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(54) **A coke-oven door and a coke-oven battery having such a door.**

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DE-A- 2 219 516
DE-A- 3 240 305

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EP 0 227 175 B2

Description

The invention relates to a coke-oven door for a coking chamber of a battery of coke ovens, consisting of a door body carrying a door seal and a door plug which extends into the coking chamber when the door is closed, the door plug consisting of a generally closed metal box construction in which the side walls form on each side of the plug, when the door is closed, together with the side walls of the coking chamber, a vertical gas flue, each side wall of the box construction being shaped to recede from the side wall of the coking chamber so as to form, when the door is closed, in conjunction with the side wall of the coking chamber, the said vertical gas flue for passage of coke-oven gas, so that gas pressure on the seal during coking is reduced and in which the box, construction of the plug in the vertical direction of the door is formed from a plurality of elements, each connected to the door body.

A coke-oven door of this type is known from WO-85/04180. This known coke-oven door has a closed metal plug in which the side walls are so shaped that gas flues are formed. The occurence of gas leakages through the door seal is effectively reduced with this coke-oven door in that high gas pressures are prevented by the passage of coke-oven gas through the gas flues to the space above the coal in the coking chamber, from where the process gas is led off from the coking chamber through so-called ascension pipes (standpipes). The door plug has, however, a short rectangular gap on the front through which considerable leakage of coal takes place into the gas flues, or if the gap is so narrow that there is no coal leakage, difficulties arise when the door is fitted. It should be taken into account that whenever a coke-oven battery has been in service for some time, the width of the coking chamber varies one from another. As a result door plug constructions with narrow gaps cease to be interchangeable, and a door plug must be adapted to the width of the individual coking chamber.

The door plug of the coke-oven door according to WO-85/04180 consists of two constructions along the direction of the coking chamber. The fastening of the two involves an internal assembly which can only be reached by widening the front wall of the door plug. The door plug design is complicated and is liable to thermal stresses.

DE-A-2,219,516 also discloses a coke-oven door in which vertical gas flues are formed adjacent the seal, but the whole of the door plug construction is not shown.

EP-A-28679 shows a door plug consisting of a plate which is held away from the door body by stanchions. A similar door plug is also shown in DE-A-3440311, in which, however, the plate is fashioned as an open box for the transport of coke-oven gas, which is also held away from the door body by stanchions. In both cases the space behind the front plate is seen as a large gas flue. Both these designs of door plug have the disadvantage of leakages of coking coal into the gas flue. A large gas flue of this type is favourable for precluding gas leakages through the door-sealing construction by the reduction of the pressure of the coke-oven gas by leading off the coke-oven gas, but it is not necessary because with the greatly improved effectiveness of present day sealing constructions brought about by environmental demands, smaller gas flues suffice.

Moreover in these prior art constructions, the coking process in unfavourably disturbed in that much more coke-oven gas is led off through the large gas flue from the coking coal during coking in the coking chamber.

The object of the invention is to provide a coke-oven door of the type set out at the beginning, in which no or almost no leakages of coking coal arise and in which the elements can move unhindered in the longitudinal direction of the coke-oven door.

According to the invention the coke-oven door is characterised in that:

a) each said vertical gas flue (16) is formed by a rear portion (14) of the side wall (11) of the plug near the door body (1),

b) at a front portion (10) of each side wall of the box construction, which portion reaches furthest into the coking chamber, the side wall is shaped to form a gap (12) which as seen in horizontal section has a long wedge-shape narrowing in the direction towards the door body and opening towards the interior of the coking chamber,

c) the length in horizontal section, of the front portion (10) of the side walls of the box construction is from 30 to 70% of the total thickness from front to rear of the door plug, and

d) the smallest separation between the side walls (11) of the door plug and the side walls of the coking chamber when the door is closed is not less than 8 mm,

so that on the one hand when the coking chamber is filled with coking coal and during coking, no or almost no coking coal can pass through the gaps into the gas flues (16) and on the other hand difficulties arising when the door is fitted, are prevented and in that in each pair of neighbouring box construction elements, the upper end of the lower element has a reduced cross-section region which is received in the lower end of the upper element.

For good operation according to the invention, attention should be given to the shape and dimensions of the door plug.

The front portion of the side wall of the plug as seen in horizontal section extends over 30 to 70% of the total thickness of the door plug from front to rear, and the smallest separation, when the door is closed, between the side walls of the door plug and the coking

chamber is not less than 8 mm more preferably not less than 10 mm. If the front portion of the plug side walls has a length of less than 30% of the plug thickness, there are coal leakages; if this length is more than 70%, the gas flues are too small. If the length and dimensions of the wedge-shaped gap formed in this way are such that coking coal gets into the gas flues, fouling and blocking of the gas flues might occur; yet while the door is being fitted, there should be considerable play between the door plug and its side walls.

It is noted that the door plug of the coke-oven door known from US-A-2993845, which is constructed as a metal box, solves the problem of graphite deposits on the surface of the conventional door plug made from refractory material. The door plug is closed which means that there is no or almost no transport of coke-oven gas through the inside of the door plug. This metal door plug has a tapered shape to facilitate putting the door into its closed position.

