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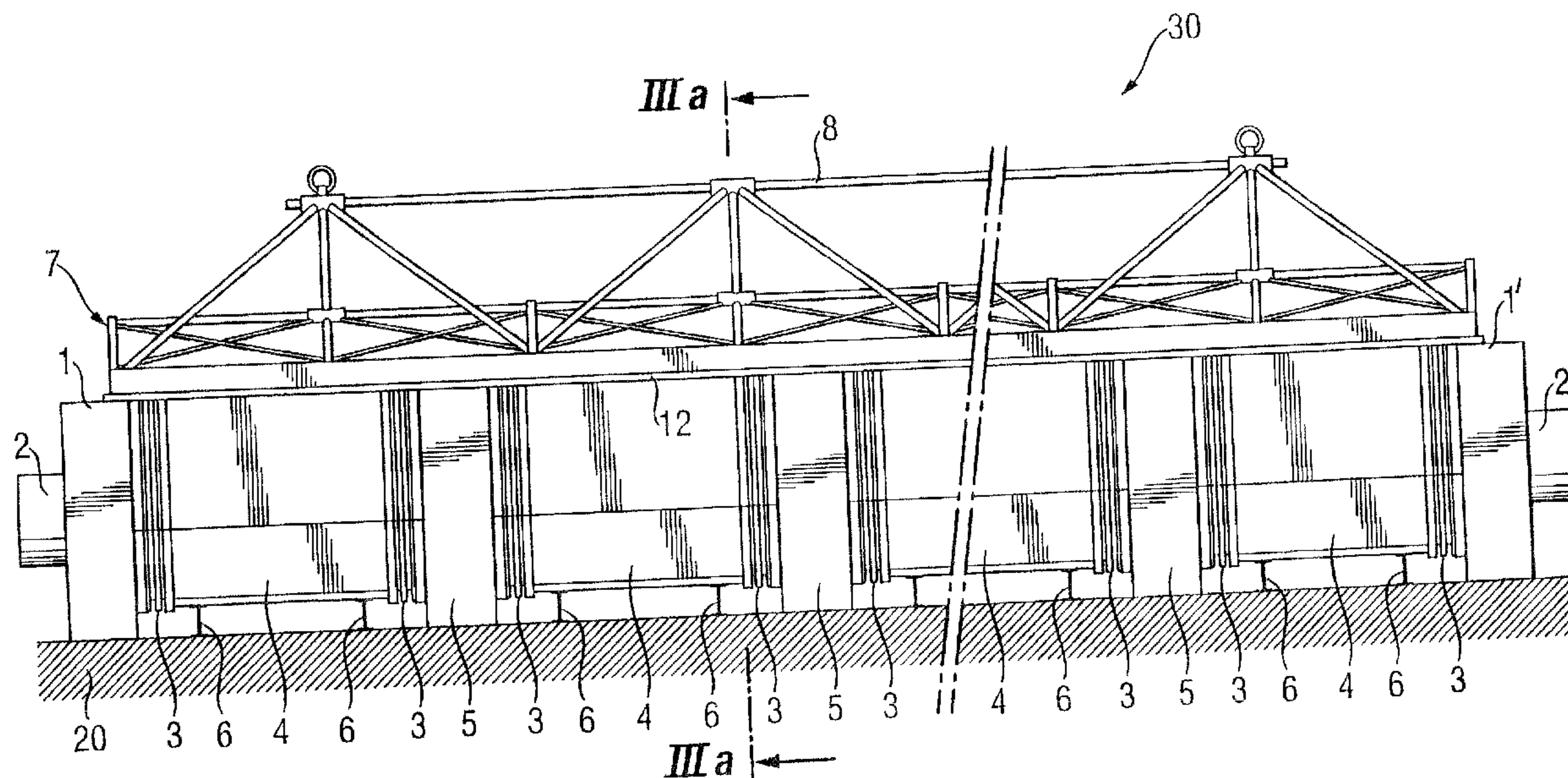
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(54) Titre : DISPOSITIF DE GRAPHITISATION DE PRODUITS DE CARBONE

(54) Title: SYSTEM FOR GRAPHITIZING CARBON BODIES



(57) Abrégé/Abstract:

A method for rebaking and graphitizing pitch-impregnated carbon bodies in an encapsulated Castner-type lengthwise graphitization furnace in one step, and a furnace shell constructed of element modules for carrying out the method. The oxygen content in the interior of the furnace is kept below 4% by volume. The method is carried out under atmospheric pressure or at pressures which differ only slightly from the atmospheric pressure.

System for graphitizing carbon bodiesAbstract

5 A method for rebaking and graphitizing pitch-
impregnated carbon bodies in an encapsulated Castner-
type lengthwise graphitization furnace in one step, and
a furnace shell constructed of element modules for
carrying out the method. The oxygen content in the
10 interior of the furnace is kept below 4% by volume.
The method is carried out under atmospheric pressure or
at pressures which differ only slightly from the
atmospheric pressure.

15 Figure 1a

System for graphitizing carbon bodiesDescription

5 The invention relates to a method for rebaking and graphitizing pitch-impregnated carbon bodies in one method step. The invention also relates to a furnace shell that is suitable for the afore-mentioned method, can be sealed off in a largely gas-tight manner and is
10 of a Castner-type lengthwise graphitization furnace for carrying out the afore-mentioned method.

The production of graphitized carbon bodies is a technique that has been mastered up to now for over one
15 hundred years and is applied on a large scale industrially and has therefore been refined in many respects and optimized with regard to costs. One of the descriptions of this technique can be found in ULLMANN'S ENCYCLOPEDIA OF INDUSTRIAL CHEMISTRY, Vol.
20 A5, published by VCH Verlagsgesellschaft mbH, Weinheim, 1986, pages 103 to 113.

