(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 206 602 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
13.10.2004 Bulletin 2004/42

(21) Application number: **00957175.3**

(22) Date of filing: **17.08.2000**

(51) Int Cl.[7]: **E02D 29/02**

(86) International application number:
PCT/SE2000/001586

(87) International publication number:
WO 2001/016432 (08.03.2001 Gazette 2001/10)

(54) **WALL BLOCK AND RETAINING WALL MADE OF SUCH BLOCKS**

MAUERSTEIN UND MIT SOLCHEM STEIN HERGESTELLTE STÜTZMAUER

BLOC MURAL ET MUR DE SOUTENEMENT CONSTITUE DE TELS BLOCS

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **27.08.1999 SE 9903048**
23.03.2000 SE 0001046

(43) Date of publication of application:
22.05.2002 Bulletin 2002/21

(73) Proprietor: **Hedared Sand & Betong Aktiebolag**
504 92 Hedared (SE)

(72) Inventor: **SAMUELSSON, Bertil**
S-504 92 Hedared (SE)

(74) Representative: **Hynell, Magnus**
Hynell Patenttjänst AB,
Patron Carls väg 2
683 40 Hagfors/Uddeholm (SE)

(56) References cited:
WO-A1-88/02050
US-A- 5 252 017
US-A- 5 294 216
US-A- 5 865 006

EP 1 206 602 B1

Printed by Jouve, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The invention concerns a wall block for a retaining wall, said block comprising a front surface and a rear surface, a top surface and a bottom surface spaced apart from each other by a distance that defines the thickness of the block, and first and second end surfaces. The invention also concerns a retaining wall which consists entirely or partly of such wall blocks.

BACKGROUND OF THE INVENTION

[0002] There exist a great number of retaining wall designs and wall blocks for such retaining walls. There also exist a great number of systems for interlocking the wall blocks for the achievement of a stable retaining wall which resists the earth pressures that act on the rear of the wall, without the use of mortar or other kinds of jointing sealing compounds. Inter alia there exist systems which employ interlocking pins, cotters, metal clips, or similar connections between the wall blocks of the tiers resting on one another in the retaining wall.

[0003] In WO 88/02050 there is disclosed a retaining wall and blocks therefore, which shall satisfy very high requirements. These blocks allow the construction of retaining walls which slope backwards as well as retaining walls which are substantially vertical. In the case of constructing a vertical retaining wall, one also has a very great freedom to curve the wall to be convex or concave. This system works very well and millions of square meters are constructed each year within various fields of use, such as for various part of golf courses, e.g. for raising the level of tee areas, constructing cart raceways, retaining walls for channels and basins for the prevention of erosion problems, freeway construction, just to mention some conceivable examples. Typically this system is used for larger constructions.

[0004] US-A-5,865,006 discloses a wall block of a more simple design, suitable for smaller constructions, e.g. for retaining walls in residential gardens. This well known wall block, however, can not be employed for vertical walls, which is a serious limitation, particularly because the need of vertical retaining walls are much greater than the need of sloping walls.

BRIEF DISCLOSURE OF THE INVENTION

[0005] The invention is the result of a development work aiming at improving the system which is disclosed in the said US-A-5,865,006. More particularly, the invention aims at providing a wall block having a comparatively simple design which allows the construction of a well united, vertical retaining wall, which can be given a convex as well as a concave curvature.

[0006] How this aim can be achieved will be apparent from the following description of some preferred embodiments.

[0007] The invention also offer a possibility to integrate, in the improved system, the interlocking system for sloping walls which is described in the said US-A-5,865,006. How this can be achieved will also be apparent from the following description.

[0008] Further characteristics and aspects of the invention will be apparent from the detailed description of the invention and from the appending patent claims.

BRIEF DESCRIPTION OF DRAWINGS

[0009] In the following detailed description of the preferred embodiments, reference will be made to the accompanying drawings, in which

- Fig. 1 is a view of a wall block according to a first preferred embodiment of the invention, as viewed from underneath,
- Fig. 1A shows the encircled portion A in Fig. 1 at a larger scale,
- Fig. 2 shows a cross section through the wall block along a line II-II in Fig. 1,
- Fig. 3 is a top view of a straight wall section, which employs blocks according to Fig. 1 and 2,
- Fig. 4 is a top view of a convex wall section, which employs blocks according to Fig. 1 and 2,
- Fig. 5 is a top view of a concave wall section, which employs blocks according to Fig. 1 and 2,
- Fig. 6 shows a cross section along the line VI-VI in Fig. 3 through a lower wall block which has been prepared in order to receive and secure an upper wall block,
- Fig. 7 is a view along the line VII-VII in Fig. 3 showing a lower wall block and an upper wall block, which is a top block of the wall,
- Fig. 8 shows a modified wall block according to the first embodiment as viewed from underneath,
- Fig. 9 is a view along the line IX-IX in Fig. 8,
- Fig. 10 shows another embodiment of the block of the invention from underneath,
- Fig. 11 shows the same wall block from above, and
- Fig. 12 shows the wall block in cross section along a line XII-XII in Fig. 10