A disadvantage of this coke-oven door is that gas leakages occur through the door seal. These gas leakages are not acceptable from the viewpoint of environmental pollution. The first cause of gas leakages is the high pressure of coking gas during coking. High gas pressure occurs especially at the commencement of coking at the lowest part of the coke-oven door.

A second cause of gas leakages with the coke-oven door described above is that the door plug is too inflexible along the length of the coke-oven door, so that the door body distorts and as a result leakages of gas arise through the door seal.

It is further remarked that the door plug of the coke-oven door known from DE GM 77 17505 has an outer shape which provides for gas flues and which prevents leakage of coal from the coking chamber into the gas flues. The door plug consists however of refractory elements. Graphite deposits on the surface thereof are difficult to remove. The gaps between subsequent elements are filled with a refractory felt. The elements cannot move unhindered in the longitudinal direction of the door.

The use in the present invention of a closed box construction for the door plug, which encloses a substantial part of the space defined by the front face of the coking coal in the coking chamber, the side walls of the coking chamber and the door body, is essential. By this means the door body is well insulated, and heat loss from the coke-oven battery is reduced. At the same time the coking coal is evenly coked and there are no cold spots at the front face of the coal.

Preferably at least the upper end of the box construction of the plug is closed by a metal plate when the door is closed. The box construction is thus closed or nearly closed against transport of coke oven gas by shutting off at least its upper end. Passage of coke-oven gas through the interior of the box construction is undesirable, because the heat transfer to the coking coal during coking, especially to the coal near the door plug, can be disturbed. This can result in the coking of that coal being retarded, and not being done in time. Moreover, such gas transport leads very quickly to fouling of the interior of the box construction, which is difficult to clean. Preferably the lower end of the box construction is also closed by a metal plate. An additional advantage is that the lower end of the box construction is stiffened by the metal plate, reducing deformation of the box construction.

Preferably the box construction of the door plug is in the invention formed longitudinally (vertically) of a plurality of elements, each of which is connected to the door body. By this means the door plug is fully flexible along the length of the coke-oven door, so that distortion of the elements by thermal stresses brings no or almost no force to bear on the door body, and thus distortion of the door body is avoided.

Preferably in each pair of neighbouring elements of the box construction, when the door is closed, the lower element has a reduced cross-section region at its upper end which is received in the lower end of the upper element. This telescopic or sleeve design frustrates any ingress of coal into the joint between the two elements. It appears that the sleeve design is durable and little susceptible to thermal stresses, because the elements can move unhindered in the longitudinal direction of the coke-oven door.

The upper and lower ends of the elements of the box construction are preferably closed by metal plates. By this, the elements can be hermetically sealed from the coking chamber, so that no gases and vapours can get into the interior of the elements via the joint between two elements and thus cannot give rise for instance to soiling of the insulation which is described below or to deterioration of the properties of this insulation.

Preferably, when the elements are closed, they are provided with ventilation means for the element interior. Preferably this ventilation means is a vent pipe, which is connected to the exterior air. An accompanying advantage of this is that measuring leads from measuring apparatus within the door plug can be led out through the vent pipe.

The metal plates which close the box construction are subject to thermal stresses and thus can be a source of cracks in the door plug. Therefore the number of metal plates used in a door plug is a matter that can only be optimised after experience over the long term.

Preferably the box construction of the plug has thermal insulating material arranged in its interior. Except when the insulating material is applied to the outside of the box construction, the insulating material need not be covered. In the case of hermetically sealed elements the insulating material cannot be fouled by tar products.

Preferably only the rear part of the box construction i.e. the part near the door body, is provided with

insulating material. With this arrangement the coal near the door plug gets completely coked, while the door body is well insulated. Apparently good coking of the coal near the coke-oven door as described in the invention takes place by radiation in and around the door plug. For this reason the configuration and heat capacity of the door plug are of great importance.

Preferably the insulating material is refractory felt which is attached by fastening means to rear wall portions of the box construction. In this way the weight of the door plug is further reduced.

Embodiments of the invention will now be described by way of non-restrictive example with reference to the drawings, in which:

Figure 1 is a horizontal cross-section of a coke-oven door according to the invention during use,

Figure 2 is a vertical cross-section of the door plug of the coke-oven door of Fig. 1 on line II-II in Fig. 1,

Figure 3 shows the detail III in Fig. 2 on a larger scale,

Figure 4 is a horizontal cross section of the door plug on line IV-IV in Fig. 2,

Figure 5 is the detail V in Fig. 4, and

Figure 6 is a horizontal cross section of the door plug in a second embodiment of the invention.

The coke-oven door 1 shown in Fig. 1 consists of a door body 2 carrying a seal 3 on a membrane 15 and a door plug 4 which when the door is closed extends into the coal-filled coking chamber 5 of a battery of coke ovens 6. The door plug 4 is constructed as a metal box, with a thin wall 7, the interior of the box construction 8 being mainly hollow.