A striking feature of this technique is the repeated reimpregnation and rebaking of carbon bodies. These
25 method steps are necessary, because the graphitized carbon bodies must have a minimum density, strength and conductivity in order to meet the requirements with respect to the application of the graphitized carbon bodies. These method steps are associated with costly
30 handling of the carbon bodies, that is, the carbon bodies must be repeatedly inserted into impregnating autoclaves, removed, inserted into carbonization furnaces and removed again.

35 There has not been any lack of attempts, therefore, to combine the method steps, to allow one or more of these

method steps to be omitted, by means of changed raw materials, changed recipes for the raw-material mixtures or optimized techniques for "green production".

5

Another attempt to manage with fewer method steps consisted in combining the last rebaking step with the final graphitization step. Trials with Acheson furnaces from the past few decades are known. This so-called
10 "transverse graphitization" is less economical than the "lengthwise graphitization" widespread today, in which the carbon bodies are arranged in the furnaces in such a way that the electric current flows directly through the carbon bodies parallel to their longitudinal axis.
15 Reimpregnated carbon bodies were thus installed in transverse graphitization furnaces and then attempts were made to achieve rebaking and graphitization in one method step or in one furnace life with just one step of installing the reimpregnated carbon bodies and one
20 of removing the then graphitized carbon bodies. By the term "furnace life", also when used further below, what is to be understood is as follows: reimpregnated or non-impregnated carbon bodies are inserted into a graphitization furnace and surrounded
25 with a thermally insulating packing, preferably consisting of coke. By means of direct current passage through the packing and through the carbon bodies, the latter are heated, with the heating then being effected from ambient temperature up to the graphitization
30 temperature (up to 3000°C) using a predetermined temperature-time-program. The peak temperature can be maintained for a short period of time. Following this, the current is switched off and with that the whole furnace cools, something which, depending on the total
35 mass of the carbon bodies, the packing and the furnace components, can take up several days.

A lengthwise graphitization furnace in which the carbon electrodes are graphitized as a column without a surrounding insulating packing is described in German Offenlegungsschrift 24 57 923. In this respect, this furnace is not a Castner-type lengthwise graphitization furnace. So that the electrodes are not attacked by the oxygen in the air during the thermal treatment, the electrode column is surrounded by water-cooled, bowl-shaped walls that are lined on the inside with graphite felt, and the hollow space between the electrode column and the walls is flushed with protective gas. The teaching of this specification does not specify that (re-)impregnated carbon bodies are inserted into the furnace; on the contrary, there is discussion of "carbon bodies", see page 6, first paragraph, 4th and 9th line and also 3rd paragraph, 1st line, that is, of baked carbon which gives off very little low-temperature carbonization gas or cracked gas during the thermal treatment. The rebaking and graphitization in one method step is not taught for this specific type of furnace.

The Patent Specification US 5,299,225 provides teaching regarding a Heroult or Castner-type lengthwise graphitization furnace in which a column of carbon electrodes are surrounded by an insulating packing of coke grains during the thermal treatment. The column of carbon electrodes and the surrounding insulating packing of coke grains, according to the teaching of this specification, are located in a relatively gas-tight furnace shell consisting of metallic and ceramic components, see column 2, lines 40 to 45, and covered by a hood. By means of this device it is possible for low-temperature carbonization or cracked gases that develop during the thermal treatment to be collected

and disposed of easily. In this specification, however, it is not taught that the rebaking and graphitization are carried out in one method step.

5 A method for combining the step of rebaking and graphitization is described in Specification DE 22 24 905. According to this, the carbon bodies that are orientated transversely in relation to the current flow are installed in the furnace in a
10 plurality of layers one above the other. The lower layers consist of carbon bodies that are reimpregnated with pitch and the upper layers consist of non-impregnated carbon bodies. In this way, on the one hand the quantity of pitch introduced into the furnace
15 was reduced. On the other hand, by means of this arrangement of the carbon bodies the temperature distribution in the furnace was influenced in a favourable manner during the furnace life. A higher temperature namely set in in the upper portion of the
20 furnace, which temperature effected further decomposition of the problematic cracked gases that developed from the pitch in the lower portion of the furnace to give less problematic gases. This method has not been carried through to success in practice and
25 in the end has failed with respect to the resultant cracked gases. This can be explained as follows:

Baked carbon bodies have a considerable porosity of the order of magnitude of 20 to 25% by volume after the
30 initial baking. The pores are filled with pitch during (re-)impregnation. If (re-)impregnated carbon bodies are installed in an Acheson furnace in comparatively large quantities of, for example, some ten tons, a few tons of impregnating pitch is also introduced into the
35 furnace. When the

(re-)impregnated carbon bodies are heated up, the pitch first becomes soft and then liquid until it decomposes given further rising temperatures. From the impregnating pitch there develop solid carbon (coke) and volatile cracked gases which are composed of an extraordinarily broad spectrum of hydrocarbon compounds, starting with high-molecular tars and oils and ending with low-molecular compounds, such as CH₄ or CO. At low heating-up rates, small volumes of volatile cracked gases develop from the impregnating pitch per unit of time; at high heating-up rates large volumes develop.

Very high final temperatures of, for example, 3000°C are achieved in comparatively short periods of time of, for example, 15 to 25 hours, that means, high heating-up rates are achieved, in graphitization furnaces. In comparison, final temperatures of, for example, 1000°C are achieved in comparatively long periods of time of, for example, seven days in carbonization furnaces. The high heating-up rate gives rise, in an unfavourable manner, to the development of extraordinarily large quantities of volatile cracked gases from the impregnating pitch. The graphitization system, the surrounding building and also the environment are loaded to excess by means of these undesirable gases; production according to this method is not therefore expedient.

