The bottom side 15 of the block 5 is formed by the bottom 19 of the foamed plastic body 18. The bottom 19 projects some centimetres from the lower edge of the cover plates 16 to directly engage the bottom 4 of the respective hold 3, thereby to follow exactly the bottom shape in order to equalise or absorb any irregularities of the bottom 4 and to distribute the static load on the bottom. As an alternative to a foamed plastic body 18, a body may be used which consists of some other light-weight material, such as light-weight concrete, cement-bonded burned expanded clay, or the like.

The blocks 5 are rapidly and conveniently dismantlable from the bottom 4 of the respective hold 3 by means of tie rods 20 extending through the narrow gaps 21 between two adjacent blocks 5. The tie rods 20 are anchored at their lower end in lugs 22 or the like secured to the bottom 4, and have an upper threaded end. Shims 23 are clamped, by means of nuts 24 on the upper end of the rod 20 and by means of nuts 25 on threaded pins associated with the respective block 5, against the blocks to fix them in position.

The invention has been described above with specific reference to the use in a ship's hold but, as has been mentioned in the introduction, there is no obstacle to using the invention in other contexts

involving the storage and transport of bulk material in various types of containers.

Claims

1. A system for fluidising bulk material in such spaces as the hold (3) of a ship (2), storage and transport containers etc., said system (1) comprising inclined slides (7) for the bulk material on the bottom (4) of the space (3), each slide (7) having a panel (8) with channels (10) or openings connected to a source of pressure gas, and a gas-permeable layer (11) covering said panel (8) and adapted to fluidise the bulk material and move it by gravity to discharge points (12) located at a lower level, for emptying said space (3), as well as a number of light-weight blocks (5) mounted on the bottom (4) of the space (3), each block (5) having an upper side (6) forming a slide (7), and long, short, and bottom sides (13,14,15), the long and short sides (13,14) being formed by thin cover plates (16) and the panel (8) and the cover plates (16) defining a box structure having a cavity (17), **characterised** in that said cavity (17) is filled with a body (18) of light-weight material and in that the bottom (19) of said body (18) constitutes the bottom side (15) of the block (5) and is in direct engagement with the bottom (4) of the space (3) to follow the shape thereof, thereby to distribute the static load thereon.
2. A system as claimed in claim 1, **characterised** in that said light-weight material in the body (18) is foamed plastic, preferably polyurethane.
3. A system as claimed in claim 2, **characterised** in that the cavity (17), in the upside down position of the block (5), constitutes a mold for the production of the foamed plastic body (18).

Patentansprüche

1. Ein System (1) zur Fluidisierung von Schüttgut in Räumen wie dem Laderaum (3) eines Schiffes (2), Lager- und Transportcontainern etc., geeignete Gleitflächen (7) enthaltend für das Schüttgut am Boden (4) des Laderaums (3), wobei jede Gleitfläche (7) eine Tafel (8) mit Kanälen (10) oder Öffnungen die mit einer Gasdruckquelle verbunden sind und eine die Tafel (8) bedeckende gasdurchlässige Schicht (11) aufweist und die geeignet ist um das Schüttgutes zu fluidisieren und es durch die Gravitation zu Entladepunkten (12) zu bewegen die sich auf einer geringeren Höhe befinden, um den Laderaum (3) und eine Anzahl von am

Boden (4) des Laderaums (3) angebrachten leichten Blöcken (5) zu entleeren, wobei jeder Block (5) eine eine Gleitfläche (7) bildende Oberseite (6), sowie lange, kurze und Boden-seiten (13,14,15) aufweist, wobei die langen und kurzen Seiten (13,14) durch dünne Deck-platten (16) gebildet sind und wobei die Tafel (8) und die Deckplatten (16) eine mit einer Aushöhlung (17) versehene Kastenstruktur definieren, dadurch gekennzeichnet, dass die Aushöhlung (17) mit einem Körper (18) aus leichtem Material gefüllt ist und dass der Boden (19) des Körpers (18) die Bodenseite (15) des Blockes (5) bildet und am Boden (4) des Laderaumes (3) unmittelbar anliegt um sich dessen Form anzupassen und um dadurch die statische Last darauf zu verteilen.

