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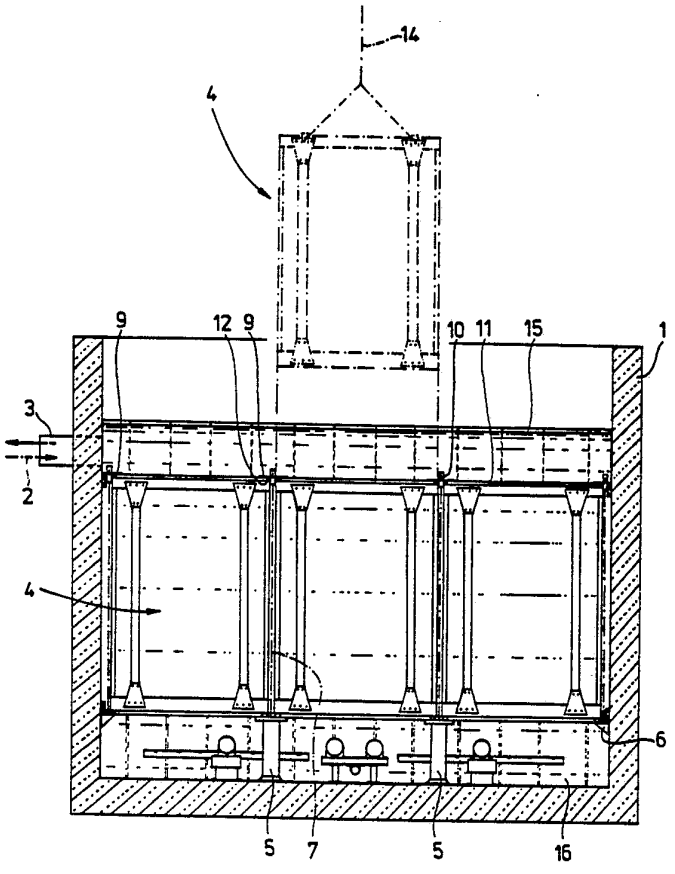
(54) Title: REACTOR FOR THE BIOLOGICAL TREATMENT OF WASTE WATER

(57) Abstract

A reactor for the biological treatment of waste water comprises a reactor vessel (1) intended to receive support material. Biomass is able to adhere to this material. The reactor vessel has an inlet (2) for the water to be treated and an outlet (3) for treated water. A number of module tanks (4) adjoining one another, over which said support material can be distributed, are placed in the reactor vessel. These module tanks can individually be inserted in and removed from the reactor.



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Title: Reactor for the biological treatment of waste water.

The invention relates to a reactor for the biological treatment of waste water, comprising a reactor vessel intended to receive support material to which biomass can adhere, which reactor vessel is provided with an inlet for water to be treated and an outlet for treated water.

Reactors of this type are known and are intended for fixed bed systems in which the support material is fitted in the system so that it is immobile. Examples of fixed bed systems are oxidation beds (trickling filters) for the aerobic treatment of waste water and submerged filters for the anaerobic treatment of wasteb water. In order to fix the support material for the biomass in the system, it is known in the case of aerobic trickling filters to fill the reactor vessel with small pieces of support material in the form of lava fragments, plastic rings or cylinders. It is also known to fill the reactor vessel with packages of corrugated sheeting-like constructions which are fitted staggered relative to one another.

A disadvantage of these systems is that they are susceptible to blockage, which is caused by solid particles in the waste water or by excessive growth of biomass or by precipitate formation. In order to remove a blockage, the reactor has to be completely shut down, the water has to be discharged and the support material has to be removed by hand and replaced by cleaned or fresh support material. It will be obvious that removal of a blockage in this way takes considerable time. In addition, odour problems can arise.

The aim of the invention is to overcome this disadvantage and to this end the reactor specified in the preamble is characterised in that a number of module tanks adjoining one another, over which said support material can be distributed, are placed in the reactor vessel, which module tanks can individually be inserted in and removed from the reactor.

By replacing one or a few module tanks at specific times by clean module tanks which are ready for use, the time for which the reactor is shut down can be kept to a minimum.