DETAILED DESCRIPTION OF THE INVENTION

[0010] With reference first to Fig. 1 and 2 a wall block for retaining walls is generally denoted 1. It consists, according to the preferred embodiment, of cast high strength concrete. Other conceivable materials are e.g. brick, plastics, and others. The block 1 has a top surface 2 and a bottom surface 3, spaced apart from each other by a distance that define the thickness of the block; a front surface 4, a rear surface 5, a first end surface 6, and a second end surface 7.

[0011] The front surface 4 of the block 1 may have

various aesthetic appearances, e.g. have three faces at an angle to one another, as is shown in Fig. 1, but also rounded designs are conceivable as well as completely straight ones. Also various, aesthetically appealing surface structures on the front surface of the block are conceivable. The end surfaces 6 and 7 converge in the direction towards the rear surface 5, which is advantageous when a retaining wall having a curved, convex shape shall be constructed. Generally the block 1 according to the preferred embodiment has the same geometrical outer contour as the basic shape of the blocks according to the preferred embodiment of US-A-5,865,006 such that it can be integrated in the system which employs wall blocks according to the said US patent. From this reason, there is a row of pin apertures 12-15, more particularly four pin apertures, provided in the wall block at a distance from its rear surface 5 in the same way as according to said US-A-5,865,006. The pin apertures 12-15 have a slightly conical shape and extends about 20 mm upwards in the block from the bottom surface 3.

[0012] The above belongs to prior art. According to the preferred embodiment of the present invention, there are provided two large recesses in the block 1, referred to as first and second recesses 16 and 17, respectively, which extend upwards in the block from the bottom surface 3. The two recesses 16 and 17 are symmetrically provided on each side of a vertical plane of symmetry S of the block 1. The two recesses 16 and 17 in other words are provided mirror-wise relative to one another.

[0013] The first recess 16 has a rear wall 16a, an outer side wall 16b facing the first end surface 6 of the block, an inner side wall 16c, facing the symmetry plane S and a front wall 16d facing the front surface 4 of the wall 1. All the walls 16a-16d are vertical. Correspondingly, the second recess 17 has a rear wall 17a, and outer side wall 17b facing the second end surface 7 of the block, an inner side wall 17c, and a front wall 17d. At a distance from the top surface 2 of the block, each of said first and second recesses 16 and 17, has a vaulted recess ceiling 17e in the second recess 17.

[0014] The distance between the recess ceiling 17e and the top surface 2 of the block is sufficient to give the roof portion 18 between the recess ceiling 17e and the top surface 2 a sufficient strength.

[0015] Between the rear wall 16a and the outer side wall 16b of the first recess 16 there is a first corner, here referred to as outer corner 19, and between the rear wall 16a and the inner side wall 16c there is a second corner, here referred to as inner corner 20. The rear wall 16a between said outer corner 19 and said inner corner 20 is slightly concave. More particularly the rear wall 16a has a first straight portion 21 adjacent to the outer corner 19 and a second straight portion 22 adjacent to the inner corner 20. Said first and second straight wall portions 21 and 22 form an obtuse angle to one another. The meeting point between the angled first and second wall portions is referred to as the concaveness 23 of the rear wall 16a.

[0016] In a corresponding way the second recess 17 has an outer corner 29, an inner corner 30, a first straight wall portion 31 adjacent to the outer corner 29, a second straight wall portion 32 adjacent to the inner corner 30 and a concaveness 33 in the meeting point between said first and second wall portions 31 and 32.

[0017] According to a modified design the rear wall 16a and 17a, respectively, of the two recesses 16 and 17 may be curved concavely all the way between the respective outer corner 19, 29 and inner corner 20, 30.

[0018] The height of the rear end walls 16a and 17a under all circumstances is larger than half the length of those pins 35 which are employed in the system for interlocking or securing those tiers of wall blocks that shall be included in the retaining wall. Preferably the rear walls 16a and 17a have such a large height that the thickness of the roof portions 18 in the region of the outer corners 19 and 29, respectively, is at least half, and preferably not more than twice, suitably not more than 1,5 times as long as said pins 35 from reasons which will be understood from the following.