The object therefore consisted in combining the method steps of rebaking and graphitization in one method step when producing graphitized carbon bodies and to provide a suitable, modern and economically operating graphitization furnace therefor. A further object was to construct the important units of the furnace, such as the furnace ends, shell and covering, in such a gas-

tight manner that a change in gas pressure in the furnace can be permanently maintained in the range of +10Pa to -40Pa in relation to the surrounding air pressure.

5

By means of such a system and the use thereof, on the one hand a situation is reached where instead of running through two separate method steps (in the first instance rebaking and then graphitization) the carbon
10 bodies only run through one furnace life and thus less handling of the whole tonnage of graphitized carbon bodies that is produced is required. On the other hand, the cracked gases which develop from the impregnating pitch are collected by the sealed rebaking
15 and graphitization furnace and the environment is not loaded to an inadmissible extent.

The object is achieved by means of a method in accordance with the characterizing part of claim 1 and
20 by means of a furnace shell for a graphitization furnace in accordance with the characterizing part of claim 8. The process temperatures demand that, for example, carbonization furnaces should not be used for the combination of the two method steps, rebaking and
25 graphitization, because these furnaces would not withstand the high temperatures during the graphitization, but that instead graphitization furnaces should be used in which the carbonization temperatures only represent an intermediate stage
30 before the graphitization temperatures are reached. It was explained in a corresponding manner with respect to the prior art that attempts have been made to achieve rebaking and graphitization in an Acheson furnace and methods have been described regarding this. For the
35 solution to the present object, a modern and economically operating Castner-type graphitization

furnace was selected instead of the Acheson-type graphitization furnace. With a furnace of such a kind, rebaking and graphitization were realized in one method step or in one furnace life.

5

Castner-type lengthwise graphitization furnaces have two furnace ends and an extended furnace bed that lies in between and is made of a coke packing, arranged on which are the carbon bodies that are to be graphitized, 10 which bodies in turn are covered with a coke packing for the purposes of insulation. Given such an open pile-like arrangement, it is impossible to regulate the pressure and composition of the atmosphere above this open Castner-type system. Regulation of the furnace 15 atmosphere is only successful if the furnace is largely sealed off. In accordance with the invention, the Castner-type graphitization furnace is so gas-tight that a change in gas pressure in the furnace can be permanently maintained in the range of +10Pa to -40Pa 20 in relation to the surrounding air pressure.

In accordance with the invention, the Castner-type graphitization furnace has such a gas-tight shell consisting of joined, ceramic, concrete-like or 25 metallic materials or a combination of these materials, including the covering, that a change in gas pressure in the furnace can be permanently maintained in the range of +10Pa to -40Pa in relation to the surrounding air pressure.

30

The considerable changes in temperature in the furnace after many furnace lives give rise to cracks or distortions in the shell if the latter is made of ceramic brickwork. Such cracked or distorted shells 35 can only be returned to a largely gas-tight condition

with difficulty. It would be necessary to re-build the furnace with a tight shell.

In the literature, shells for graphitization furnaces are described that only consist of metallic, preferably steel-sheet elements. However, as presented in the case of International Application WO 87/06685, these do not have the object of providing a largely gas-tight container for the graphitization process, but instead the whole furnace bed is to be conveyable without effort. In the case of such "normal" graphitization furnaces, it is also not the object to remove comparatively large quantities of cracked gases, because the carbon bodies are inserted into the furnace in the carbonized, non-impregnated state.

In contrast with the system according to WO 87/06685, a combination of concrete elements and metallic elements provided the solution in accordance with the invention to the object that is set here. The Castner-type graphitization furnace contains such a gas-tight shell in accordance with the invention, made of assemblies arranged along the length of the graphitization furnace and consisting of, in each case, a steel-sheet element, a steel-sheet compensator and an electrically insulating concrete rib, that a change in gas pressure in the furnace can be permanently maintained in the range of +10Pa to -40Pa in relation to the surrounding air pressure.

The cracked gases that develop in a hot graphitization furnace emerge on all sides from a pile-like construction of the furnace, leaving aside the tight end faces of the furnace ends in which the electrical contacting with the carbon bodies in the furnace is also located. If the graphitization furnace is now equipped in accordance with the invention with a shell that is gas-tight in the manner described, the cracked

gases can only emerge upwards. In order to prevent the cracked gases from escaping into the environment, the Castner-type graphitization furnace in accordance with the invention has such a gas-tight, heat-insulated steel-sheet covering that a change in gas pressure in the furnace can be permanently maintained in the range of +10Pa to -40Pa in relation to the surrounding air pressure. The heat-insulated steel-sheet covering permits developing cracked gases from the impregnated carbon bodies to be collected and removed at a gas pressure in the furnace in the range of +10Pa to -40Pa.

During the heating-up phase, current flows through the carbon bodies in a Castner-type graphitization furnace. On account of the electrically conductive connection with the coke packing that surrounds the carbon bodies, it is inevitable that current will flow through this packing as well in accordance with its respective electrical resistance. Current would also flow through the furnace shell, which consists of the steel-sheet elements and pertains to the furnace in accordance with the invention, to an inadmissibly high extent if electrically insulating concrete ribs were not arranged between the steel-sheet elements and the steel-sheet compensators. The same considerations naturally also apply to the steel-sheet covering for the whole furnace. It too must be electrically insulated in relation to the coke packing and the steel-sheet elements with the steel-sheet compensators. This is achieved in that the Castner-type graphitization furnace has a covering, sitting on the upper shell edge, and a shell which are electrically insulated in respect of each other with the aid of mineral wool for one respective furnace life. At the same time, the mineral wool has the effect of sealing the shell and the covering in relation to each other in such a gas-

tight manner that a change in gas pressure in the furnace can be permanently maintained in the range of +10Pa to -40Pa in relation to the surrounding air pressure.