2. Ein System gemäß Anspruch 1, dadurch gekennzeichnet, dass das leichte Material des Körpers (18) Kunststoffschaum, vorzugsweise Polyurethan ist.

3. Ein System gemäß Anspruch 2, dadurch gekennzeichnet, dass die Aushöhlung (17) in der kopfstehenden Stellung des Blockes (5) eine Form zur Herstellung des Körpers (18) aus Kunststoffschaum bildet.

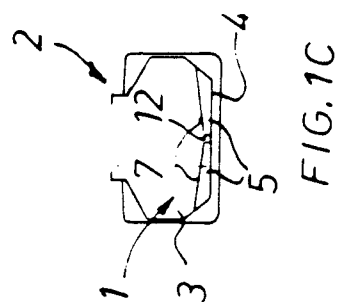
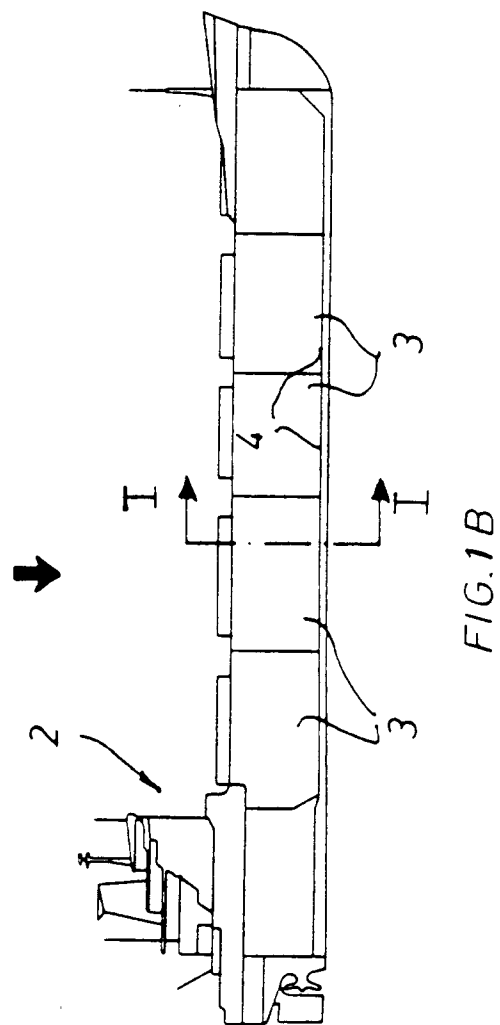
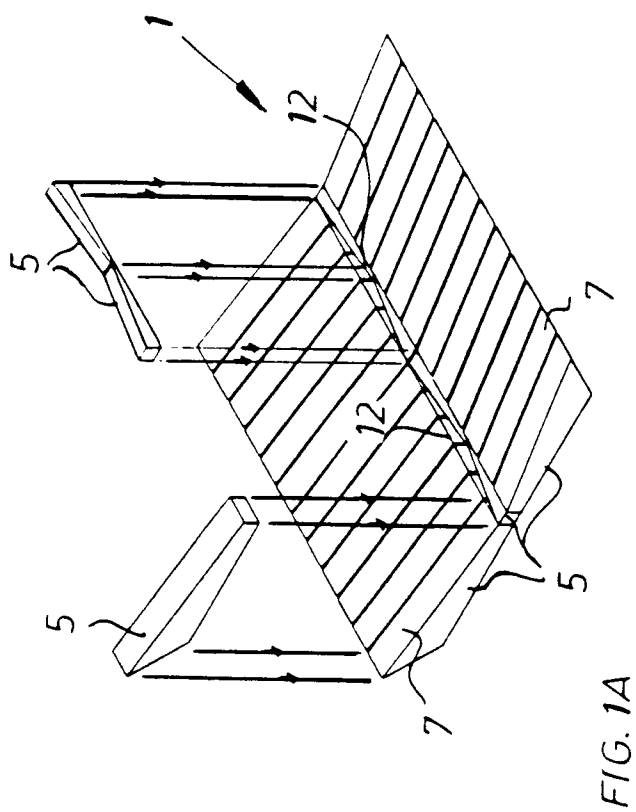
Revendications