Fig. 2 shows that the box construction of the plug consists of a plurality of elements 9, arranged vertically one above another and each mounted on the door body 2.

Fig. 1 shows that the front portion 10 of each side wall 11 of the box construction when the door is closed forms a long narrow wedge-shaped gap 12 with the side walls 13 of the coking chamber 5, this gap 12 narrowing from the front corner towards the door body 2. The gap has at its narrowest place a width such that no or almost no leakage of coking coal from the coking chamber 5 past the narrowest place of the gap 12 can take place.

Moreover the rear portion 14 of each side wall 11 recedes from the coking chamber wall in the direction towards the door body 2 from the narrowest place of the gap 12, so that when the door is closed it forms, in conjunction with the side wall 13 of the coking chamber and with the door body 2 (i.e. with the membrane 15 of the seal 3 in the example illustrated), vertical gas flues 16 via which any high gas pressure arising during coking at the base of the door can be reduced. These flues 16 extend the whole height of the box construction and open at the top into the space above the coke.

The box construction 8 is closed, which means that no or almost no gas movement can take place through the hollow box construction during the coking process.

Fig. 3 shows that in each pair of neighbouring elements 9 the upper end of the lower element is provided with a reduced cross-section portion 21 which is at least partly received by the lower end 22 of the upper element, thus forming a sleeve or telescopic construction, which avoids excessive rigidity of the box construction.

In this embodiment, as is shown in Fig. 2, the upper and lower ends of the box construction are closed by metal plates 17. Alternatively or additionally both ends of each element 9 of the box construction are closed by metal plates 18 (see Fig. 3).

Fig. 4 shows that each closed element 9 is fitted with ventilation means for its interior, in the form of a vent pipe 18a, which in this embodiment leads to the outside air.

Each element is connected to the door body 2 by connecting elements 19. The embodiment of these connection elements shown in the figures, i.e. plugs threaded at the ends, is adapted to the embodiment of door body shown in the figures, especially the seal 3,15. It is within the scope of the expert in this field to choose connecting elements which are appropriate to the design of the door body. In addition Fig. 4 shows that the interior of the door plug is stiffened with a reinforcing beam 20.

Figs. 4 and 5 show that the box construction contains insulating material 23, arranged in the rear part of the construction nearest to the door body. In the example shown, refractory felt is used, attached to the rear wall 25 and to the rear parts 14 of the side walls 11 by appropriate fastening means 24.

A second embodiment for the door plug according to the invention is shown in Fig. 6, in which the part of the box construction consisting of the front wall 25a and the front portions 10 of the side wall 11 of the door plug is a separate hollow box construction which is attached by fastening means 27 to a metal brick holder 26 and to the door body (not shown). The metal brick holder forms a rear box construction and consists of a metal casing containing brick material and is filled with insulation material 23.

Claims

1. A coke-oven door for a coking chamber of a battery of coke ovens, consisting of a door body (1) carrying a door seal (3, 15) and a door plug (4) which extends into the coking chamber when the door is closed, the door plug consisting of a generally closed metal box construction in which the side walls (11) form on each side of the plug (4), when the door is closed, together with the side

walls of the coking chamber, a vertical gas flue (16), each side wall of the box construction being shaped to recede from the side wall of the coking chamber so as to form, when the door is closed, in conjunction with the side wall of the coking chamber, the said vertical gas flue (16) for passage of coke-oven gas, so that gas pressure on the seal (3, 15) during coking is reduced, and in which the box construction of the plug (4) in the vertical direction of the door is formed from a plurality of elements (9), each connected to the door body (1), characterised in that

a) each said vertical gas flue (16) is formed by a rear portion (14) of the side wall (11) of the plug near the door body (1),

b) at a front portion (10) of each side wall of the box construction, which portion reaches furthest into the coking chamber, the side wall is shaped to form a gap (12) which as seen in horizontal section has a long wedge-shape narrowing in the direction towards the door body and opening towards the interior of the coking chamber,

c) the length in horizontal section, of the front portion (10) of the side walls of the box construction is from 30 to 70% of the total thickness from front to rear of the door plug, and

d) the smallest separation between the side walls (11) of the door plug and the side walls of the coking chamber when the door is closed is not less than 8 mm,

so that on the one hand when the coking chamber is filled with coking coal and during coking, no or almost no coking coal can pass through the gaps into the gas flues (16) and on the other hand difficulties arising when the door is fitted, are prevented and in that in each pair of neighbouring box construction elements (9), the upper end of the lower element has a reduced cross-section region (21) which is received in the lower end (22) of the upper element.

2. A door according to claim 1 wherein the upper and lower ends of each element (9) are closed by metal plates (18).

3. A door according to claims 1 or claim 2, wherein the elements (9) have means for ventilation of the interior of the element.

4. A door according to claim 3, wherein the ventilation means consists of at least one vent pipe which is openly connected to the exterior air.

5. A door according to any one of the preceding claims wherein in the interior of the box construction thermal insulating material (23) is arranged, characterised in that the insulating material (23) is located only at the rear part of the box construction nearest the door body (1).