5

The individual steps of inserting the carbon bodies into the graphitization furnace until they are removed from the graphitization furnace are as follows:

- 10 - insertion of the impregnated carbon bodies into a Castner-type graphitization furnace;
- heating of the impregnated carbon bodies in one furnace life with an adjustable temperature program from ambient temperature to the usual
15 (re-)baking temperatures of 800 to 1200°C up to graphitization temperature;
- collection and removal of the cracked gases that develop thereby at an excess gas pressure or low
20 gas pressure of +10Pa to -40Pa in relation to the surrounding air pressure under a covering over the Castner-type graphitization furnace;
- cooling of the graphitized carbon bodies thus formed; and
- removal of the latter from the carbonization
25 furnace.

The cracked gases that develop when the impregnated carbon bodies are heated up were dealt with in the discussion of the prior art. It was shown that the
30 quantity of cracked gases that develop is dependent upon the heating-up rate of the impregnated carbon bodies.

Another important variable is the absolute quantity of impregnated carbon bodies in the furnace. If an
35 Acheson furnace is compared with a Castner-type furnace, given the same spacing of the furnace ends, it

can be specified as a rule of thumb that an Acheson furnace can receive approximately two to three times the quantity of carbon bodies as a Castner-type furnace. This means, with respect to the quantity of pitch that is introduced into the furnace with the carbon bodies, that a fully occupied Castner-type furnace contains only approximately one half to one third of the quantity of pitch as an Acheson furnace. This is to be regarded as being favourable for the quantity of cracked gases that develop - during one furnace life of the furnace in accordance with the invention. The type of pitch only influences the quantity of cracked gases that develop to a slight extent, since the pitch composition of the impregnating pitches does not vary very much. The two variables "heating-up rate" and "absolute pitch quantity in the furnace" are critical for the volumes of cracked gases that develop during the furnace life per unit of time. The removal of these volumes depends upon the construction and the operation of the furnace.

As long as the covering hood on the Castner-type graphitization furnace is in use, *inter alia* the gas pressure is regulated throughout the furnace with the aid of a suction-removal arrangement. Compared with the surrounding air pressure, an excess gas pressure of up to +10Pa or a low gas pressure of down to -40Pa, preferably +5 Pa to -25 Pa, prevails in the furnace. Even with an excess gas pressure of 10 Pa, the furnace is tight to a sufficient extent in technical terms so that it does not give off any smoke or vapours towards the outside. The gas pressures change in the course of a furnace life as a function of the chemical and physical processes in the furnace. The impregnating pitch carbonizes preferably in the temperature range of approximately 400 to approximately 700°C and at the

same time cracked gases develop. Whilst passing through this temperature range, the largest quantities of cracked gas develop; the furnace is operated with slight excess pressure (up to a maximum of +10Pa, preferably up to 5Pa) in this period of time.

As described, the cracked gases are composed of an extraordinarily broad spectrum of hydrocarbon compounds. In accordance with their molecular weight and the other properties, these hydrocarbon compounds have very different condensation and evaporation temperatures. Under the conditions of the Castner-type graphitization furnace, these compounds come into different temperature zones. Close to the central hot core of pitch-impregnated carbon bodies, many compounds are present there just in a gaseous form. The gas pressure does, however, drive the compounds into the thermal insulation of coke grains that surrounds the carbon bodies. Starting from the hot core of the furnace, the temperature decreases towards the outer edge of the insulation. Constituents of the cracked gases now condense in these cooler parts of the insulation.

Since the temperature distribution in the furnace, and specifically in the insulation, is not static, the substances which have condensed in the first instance in the cooler sections do not remain at these points. In the course of the furnace life, the temperature rises in the furnace in general and in the insulation in the first instance, but later decreases again. The wave of high temperatures migrates outwards in the insulation and reaches the substances which have condensed in the sections of the insulation that are cooler first. These substances evaporate anew. In this way, the coke packing emits gas over a comparatively long time span. For this reason, the

suction-removal for the whole furnace remains further
in operation for up to 24 hours after the maximum
temperature has been reached in the furnace core and
after the current-flow through the carbon bodies has
5 then subsequently been switched off.

The cracked gases are combustible. Combustible gases
produce ignitable explosive gas mixtures when mixed
with oxygen with an oxygen content of over five percent
10 by volume. The oxygen content of the furnace
atmosphere is therefore monitored by means of suitable
sensors. The oxygen content is regulated in two ways
in order to prevent too great a rise: either inertia-
producing gases are fed into the furnace atmosphere or
15 else the low pressure is reduced by means of suction-
removal and thus less infiltrated air is drawn into the
furnace until less than four percent by volume oxygen
can be detected in the furnace atmosphere.

At the beginning of the furnace life, the oxygen
20 content in the furnace and under the covering is
identical with that of the ambient air, that is, it
lies at approximately 21% by volume. With the rise in
the temperatures in the furnace core, the first
combustible cracked gases start to develop there. In
25 order to prevent ignitable gas mixtures from developing
precisely during the beginning of the furnace life,
gases which produce inertia during this phase, such as,
for example, nitrogen and carbon dioxide, are flushed
into the furnace. Sensors are used to monitor whether
30 the oxygen content remains below 4% by volume at the
beginning of the furnace life as well.

The invention is explained in greater detail by way of
example in the Figures, in which:

35

Figure 1a: shows a side view of the furnace;

Figure 1b: shows a plan view of the furnace;
Figure 2: shows a three-dimensional representation
of a shell portion of the furnace;
Figure 3a: shows a section along AA of Figure 1a
5 through the assembly of the upper shell
edge, the mineral wool and the lower
edge of the covering; and
Figure 3b: shows a detail view of Figure 3a.