[0019] In the outer corners 19 and 29 of the recesses 16 and 17, respectively, there is an aperture generally designated 36 and 37, respectively. The apertures 36 and 37 are identically designed and shall now be described with reference also to Fig. 1A, which shows the aperture 37 from beneath at a larger scale. The aperture 37 consists of two portions, namely a first portion 38, in the following referred to as entrance portion, and a second portion 39, in the following referred to as pin retaining portion. The entrance portion 38 extends from the vaulted recess ceiling 17e vertically a distance upwards in the wall block. The mean depth of the entrance portion 38 approximately corresponds to half the length of a pin 35. The pin retaining portion 39 then extends from the entrance portion 38 vertically upwards in the wall block towards the top surface 2 a distance approximately corresponding to half the length of a pin. Between the inner end of the pin retaining portion 39 and the top surface 2 of the wall block 1 there is a cover 40 of block material, which is so thin that it can be penetrated by the pin 35, when striking the pin. A suitable thickness is about 3 mm, when the wall block I consists of high strength concrete. The entrance portion 38 is substantially wider than the pin retaining portion 39 so that it can accommodate an impact tool, i.e. a rod which is thicker than the pins 35 which shall be used as interlocking members in the retaining wall. The pin retaining portion 39 is substantially circular cylindrical and has the same diameter as the pins 35. However three evenly distributed constrictions 41, i.e. longitudinal, inwardly directed indentations are provided in the pin retaining portion, said indentations being designed such that a cylindrical pin 35 made of a plastic material, which is driven in into the pin retaining portion, is retained in the aperture through friction against the projections 41, at the same time as the

pressure of the pin acting against the aperture wall is not so great that the block 1 is fractured when the pin 35 is driven into the pin retaining portion 39 of the aperture 37. The aperture 36 in the outer corner 19 of the first recess 16 is identically designed, having an entrance portion 42 and a pin retaining portion 43.

[0020] The modified wall block 1' which is shown in Fig. 8 and Fig. 9 is designed in the same way as the wall block 1 with the following exceptions. A flange or lip 50, which can be removed by a stroke with a hammer, mallet or other tool, extends, in the same way as is shown in said US-A-5,865,006, from the rear surface 5 down beyond the bottom surface 3 of block 1' at the rear of the row of pin apertures 12-15. The front surface 4' is arched and structured. The rear walls 16a' and 17a' of the recesses 16 and 17, respectively, are curved concavely between the inner and outer corners 19, 20 and 29, 30, respectively, of the recesses. Further there are provided connecting recess portions 46, 47, and 48 between said first and second recesses 16 and 17 in order further to reduce the total mass of the wall block 1'. These connecting recesses 46, 47, and 48, however, are preferably not as deep as the recesses 16 and 17 in order not to jeopardize the strength of the wall block 1'.

[0021] The portion 25 between said first and second recesses 16, 17 is referred to as the partition wall of the block, the portion between the first recess 16 and the first end surface 6 is referred to as the left hand outer wall 26 of the block, and the portion 27 between the second recess 17 and the second end surface 7 is referred to as the right hand outer wall 27 of the block. The partition wall 25 is thicker than the two outer walls 26 and 27. The portion between the recesses 16, 17 and the rear surface 5 is referred to as the rear wall 28 of the block. The pin apertures 12-15 are provided in the rear wall 28.

[0022] When a sloping retaining wall shall be constructed, the procedure is the same has been described in the said US-A-5,865,006, wherein pins can be placed in any or a plurality of the apertures 12-15 while, particularly if the wall shall be made sloping but straight and when wall blocks according to the embodiment shown in Fig. 8 and 9 are employed, the lange 50 is used in order to interlock the tiers of wall blocks 1' with one another.