6. A door according to claim 5 wherein the insulating material (23) is refractory felt which is attached by fastening means (24) to rear wall portions (24, 25) of the box construction.

7. A coke-oven battery having a plurality of coking chambers and at least one coking chamber door according to any one of the preceding claims.

Patentansprüche

1. Eine Koksofentüre für eine Kokskammer einer Koksofenbatterie, bestehend aus einem, Türdichtungen (3, 15) tragenden Türkörper (1) und einem, sich bei geschlossener Türe in die Kokskammer erstrecken Türstopfan (4), welcher aus einer im allgemeinen geschlossenen Metallkastenkonstruktion besteht, bei der die Seitenwände (11) auf jeder Seite des Stopfens (4) bei geschlossener Tür, zusammen mit den Seitenwänden der Kokskammer einen vertikalen Gaskanal (16) bilden, wobei jede Seitenwand der Kastenkonstruktion so geformt ist, daß sie von der Seitenwand der Kokskammer zurückweicht, sodaß sie bei geschlossener Tür, in Verbindung mit der Seitenwand der Kokskammer besagten vertikalen Gaskanal (16) für den Durchgang von Kokereigas bildet, sodaß der Gasdruck auf die Dichtung (3, 15) während der Verkokung reduziert ist, und wobei die Kastenkonstruktion des Stopfens (4) in vertikaler Richtung der Türe von einer Vielzahl an Elementen (9) gebildet ist, deren jedes mit dem Türkörper (1) verbunden ist, dadurch gekennzeichnet, daß

a) jeder der besagten vertikalen Gaskanäle (16) durch eine hinteren Teil (14) der Seitenwand (11) des Stopfens nahe dem Türkörper (1) gebildet wird,

b) die Seitenwand an dem, am weitesten in die Kokskammer reichenden vorderen Abschnitt (10) jeder Seitenwand der Kastenkonstruktion, zur Bildung eines Zwischenraumes (12) geformt ist, welcher im Horizontalschnitt gesehen eine lange Keilform hat, die sich in Richtung zum Türkörper verengt und sich ins Innere der Kokskammer öffnet,

c) die Länge des vorderen Abschnittes (10) der Seitenwände der Kastenkonstruktion, im Horizontalschnitt, von 30 % bis 70 % der Gesamtdicke von der Vorderseite zur Rückseite des Türstopfens beträgt, und

d) der kleinste Abstand zwischen den Seitenwänden (11) des Türstopfens und den Seitenwänden der Kokskammer bei geschlossener

Tür nicht weniger als 8 mm beträgt, sodaß einerseits beim Füllen der Kokskammer mit Kokskohle und während der Verkokung keine oder beinahe keine Kokskohle durch die Zwischenräume in die Gaskanäle (16) gelangen kann und anderseits beim Einpassen der Türe auftretende Schwierigkeiten verhindert werden, und dadurch, daß bei jedem Paar von benachbarten Kastenkonstruktionselementen (9) das obere Ende des unteren Elementes einen Bereich (21) mit verringertem Querschnitt aufweist, welcher im unteren Ende (22) des oberen Elementes aufgenommen ist.

2. Tür gemäß Anspruch 1, wobei die oberen und unteren Enden jedes Elementes (9) von Metallplatten (18) verschlossen sind.

3. Tür gemäß Anspruch 1 oder 2, wobei die Elemente (9) im Inneren des Elementes Lüftungsmittel aufweisen.

4. Tür gemäß Anspruch 3, wobei die Lüftungsmittel zumindest aus einem, zur äußeren Luft offen verbundenen Ventilationsrohr besteht.

5. Tür gemäß irgendeinem der vorhergehenden Ansprüche, wobei im Inneren der Kastenkonstruktion wärmeisolierendes Material (23) angeordnet ist, dadurch gekennzeichnet, daß das wärmeisolierende Material (23) nur im hinteren Teil der Kastenkonstruktion am nächsten zum Türkörper (1) angeordnet ist.

6. Tür gemäß Anspruch 5, wobei das Isolationsmaterial (23) Feuerfestfilz ist, der mit Befestigungsmitteln (24) an den Rückwandabschnitten (24, 25) der Kastenkonstruktion angebracht ist.

7. Eine Koksofenbatterie mit einer Vielzahl an Kokskammern und zumindest einer Kokskammertür gemäß irgendeinem der vorhergehenden Ansprüche.