10 The side view of the furnace in Figure 1a
diagrammatically shows the furnace shell that is
subdivided along the length of the furnace 30 and which
stands on the hall floor 20. The furnace 30 starts on
the left-hand side with the furnace end 1 through which
15 a contact electrode 2 passes. Following on from the
furnace end 1 there is a compensator 3 of steel sheet
that can compensate for the changes in length of the
furnace during a furnace life parallel to its
longitudinal axis. The compensator 3 is connected to
20 the furnace end 1, on the one side, and to the steel-
sheet element 4, on the other side, in a fixed and gas-
tight manner in accordance with the demands made on the
whole furnace 30. The steel-sheet element portion 4 is
held by carriers 6. Following on from the first steel-
25 sheet element section 4 there is a further compensator
3. A concrete rib 5 follows. The assembly,
compensator 3, steel-sheet element 4, compensator 3 and
concrete rib 5, is repeated along the length of the
furnace several times. The furnace is sealed off on
30 the right-hand side of Figure 1a by a second furnace
end 1' with a contact electrode 2. The furnace bears,
over the whole of its length, a covering 7 which is
held by a framework of struts 8. The covering 7 can
easily be removed as a whole with the aid of a crane.

Figure 1b shows the plan view of the furnace without the covering. Two furnace shells 9 and 10 that are close together and each of which is composed of a plurality of assemblies, compensator 3, steel-sheet element 4, compensator 3 and concrete rib 5, can be seen. Both furnace shells end on the left and on the right at the furnace ends 1 and 1'. The contact electrodes 2, which project into the interior space of the furnace, are drawn in a diagrammatic manner here.

10

Figure 2 shows a three-dimensional drawing of an assembly consisting of a concrete rib 5, a compensator 3, a steel-sheet element 4, a compensator 3 and a concrete rib 5. The upper shell edge 12 is drawn so that it is shown in an interrupted or non-continuous manner.

15

A section along IIIa IIIa from Figure 1a is shown in Figure 3a transversely through a furnace bed or transversely through a steel-sheet element 4 and the covering 7 located thereon with the bearing framework 8. Figure 3b shows an enlarged detail portion from Figure 3a. Mineral wool 11 is laid on the widened upper shell edge 12 of the steel-sheet element 4. The covering 7 loads the mineral wool 11 with its weight, compresses it and thus seals the furnace towards the top to a sufficient extent in technical terms.

20

25

List of reference numerals

	1	Furnace end
	1'	Furnace end
5	2	Contact electrode
	3	(Steel-sheet) compensator
	4	Steel-sheet element
	5	Concrete rib
	6	Carrier
10	7	Covering
	8	Framework
	9	Furnace bed
	10	Furnace bed
	11	Mineral wool
15	12	Upper shell edge
	20	Hall floor
	30	Castner-type graphitization furnace

Claims

1. Method for rebaking and graphitizing pitch-impregnated carbon bodies in one method step,
5 characterised in that
the impregnated carbon bodies are installed in a Castner-type lengthwise graphitization furnace (30) forming at least one column stretched between current-supplying and current-returning electrodes (2),
10 in that they are surrounded on all sides by a thermal insulating layer of coke packing material,
with the thermal insulating layer being taken up by a largely gas-tight furnace shell and with this shell being provided with a largely gas-tight covering (7)
15 that closes the shell in a gas-tight manner,
in that before starting to heat up the carbon bodies the oxygen content in the furnace atmosphere is lowered to a content of less than 4% by volume,
in that according to a predetermined program electrical
20 current is conducted through the column of carbon bodies in such a way that these are heated increasingly and thereby run through the rebaking stage of the impregnating pitch and at the end of the same furnace life reach graphitization temperature,
25 in that the gas pressure is regulated inside the graphitization furnace (30) in such a way that it deviates up to a maximum of +10Pa to -40Pa from the external air pressure that surrounds the furnace (30),
and in that the gases and vapours escaping from the
30 carbon bodies and from the insulating layer are removed from the furnace by way of a suction device,
in that, furthermore, the current supply is interrupted after the graphitization temperature has been reached and the now rebaked and graphitized carbon bodies are
35 removed after sufficient cooling, the end of the

emergence of vapours from the insulating packing and the furnace has been opened.

2. Method according to claim 1, characterised in that
5 the oxygen content in the furnace atmosphere is lowered before the start of heating by flushing the interior space of the furnace with carbon dioxide and/or nitrogen.

10 3. Method according to claim 1 or 2, characterised in that the oxygen content in the furnace atmosphere is kept below four percent by volume by admixing a non-combustible gas with an oxygen content of below one percent by volume.

15

4. Method according to one of claims 1 to 3,
characterised in that the gas pressure in the interior space of the furnace is adjusted in relation to the air pressure surrounding the furnace by regulating either
20 the quantities of gas to be removed by suction or the temperature course.

5. Method according to one of claims 1 to 4,
characterised in that the gas pressure in the interior
25 space of the furnace is adjusted in relation to the air pressure surrounding the furnace by regulating the quantities of gas to be removed by suction and the temperature course.

30 6. Method according to one or more of claims 1 to 5, characterised in that the gas pressure in the interior space of the furnace is regulated in such a way that its deviation from the air pressure surrounding the furnace lies in a preferred range between +5 Pa and
35 -25 Pa.

7. Method according to one or more of claims 1 to 6, characterised in that the covering (7) that closes the furnace space towards the top remains on the furnace (30) for a further up to 24 hours from the time at
5 which the electrical current is switched off and during this time the device for regulating the internal furnace pressure remains in operation.