[0023] When a vertical retaining wall shall be constructed according to the invention, instead the first and second recesses 16 and 17, the apertures 36 and 37, and pins 35 which can be secured in the said pin retaining portions 39 and 43, are utilised. It is presupposed that the wall blocks 1, which have been described with reference to Fig. 1 and 2 are used. These wall blocks are delivered to the working place lying upside-down, i. e. with the bottom surface 3 with the recesses 16 and 17 facing upwards. The first thing to be done by the construction worker is to place the pins 35 in the apertures 36 and 37. This is carried out in all the wall blocks I except in those wall blocks 1 which shall form the upper tier of the retaining wall. The pins 35 are driven into the pin retaining portions 39, 43 by means of an impact rod and a mallet so that the cover 40 is hit away and so that the pin is driven out on the other side beyond the top surface 2 of the wall block, a distance approximately corresponding to half the length of the pin 35 at the same time as the impact rod contacts the inner end of the entrance portion 38 or 42, respectively, of the aperture 36 or 37. The pins 35 are retained in the apertures by means of the inwardly directed projections/constrictions 41, Fig. 1A, in the pin retaining portions, so that the wall blocks can be turned upside-up, without risk that the pins will fall out. Thus the wall blocks 1 are laid side by side to form a tier of wall blocks. Fig. 3 shows a section of a retaining wall with a lower tier of wall blocks consisting of two wall blocks designated 1a and 1b laid side by side to form a straight section of a wall. On top of these lower wall blocks 1a and 1b there is laid an upper wall block I c which shall form part of the top tier of wall blocks of the retaining wall.

[0024] In Fig. 3 an upwards, beyond the top surface 2 of the block 1a projecting pin 35 is exposed in the outer corner 19 of the first recess 16 in the block 1a. In the outer corner 29 of the second recess 17 of the same wall block 1a, there is a pin 35 projecting in the same mode. That pin, however, is shadowed by the block 1c resting on top. This pin 35 is identified with an x. In the same way a pin 35 is exposed in the outer corner 29 of the second recess 17 of the right hand wall block 1b in Fig. 3 and a pin 35 (shadowed by the block 1c but identified with an x) in the outer corner 19 of the first recess 16 in the wall block 1b. The two lower blocks 1a and 1b are laid so that they touch one another, as is shown in Fig. 3, the rear surfaces 5 being parallel and aligned. The upper block 1c, which shall form part of the top tier of the retaining wall, is laid symmetrically on top of the two lower blocks 1a and 1b with the rear surface 5 in plane with the rear surfaces 5 of the lower blocks 1 a and 1b. Due to the design of the rear wall 16a in the first recess 16 of the upper wall block and of the rear wall 17a of the second recess 17 of the upper block 1c, the pins which are identified with an x, which are projecting upwards into the recesses 16 and 17 in the top block 1c, will lie flush against the walls 16a and 17a, respectively, in said top block 1c in the region of the concaveness' 23 and 33 of said walls 16a and 17a of the top block 1c. This means that the pins 35 will prevent the top block 1c from being pushed forwards by the masses of earth (not shown) that shall fill up the space at the rear of the wall against the rear surfaces 5 of the wall blocks. Any pins 35 have not been driven into the pin apertures 36 and 37 of the wall blocks 1c in the top tier of wall blocks. The top surface 2 of the top wall block 1c, as well as the top surfaces of all the other wall blocks of the upper tier of wall blocks of the retaining wall, therefore are intact and do not require any restoration.

[0025] At the same time as the top wall block 1c is prevented from being pushed forwards beyond the front

surface 4 of the lower wall blocks 1a and 1b, the top wall block I c is resting with its outer walls 26 and 27 and rear wall 28 steadily on the top surface 2 of the lower wall blocks 1a and 1b.

[0026] The wall portion in Fig. 4 which has a convex curved configuration consists of three lower wall blocks 1d, 1e, and 1f, and two top wall blocks I g and 1h resting on the lower wall blocks 1d and 1e and on the lower wall blocks 1e and 1f, respectively. In each tier of wall blocks adjacent wall blocks lie with their end surfaces 6 and 7 flush against one ieanother, such as the second end surface 7 of wall block I g is lying flush against the first end side 6 of wall block 1h. The shadowed pin 35 which is secured in the aperture in the outer corner 29 of the second recess 17 of the lower block 1d projects upwards in the inner corner 20 of the first recess 16 of the top block 1g. In a corresponding way a pin 35 in the aperture in the first recess 16 of the lower block 1e projects upwards in the inner corner 30 of the second recess 17 of the same top block 1g to safely interlock with the top block 1g. The right hand top block 1h is anchored in the same way to the lower blocks 1e and 1f.