Revendications

1. Porte de fours à coke destinée à une chambre de cokéfaction d'une batterie de fours à coke, constituée d'un corps de porte (1) portant un joint d'étanchéité (3, 15) et un tampon d'obturation (4) s'étendant dans la chambre de cokéfaction lorsque la porte est fermée, le tampon d'obturation étant constitué d'une construction en boîtier métallique globalement fermé dans laquelle les parois latérales (11) forment, sur chaque côté du tampon (4) lorsque la porte est fermée, conjointement avec les parois latérales de la chambre de cokéfaction, un conduit d'évacuation de gaz vertical (16), chaque paroi latérale de la construction en boîtier ayant une forme s'écartant de la paroi latérale de la chambre de cokéfaction de façon à former, lorsque la porte est fermée, en conjonction avec la paroi latérale de cette chambre de cokéfaction, ledit conduit (16) d'évacuation de gaz vertical destiné au passage de gaz du four à coke, de sorte que la pression de gaz sur le joint d'étanchéité (3, 15) pendant la cokéfaction soit réduite, et dans laquelle la contruction en boîtier du tampon d'obturation (4) est formée, dans la direction verticale de la porte, d'une pluralité d'éléments (9) reliés chacun au corps (1) de la porte, caractérisée en ce que :

   a) chacun desdits conduits (16) d'évacuation de gaz verticaux est formé par une partie arrière (14) de la paroi latérale (11) du tampon d'obturation au voisinage du corps de porte (1),

   b) à une partie frontale (10) de chaque paroi latérale de la construction en boîtier, cette partie s'étendant le plus loin dans la chambre de cokéfaction, la paroi latérale est formée de façon à laisser un interstice (12) qui, vu en section horizontale, possède une forme de coin allongé se rétrécissant vers le corps de porte et ouvrant vers l'intérieur de la chambre de cokéfaction,

   c) la longueur en section horizontale, de la partie frontale (10) des parois latérales de la construction en boîtier est de 30 à 70 % de l'épaisseur totale du tampon d'obturation de porte, de l'avant vers l'arrière, et

   d) la plus petite séparation entre les parois latérales (11) du tampon d'obturation de porte et les parois latérales de la chambre de cokéfaction lorsque la porte est fermée n'est pas inférieure à 8 mm,

   de sorte que, d'une part, lorsque la chambre de cokéfaction est remplie de charbon de cokéfaction et pendant cette cokéfaction, ce charbon de cokéfaction ne peut pas ou presque pas passer à travers les interstices vers les conduits (16) d'évacuation de gaz, et, d'autre part, les difficultés survenant lorsque la porte est ajustée sont éliminées, et en ce que dans chaque paire d'éléments (6) de construction en boîtier voisins, l'extrémité supérieure de l'élément inférieur possède une région (21) de section transversale réduite qui est reçue dans l'extrémité inférieure (22) de l'élément du dessus.

2. Porte suivant la revendication 1, dans laquelle les extrémités supérieure et inférieure de chaque élément (9) sont fermées par des plaques métalliques (18).

3. Porte suivant la revendication 1 ou la revendication 2, dans laquelle les éléments (9) comportent des moyens destinés à effectuer la ventilation de l'intérieur de cet élément.

4. Porte suivant la revendication 3, dans laquelle les moyens de ventilation consistent en au moins une tubulure de ventilation reliée de façon ouverte à l'air extérieur.

5. Porte suivant une quelconque des revendications précédentes, dans laquelle un matériau isolant thermique (23) est disposé à l'intérieur de la construction en boîtier, caractérisée en ce que ce matériau isolant (23) est disposé uniquement à la partie arrière de la construction en boîtier la plus proche du corps de porte (1).

6. Porte suivant la revendication 5, dans laquelle ledit matériau d'isolation (23) est du feutre réfractaire monté, à l'aide de moyens de fixation (24), sur les parties de paroi arrière (24, 25) de la construction en boîtier.

7. Batterie de fours à coke ayant une pluralité de chambres de cokéfaction et au moins une porte de chambre de cokéfaction selon l'une quelconque des revendications précédentes.