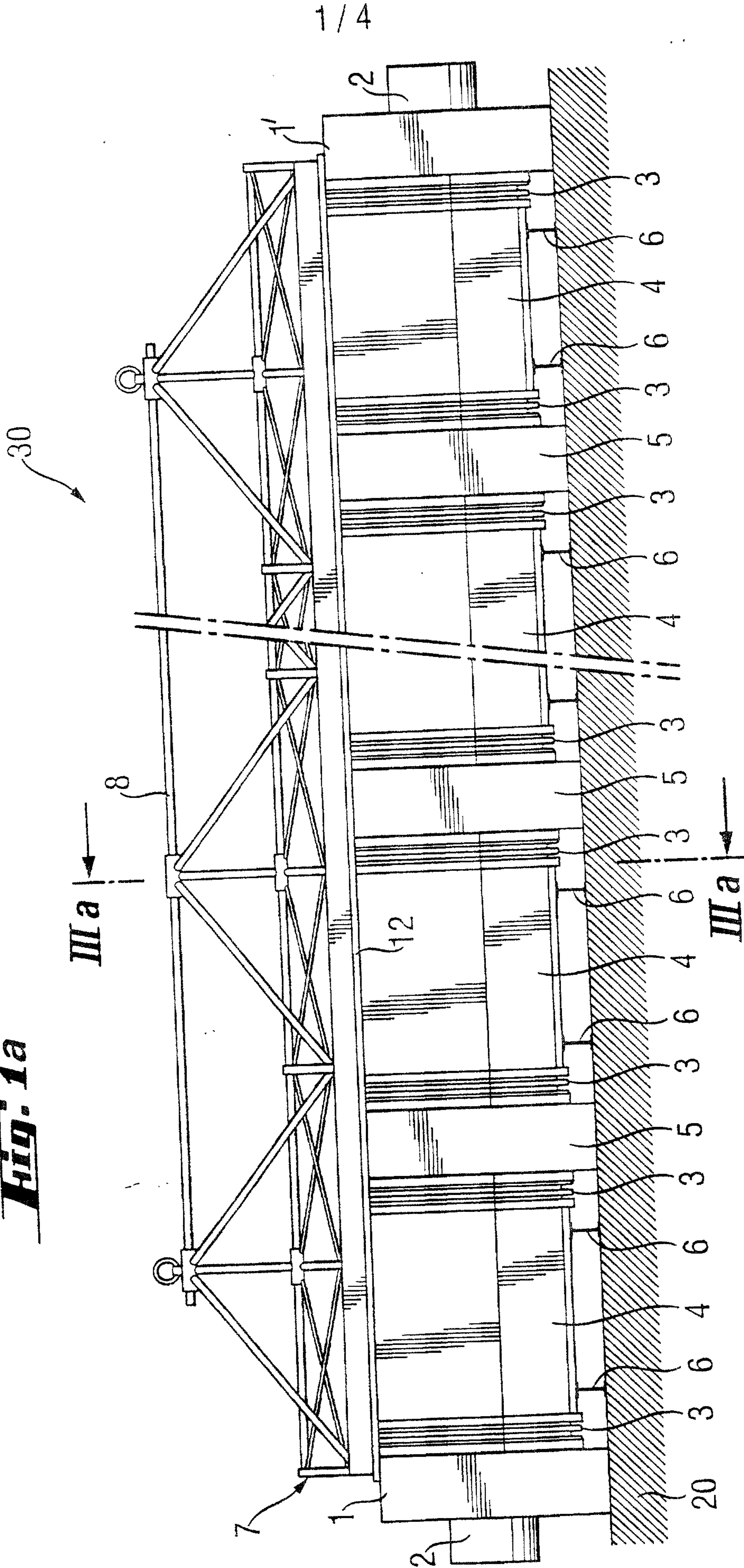
8. Furnace shell, which can be sealed off in a largely
10 gas-tight manner, for a Castner-type lengthwise graphitization furnace (30) for carrying out a method according to one or more of claims 1 to 7, having two furnace ends (1; 1') which delimit the interior space of the shell on the end faces, are made of ceramic
15 material and are largely gas-tight per se and have electrodes (2) for supplying or returning electrical current, and having a covering hood (7) that rests on the upper shell edge (12) in a sealed manner and so as to be electrically insulated in respect of the shell
20 edge, seals off the interior space of the furnace and is removable,

characterised in that the furnace shell that is located between the furnace ends (1; 1') consists of steel-sheet elements and concrete ribs which are connected
25 together and to the furnace ends (1; 1') in a detachable, but largely gas-tight manner and follow each other alternately, with one steel-sheet element (4) firstly having shell walls and a broad, largely planar shell base, which has on its lower side carriers
30 (6) or supports which rest on the hall floor (20), and secondly being connected in a gas-tight and fixed manner at two ends, pointing in the direction of the longitudinal axis of the furnace, to a compensator (3) which consists of folded or corrugated steel sheet, and
35 with the heat-resistant and electrically insulating concrete ribs (5) which stand on the hall floor (20)

located underneath the furnace shell having a
respective contour on their insides that corresponds to
the inside contour of the steel-sheet shells,
and in that the steel-sheet elements and concrete ribs
5 have, at their upper edges (12) that face the covering
hood (7), grooves, recesses or receivers that are
filled with mineral wool (11),
with the mineral wool (11) being compressed under the
weight of the covering hood (7) that engages into the
10 filled grooves with its lower edges and is placed on
the furnace shell so that during the thermal part of
the execution of the method a sufficiently gas-tight
seal is guaranteed between the furnace shell and the
covering hood (7).