[0027] Fig. 5 shows a wall portion having a concave curved configuration, where three lower wall blocks 1d, 1e, and 1 f are laid edge to edge, partly covered by two top wall blocks 1g and 1h. In this case a pin 35, which is provided in a pin aperture in an outer corner of a second recess 17 of the lower block 1d, projects upwards in the outer corner 19 of the first recess 16 of the top block 1g. In a corresponding way a pin 35, which is provided in the outer corner 19 of the first recess 16 of the lower block 1e, is projecting upwards in the outer corner 29 of the second recess 17 of the top block 1g, so that the block 1g is retained by the two projecting pins 35 in the corners 19 and 29 of the first and second recesses of the upper block 1g. The right hand top wall block 1h is anchored in an analogous way by means of pins which project upwards from the lower blocks 1e and 1f.

[0028] Fig. 4 and Fig. 5 illustrate two extreme cases. Also less convex or concavely curved, vertical wall are possible to construct by means of the wall blocks according to the invention. In such cases the pins 35 which project upwards from under lying wall blocks will lie flush against any of the straight portions 21, 22 and 31, 32, respectively, of the rear walls 16a and 17a, respectively, of the recesses. This will cause a slight displacement of the wall blocks in the cross direction of the wall. This can be completely eliminated if concave curved rear walls are used, such as the walls 16a' and 17a' according to the modified embodiment which is shown in Fig. 8.

[0029] When using the modified wall blocks 1', the wall blocks in other respects in principle are laid in the same mode as has been described with reference to the foregoing embodiment. However, the rear flange 50 first is knocked away when constructing vertical walls according to the invention.

[0030] In the illustrated embodiments, the interlocking pins consist of circular cylindrical plastic rods. It should be understood that also other shapes and materials are conceivable, such as for example is disclosed in said US-A-5,865,006. If, for example, the pins are corrugated, the longitudinal projections 41 can be eliminated in the pin retaining portions 43 and 39, respectively, of the apertures 36, 37.

[0031] The embodiments according to Fig. 1-Fig. 9 combine the possibility of easily constructing a retaining wall with the advantage of the possibility to employ the same type of wall blocks also for the top tier of wall blocks for the achievement of a retaining wall with smooth surfaces on the top face without defects. However, a condition for the use of such wall blocks is that the pins are knocked into the pin apertures from underneath. Therefore the blocks must be turned a couple of times by the constructions worker, which can be felt cumbersome. It is a purpose of the embodiment according to Fig. 10-Fig. 12 to eliminate that inconvenience, but at the same time maintain the substantial advantages of the invention, namely the possibility to construct stabile retaining walls, straight and curved, as well as sloping walls.

[0032] The wall block 1 depicted in Fig. 10-12 has the same external and internal shape and the same relative dimensions as the wall blocks which are shown in Fig. 1-Fig. 7. The general shape of the wall block therefore shall not be described here. Instead, reference is made to the above description of the first embodiments. In Fig. 10-12 also the same reference numerals have been used as above for corresponding details.

[0033] The only difference in relation to the block according Fig. 1-Fig. 7 concerns the pin apertures, which have been given the same reference numerals as is those figures but with the addition of'. Thus a pair of first pin apertures 39' and 43' extend from the top surface 2 of the block downwards into the block approximately half way to the respective recess 16 and 17. More particularly, the pin apertures 39' and 43' are provided such that their centre lines C extend through the regions of the rear outer corners 29 and 19, respectively. Possibly, the apertures 39' and 43' can be located a little more rearwards towards the rear surface 5 in order to provide a slight but sometimes desired rearward sloping of the wall, however not further rearwards than a distance from said corners corresponding to the size of the diameter of an aperture. The location of the apertures 39' and 43' in other words is the same as according to Fig. 1 and Fig. 2, but the apertures extend from the upper surface and downwards instead from underneath and upwards.

[0034] The pin apertures 39' and 43' are cylindrical or possibly slightly conical, such that they are tapered downwards, so that each aperture can accommodate a retaining pin 35 which extends upwards from the top surface 2 in the same mode as according to the previous embodiment.

[0035] Through the provision of retaining pins 35 in the apertures 39' and 43' a retaining wall can be constructed in the same mode as is shown in Fig. 3-7. The

top tier can be made of blocks without pin apertures but having in other respects the same design as any of the blocks according to the present embodiment of the invention or of blocks according to Fig. 1 and Fig. 2. As an alternative, if blocks according to Fig. 10-Fig. 12 are employed, the apertures in the upper surface of the blocks of the top tier can be filled up for the achievement of a smooth top surface.

[0036] If the apertures 39' and 43' are located a little more rearwards towards the rear surface 5, as is mentioned above, the retaining wall can be caused to slope slightly inwards.