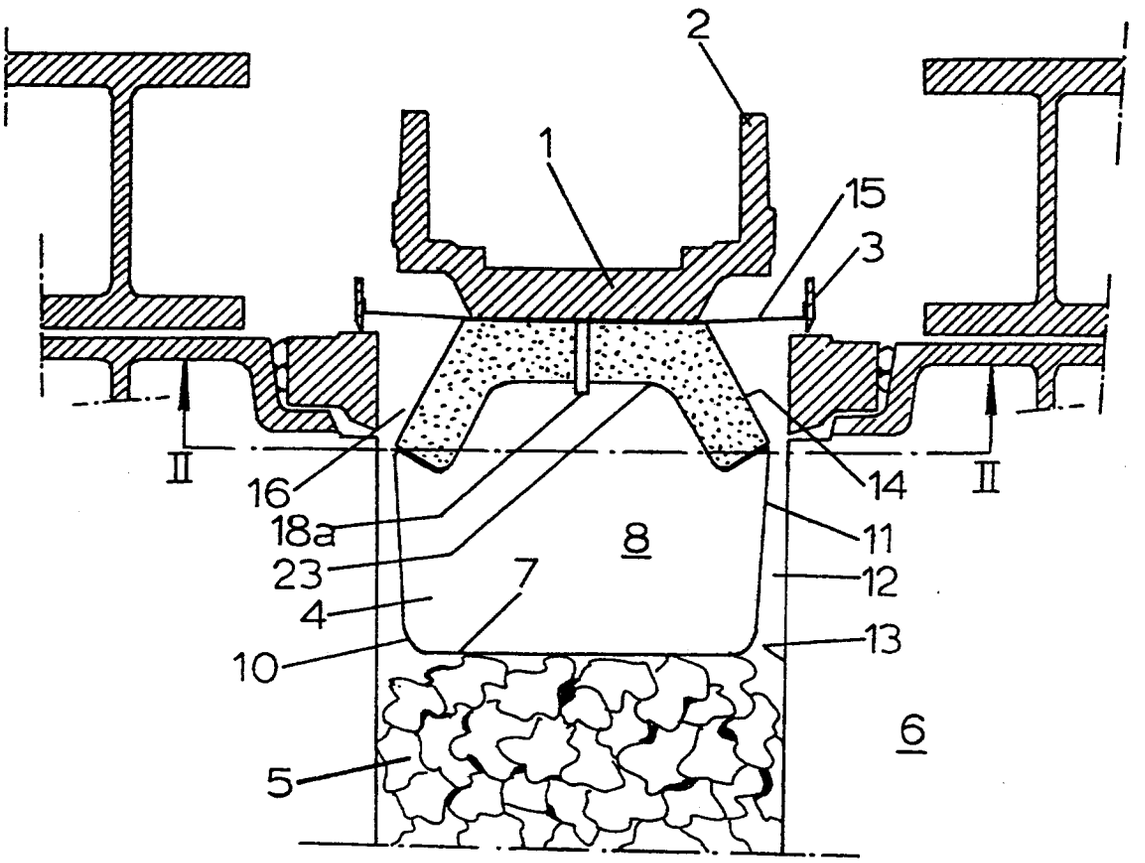

fig. 1

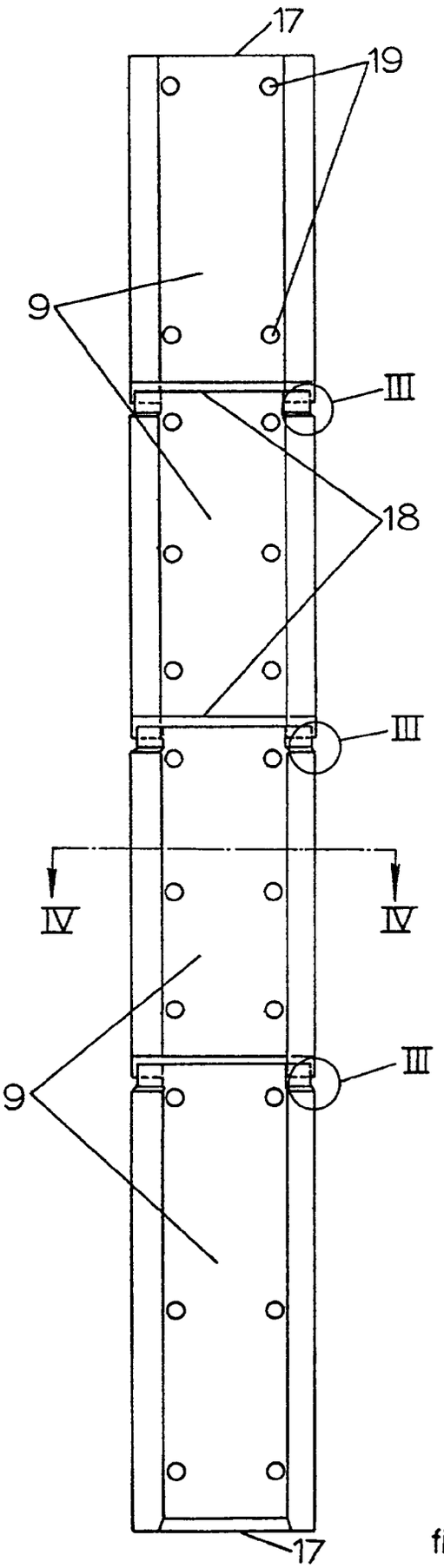

fig. 2