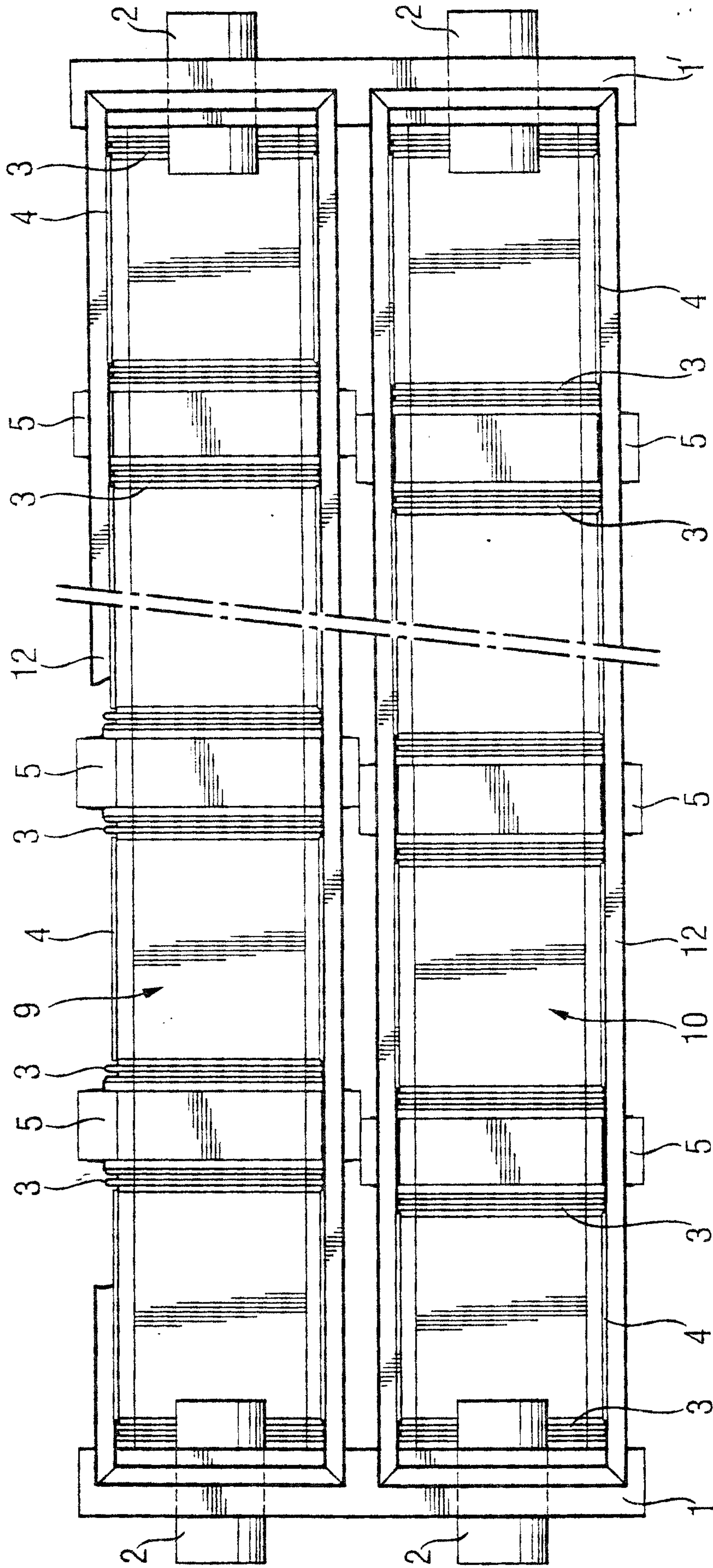
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Fig. 1a