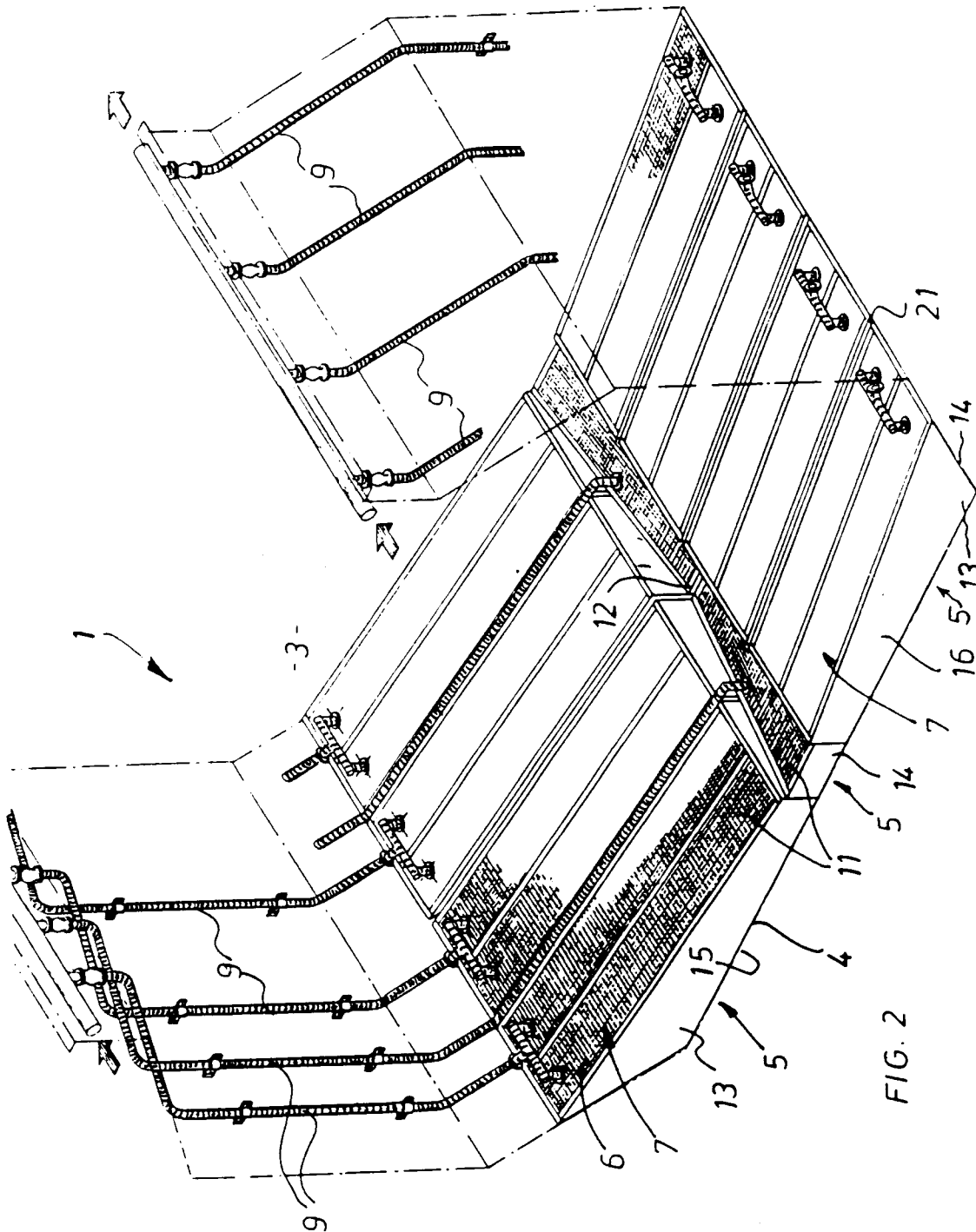
1. Un système pour la fluidisation de produit en vrac, dans des espaces tels que la cale (3) d'un bateau (2), des containers de stockage et de transport, etc., ledit système comprenant des surfaces de glissement (7) inclinées pour le produit en vrac au fond (4) de l'espace (3), chaque surface de glissement (7) ayant un tableau (8) avec des canaux (10) ou ouvertures reliés à une source de gaz comprimé et une couche (11) perméable au gaz couvrant ledit tableau (8) et adaptée pour fluidiser le produit en vrac et le déplacer vers des points (12) de déchargement situés à un niveau inférieur, pour vider ledit espace (3) ainsi qu'un nombre de blocs légers (5) montés sur le fond (4) de l'espace (3), chaque bloc (5) ayant une face supérieure (6) formant une surface de glissement (7) et des faces longue, courte et inférieure (13, 14, 15), les faces longue et courte étant formées par de minces plaques de couverture (16) et le tableau (8) et les plaques de couvertures (16) définissant une structure en caisson ayant une cavité (17), caractérisé en ce que ladite cavité (17) est remplie d'un corps (18) de matière légère et en ce que le fond (19) dudit corps (18) constitue la face inférieure (15) du bloc (5) et est en