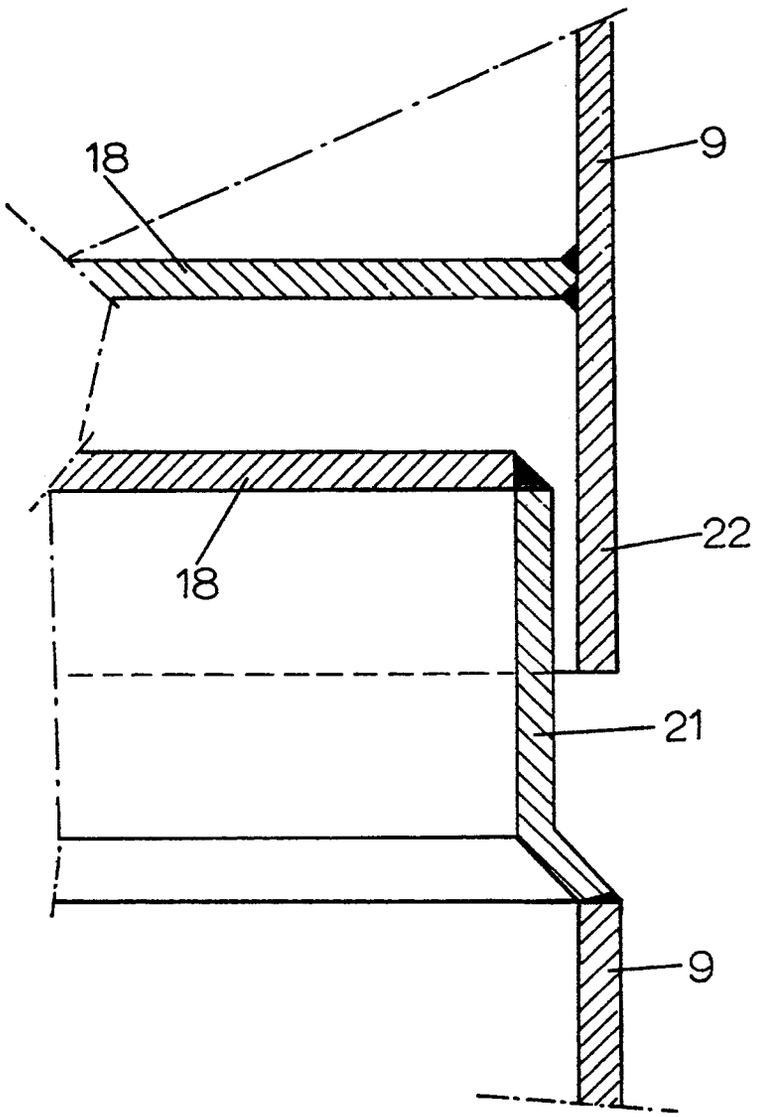

fig. 3

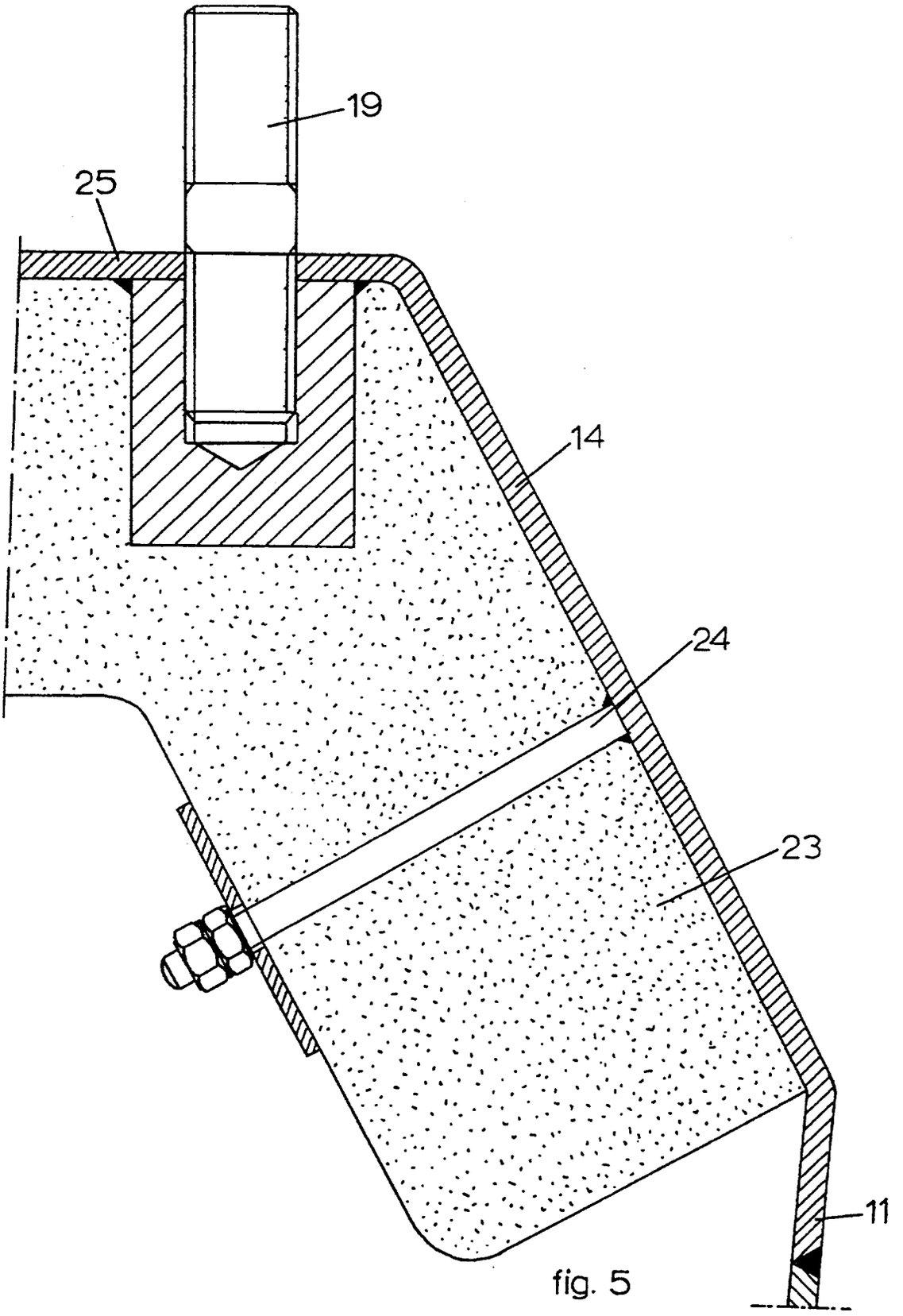

fig. 5