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Fig. 1b



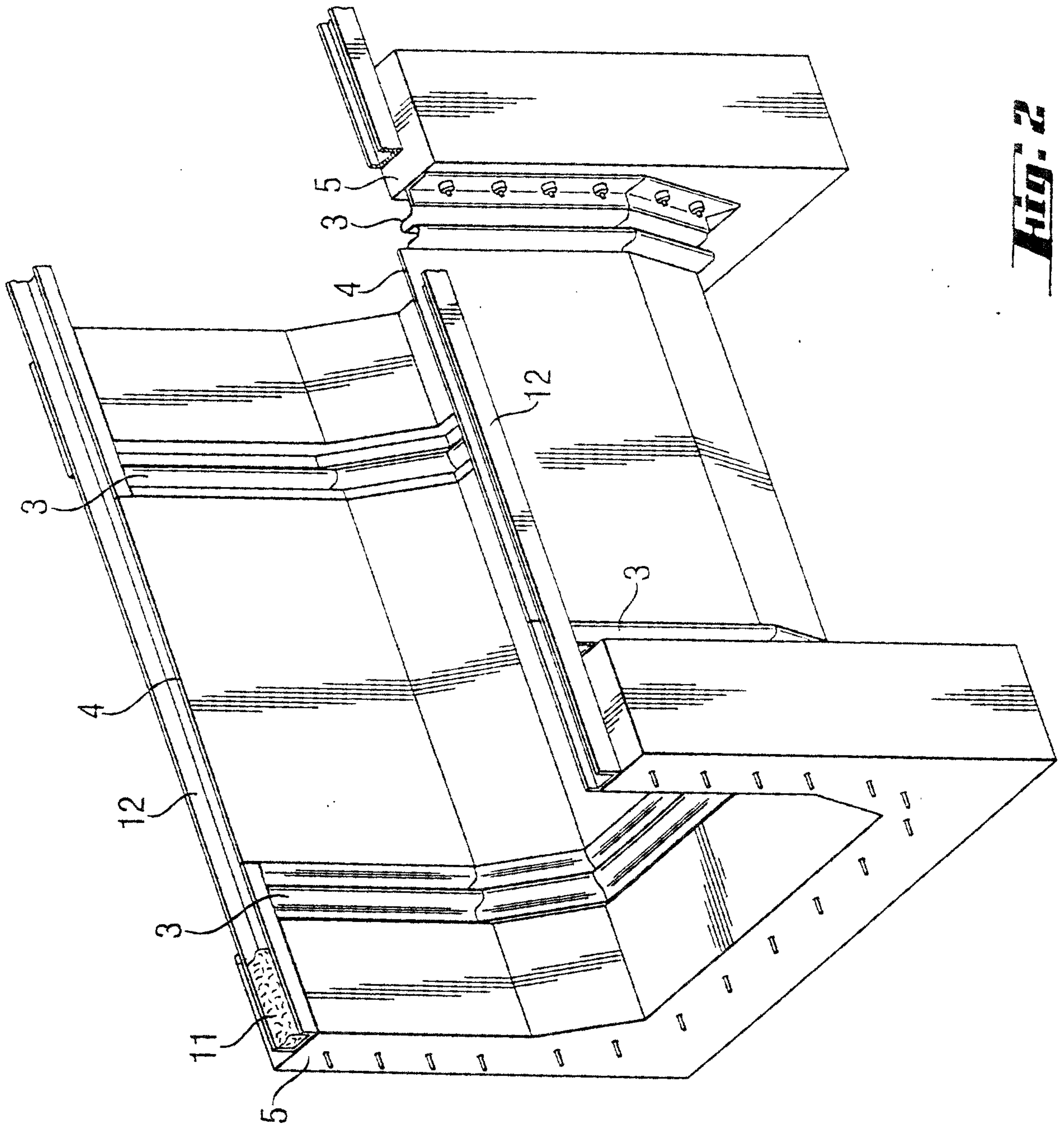


FIG. 2

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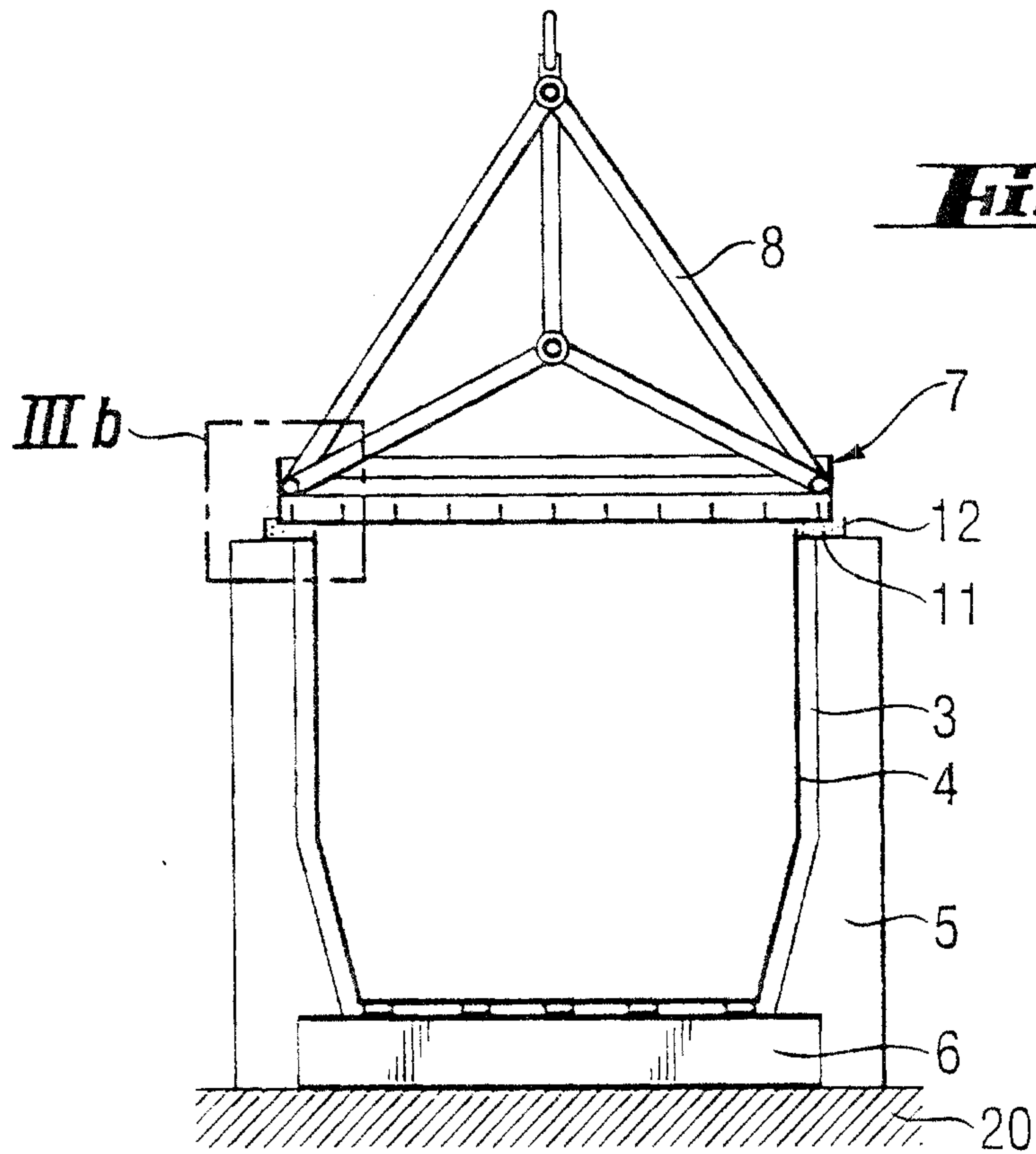


Fig. 3 b