In particular, if the module tanks are fixed at their tops in an easily

detachable manner, the tanks can be removed without the water having to flow out of the reactor.

A robust, easily detachable anchoring of the module tanks is obtained if the tanks rest, at some distance above the base of the reactor vessel, on supports from which tension anchors extend upwards to above the top of the modules through a slot in clamp plates, each clamp plate pressing on the corners of a number of modules and being detachably fixable by means of a wedge which is inserted through an eye in the upper end of a tension anchor.

Planks, which are fixed by means of the clamp plates, are preferably placed over the top edges of the module tanks.

The flow of water from the inlet via vertical downward and upward flows through the successive module tanks to the outlet can be achieved by means of baffle plates.

The invention also relates to a module tank for the abovementioned reactor provided with lifting hooks.

The invention will now be explained in more detail with the aid of the figures.

Figure 1 shows a top view of a reactor according to the invention.

Figure 2 shows a cross-section along the line II-II in Figure 1.

Figure 3 shows a cross-section along the line III-III in Figure 1.

Figure 4 shows a detail from Figure 3 on a larger scale.

Figure 5 shows a perspective view of a module tank to be used in the reactor according to the invention.

The reactor shown is intended for the biological treatment of waste water and comprises a reactor vessel 1 which has an inlet 2 for water to be treated and an outlet 3 for treated water and a number of module tanks 4, which adjoin one another and in which support material in the form of

lava fragments or plastic rings or cylinders or corrugated sheeting-like packages has been or is fitted. The biomass can adhere to this support material, which mass is needed for the anaerobic or aerobic decomposition of impurities in the water.

The module tanks 4 rest on legs 5 and wall supports 6. A rod-shaped tension anchor 7, which is indicated by a broken line in Figures 2 and 3, extends from each of these legs and wall supports to above the module tanks. An opening is made in the upper end of each tension anchor 7. The tension anchors 7 serve to fix the module tanks at their tops. To this end the upper end of each tension anchor 7 projects through an opening in a clamp plate 9 and a wedge 10, which clamps the clamp plate 9 over a number (one, two or four) of corner points of module tanks, is struck through the opening in the upper end of the tension anchor.

Planks 11 and 12 can also be laid over the edges of the module tanks. The clamp plates 9 then press onto these planks.
It will be obvious that by striking the wedges 10 free and removing the clamp plates 9, the module tanks can be removed. To this end, each module tank is provided with lifting hooks 13 (Figure 4) intended for fixing the hoisting cables 14 of a hoist (Figure 2).

The flow of the water from the inlet 2 to the outlet 3 can be influenced by means of baffle plates 15 and 16. The arrows in Figure 3 indicate the direction of flow. The baffle plates 15 project above the module tanks, whilst the baffle plates 16 project below the module tanks.

The invention makes it possible to replace one or a few module tanks by clean module tanks at set times, without removing the water from the reactor vessel. The time for which the reactor is shut down can be kept to a minimum. Because the tanks are fixed at the top, the fixing can easily be undone.

Claims

1. Reactor for the biological treatment of waste water, comprising a reactor vessel (1) intended to receive support material to which biomass can adhere, which reactor vessel is provided with an inlet (2) for water to be treated and an outlet (3) for treated water, characterised in that a number of module tanks (4) adjoining one another, over which said support material can be distributed, are placed in the reactor vessel (1), which module tanks can individually be inserted in and removed from the reactor.

2. Reactor according to Claim 1, characterised in that the module tanks are fixed in an easily detachable manner at their tops.

3. Reactor according to Claim 2, characterised in that the module tanks rest, at some distance above the base of the reactor vessel, on supports (5, 6) from which tension anchors (7) extend upwards to above the top of the modules through a slot in clamp plates (9), each clamp plate (9) pressing on the corners of a number of module tanks (4) and being detachably fixable by means of a wedge which is inserted through an eye in the upper end of a tension anchor (7).

4. Reactor according to Claim 3, characterised in that planks (11, 12), which are fixed by means of the clamp plates (9), are placed over the top edges of the module tanks.