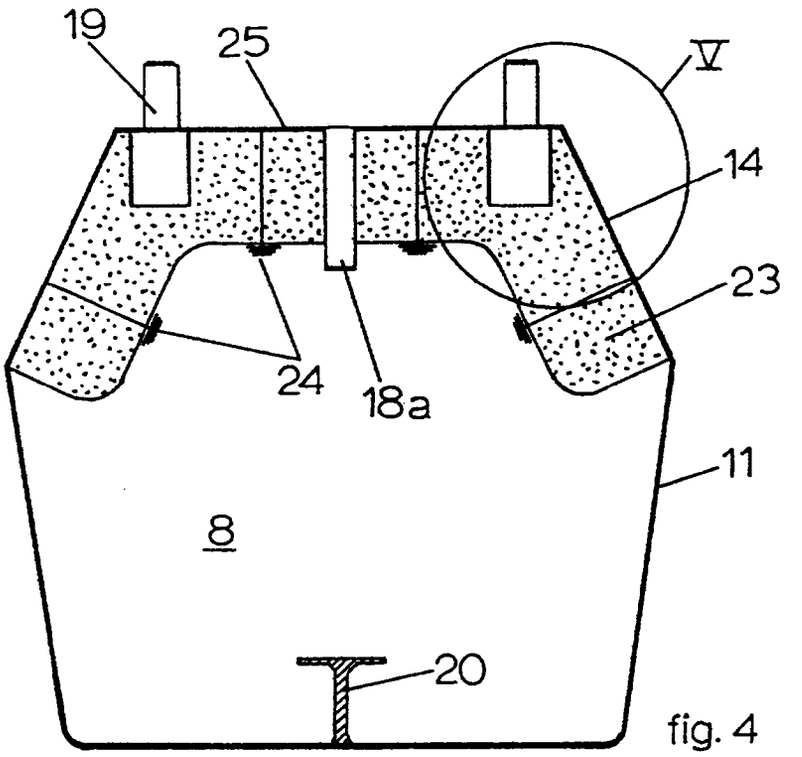

fig. 4

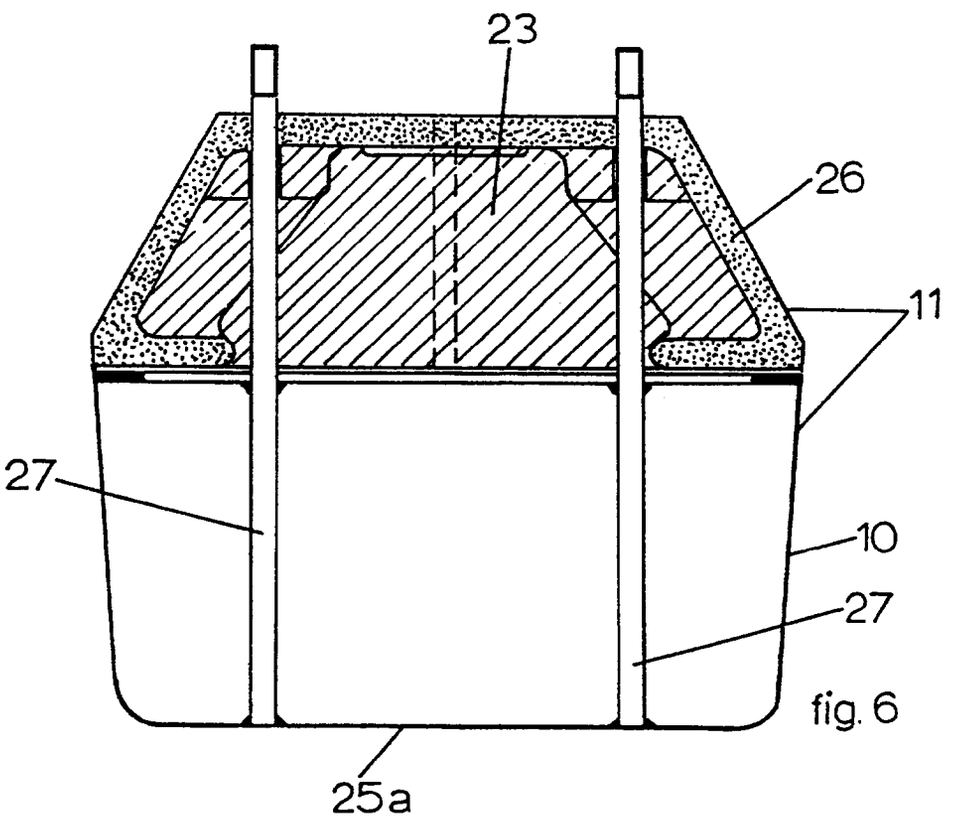

fig. 6