contact direct avec le fond (4) de l'espace (3) pour en épouser la forme et, de ce fait, y distribuer la charge statique.

2. Un système comme revendiqué à la revendication 1, caractérisé en ce que ladite matière légère du corps (18) est de la matière plastique cellulaire, de préférence du polyuréthane.

3. Un système comme revendiqué à la revendication 2, caractérisé en ce que la cavité (17), dans la position renversée de haut en bas du bloc (5), constitue un moule pour la production du corps (18) en matière plastique cellulaire.





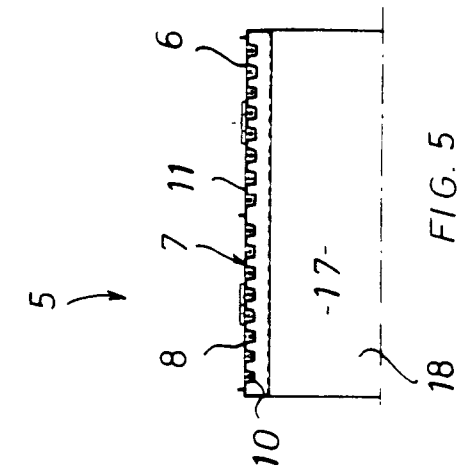


FIG. 5

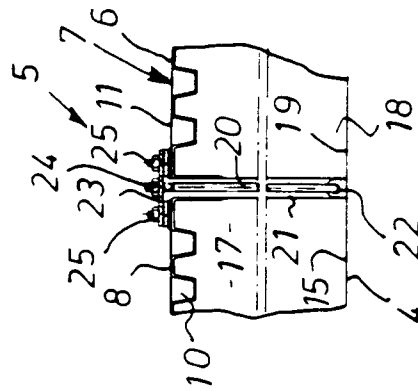


FIG. 6

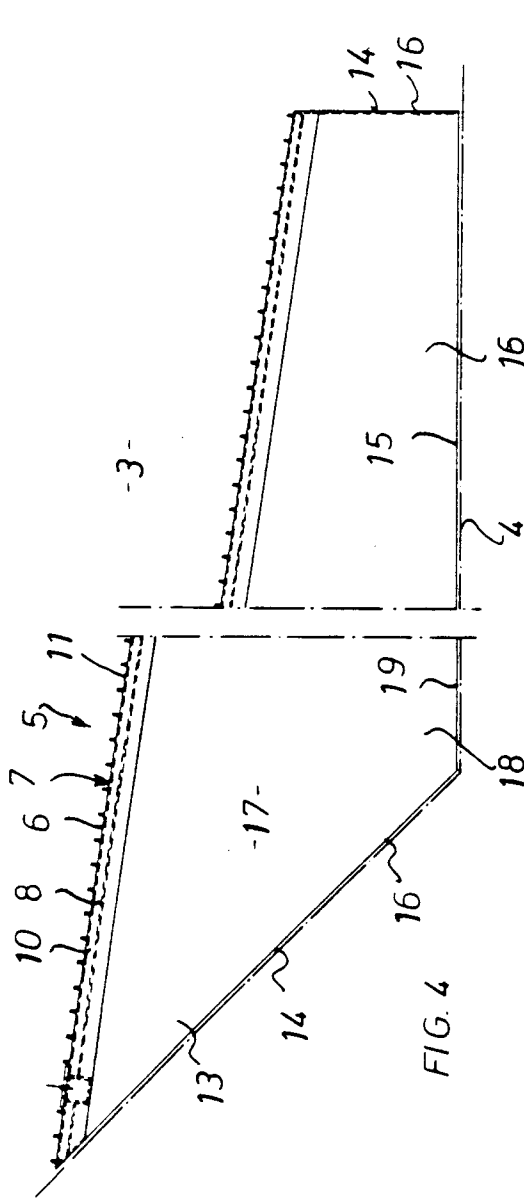


FIG. 4

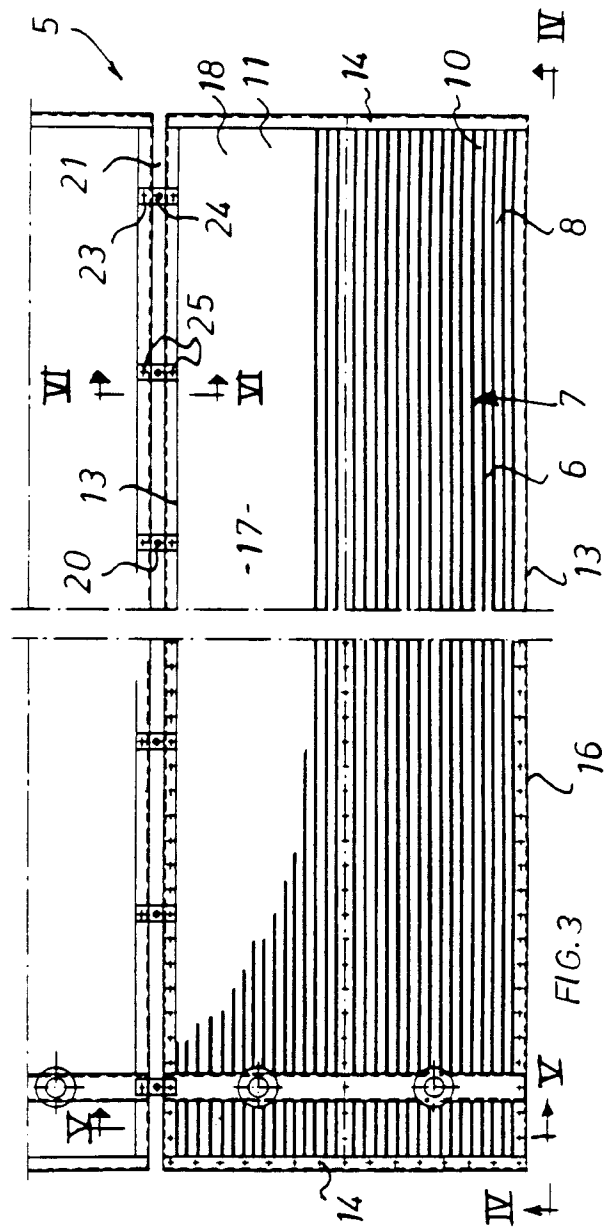


FIG. 3