5. Reactor according to one of the preceding claims, characterised by baffle plates (15, 16) to cause water to flow from the inlet via vertical downward and upward flows through the successive module tanks to the outlet.

6. Module tank for the reactor according to one of the preceding claims, provided with lifting hooks (13).

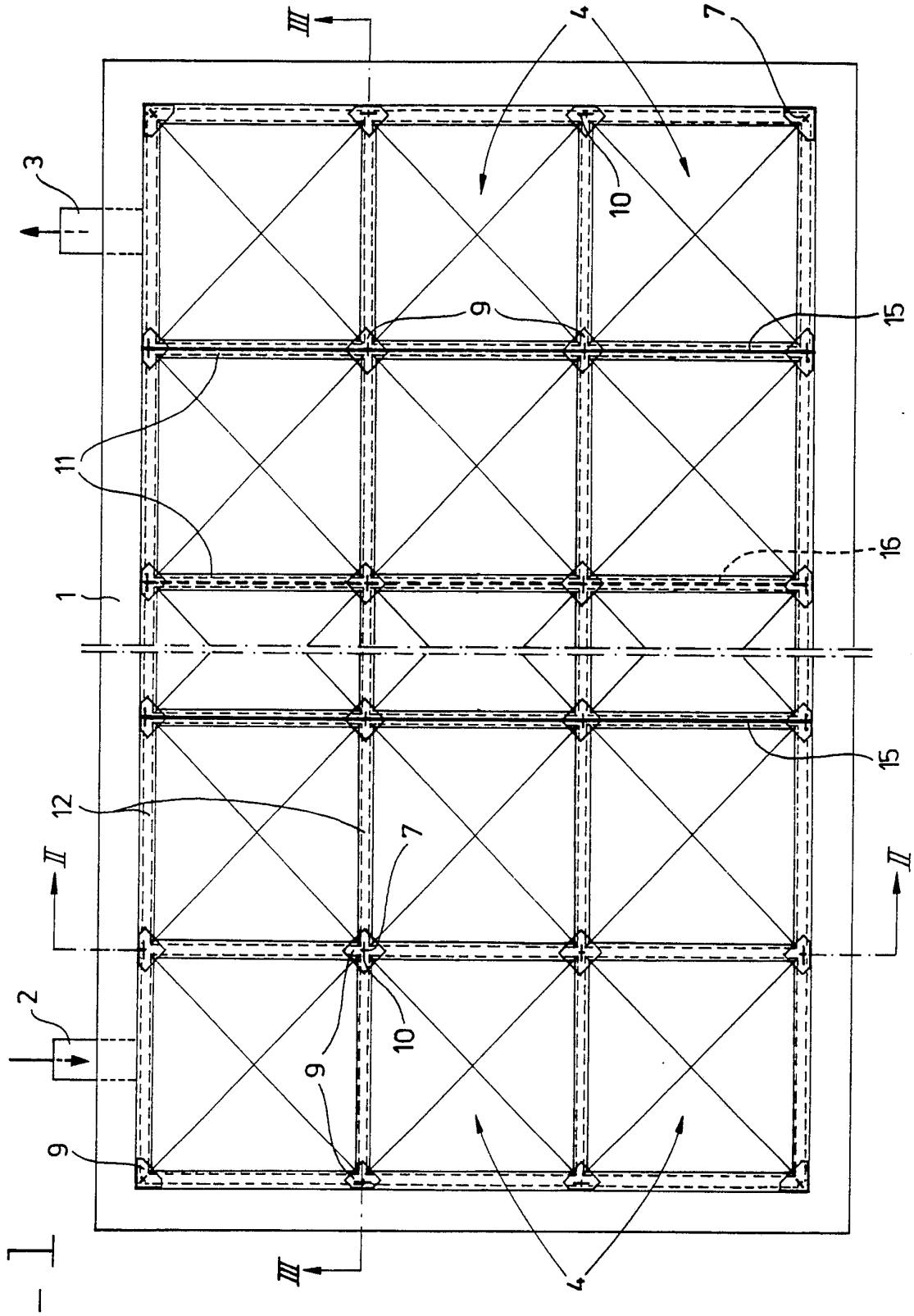
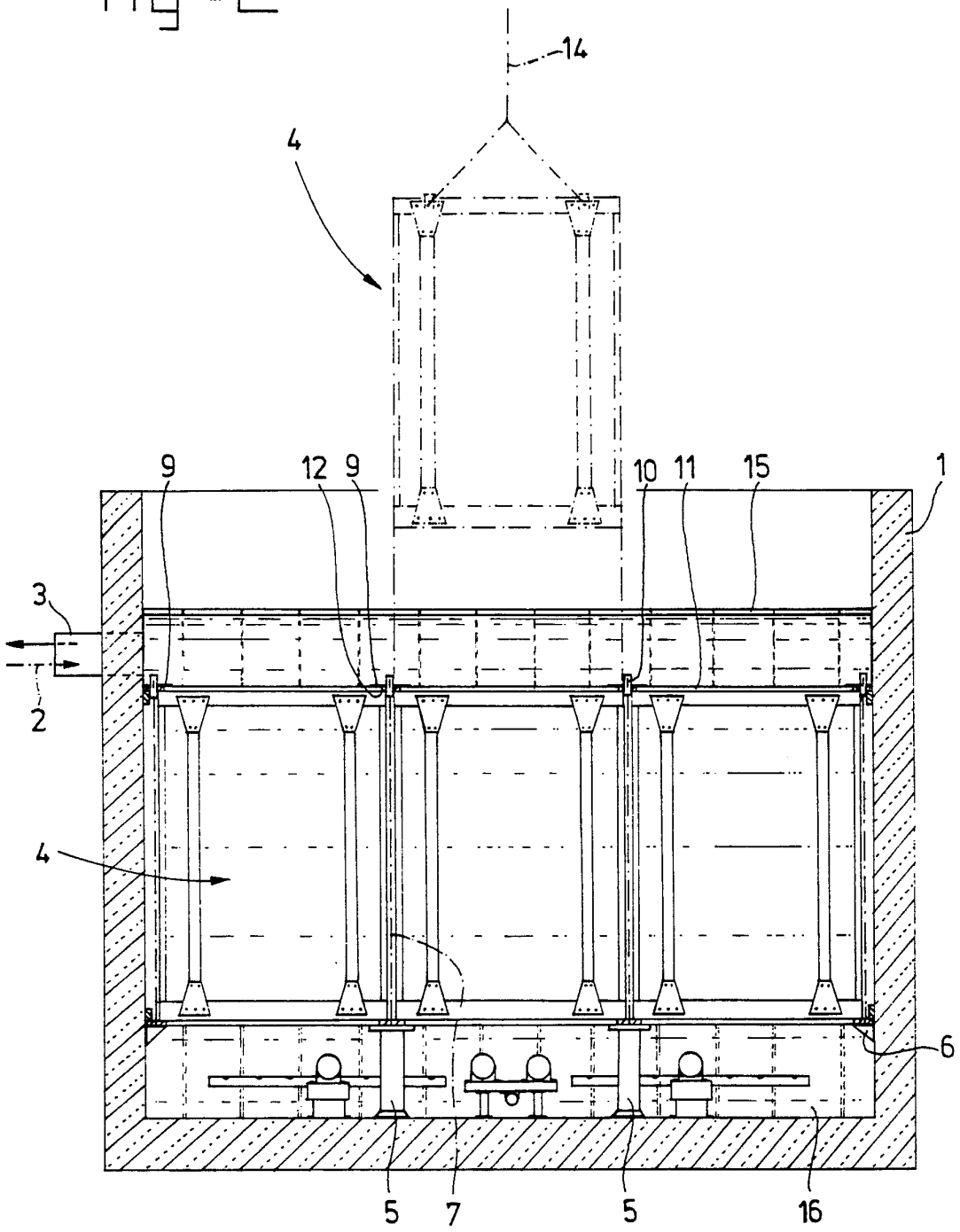


Fig - 1

fig-2



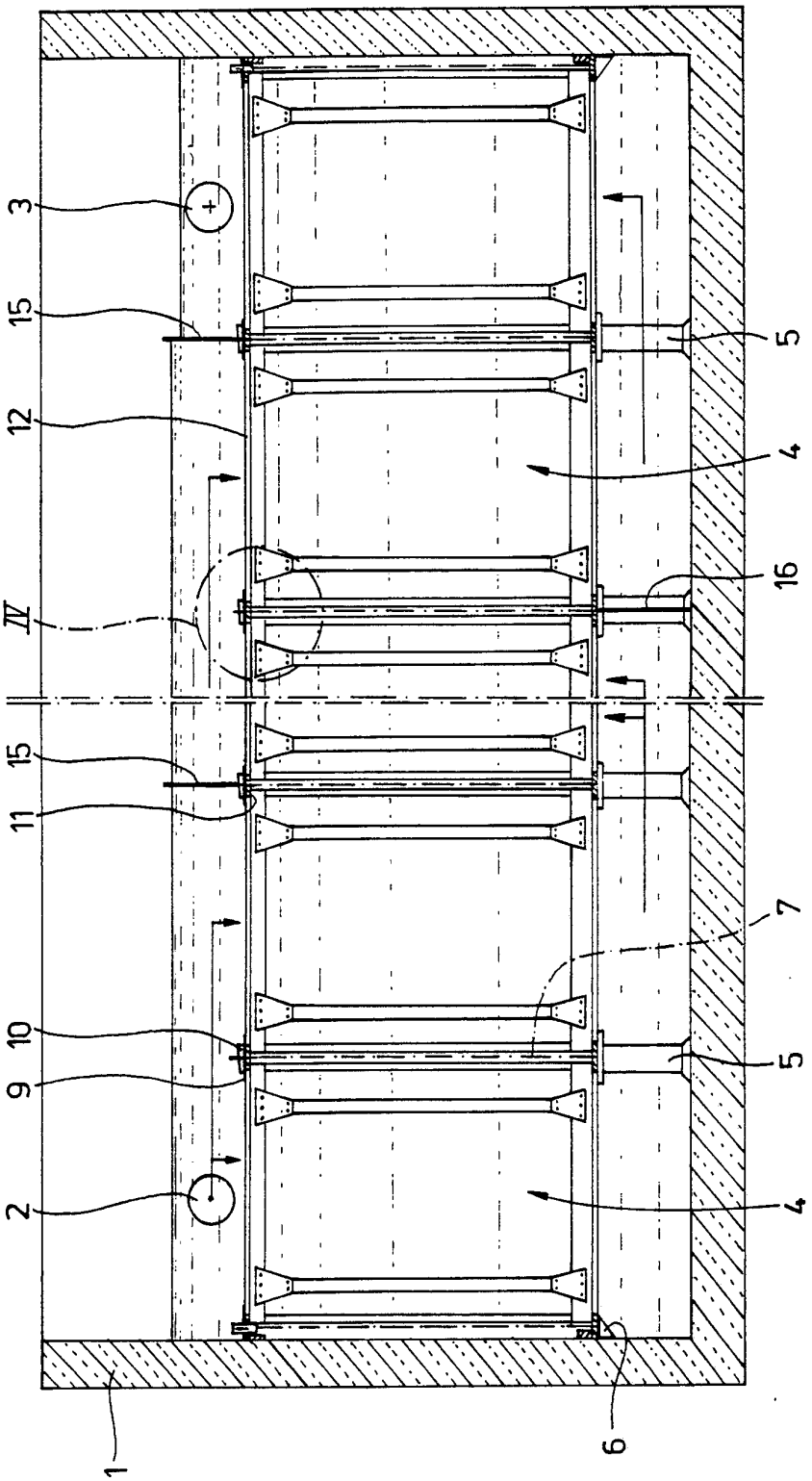


Fig-3

Fig-4

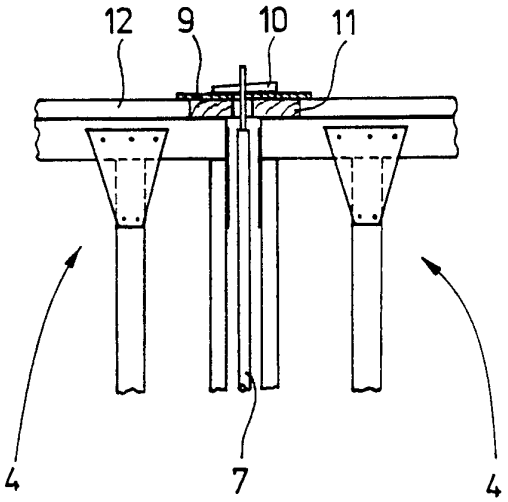
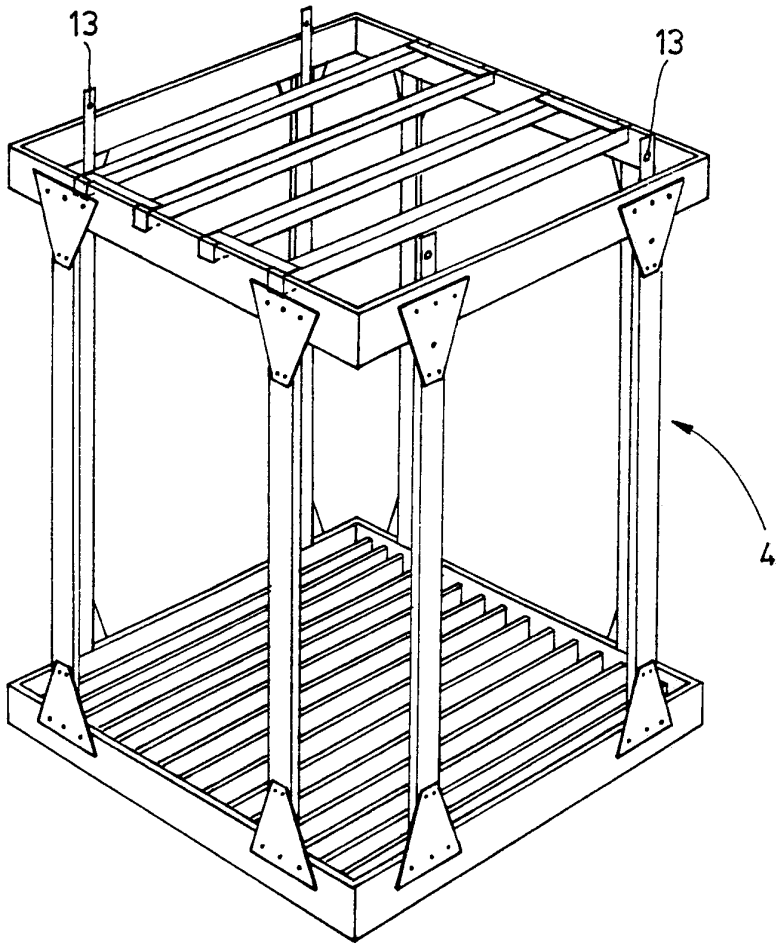


Fig-5



INTERNATIONAL SEARCH REPORT

International Application No PCT/NL 93/00018

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 C02F3/06

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	C02F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	FR,A,1 603 082 (NEVEUX, F.) 15 March 1971 see page 1, line 6 - line 14 see page 2, line 24 - page 3, line 24; figures	1
A	EP,A,0 086 489 (WESTERMAIR, WERNER) 24 August 1983 * TITELSEITE, ZUSAMMENFASSUNG * see page 21, line 3 - page 27, line 10 see page 16, line 19 - line 30 see page 37, line 1 - page 38, line 23 see page 48; claims 1,2,52,58-68	1
A	EP,A,0 133 545 (LINDE AG) 27 February 1985 see page 12; claims 1,8-11	1

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
03 MAY 1993	26.05.93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	TEPLY J.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

NL 9300018
SA 69698

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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