[0037] The apertures 12' and 15', which are provided more rearwards, are intended to accommodate retaining pins of the same kind as the retaining pins 35 when a retaining wall shall be constructed which slopes more heavily. The centre line D of these second apertures 12' and 15' also extend from the top surface 2 of the block but more rearwards in the block and down into the rear wall 28 between the rear surface 5 of the block and said recess 16 and 17, respectively. Also the pins accommodated in the apertures 12' and 15' are intended to lie flush against the rear walls 16a and 17a in the recesses 16 and 17 in blocks resting above.

Claims

1. A wall block for a retaining wall, comprising:

a) a front surface (4) and a rear surface (5),
b) a top surface (2) and a bottom surface (3), spaced apart from each other by a distance that defines the thickness of the block (1), and
c) first and second end surfaces (6, 7), **characterised in that**
d) at least one recess (16, 17) is provided in the block (1), extending from the bottom surface (3) upwards into the block,
e) that the recess has a rear wall (16a, 17a), a recess roof (17e), an outer side wall (16b, 17b), and an inner side wall (16c, 17c), and
f) that at least one pin hole (39, 39', 43, 43') extends into the block at a right angle relative to the top surface of the block, said pin hole being located such that its centre line (C) extends through the region of a rear, outer corner (19, 29) of said recess.

2. A wall block according to claim 1, **characterised in that** the rear wall of the recess extends between said rear outer corner and a rear inner corner, said rear outer corner defining a corner between said rear wall and said outer side wall, and said rear inner corner being a corner between said rear wall and said inner side wall.

3. A wall block according to claim 2, **characterised in that** the rear wall of the recess is concave arched between said outer and inner corner.

4. A wall block according to claim 2, **characterised in that** the rear wall has a concaveness (33, 23) between said corners.

5. A wall block according to any of claims 1-4, **characterised in that** said at least one pin aperture (39', 43') extends from the top surface (2) of the block downwards a distance into the block.

6. A wall block according to any of claims 1-5, **characterised in that** at least two pin apertures (12', 15') also are provided at the rear of the first mentioned pin apertures (39', 43'), and that said second pin apertures also extend from the top surface (2) of the block but more rearwards in the block, down into a rear wall (28) between the rear surface (5) and said recess (16, 17) of the block.

7. A wall block according to any of claims 1-4, **characterised in that** at least one pin aperture (36, 37) extends into the block from an aperture entrance in the recess close to the rear recess wall (16a, 17a) up towards, but not all the way to the top surface (2) of the block, that said pin apertures comprise at least a vertical pin retaining portion (39, 43) provided to be able to accommodate and to retain a pin (35) which is driven into the aperture through said aperture entrance, and that between the inner end of the pin aperture and the top surface (2) of the block remains a cover (40) of block material, which cover is provided so thin that it can be penetrated by a pin by striking the pin.

8. A wall block according to any of claims 1-7, **characterised in that** at least two recesses (16, 17) are provided in the block (1), one on each side of a vertical plane of symmetry (S) through the block, said recesses extending up into the block from underneath, that each of the two recesses has a rear wall (16a, 17a), which is the inner surface of a common rear wall (28) of the block, and an outer wall (16b, 17b) which is an inner surface of two outer walls (26, 27) of the block, that between the two recesses there is a partition wall (25) and that the bottom surfaces of the rear wall (28), the outer walls (26, 27), and the partition wall (25) are in alignment with one another.

9. A wall block according to claim 8, **characterised in that** in the region of each recess there is a pin aperture which extends into the block from an aperture entrance in the recess close to the rear recess wall up towards but not all the way to the top surface of the block, that said pin aperture comprises at least a vertical pin retaining portion (39, 43) provided to

be able to accommodate and to retain a pin (35) which is driven into the aperture through the aperture entrance, and that between the inner end of the pin aperture and the top surface (2) of the block there remains a cover (40) of block material, which cover is provided so thin that it can be penetrated by the pin when the pin is hit by a stroke.

10. A wall block according to claim 1, **characterised in that** a major, integrated recess is provided in the block (1'), comprising recess portions (16', 17') on each side of a vertical plan of symmetry (S) through the block, said recess and said recess portion extending upwards in the block from the underside.

11. A wall block according to any of claims 7-10, **characterised in that** said cover (40) has a thickness of 2-7 mm, preferably not more than 5 mm, suitably not more than 4 mm, when the wall block consists of cast concrete.

12. A wall block according to any of claims 1-11, **characterised in that** said rear recess wall and said rear recess walls (16a, 17a), respectively, is/are vertical.

13. A wall block according to any of claims 7-12, **characterised in that** said pin aperture (s) is/are provided in a rear outer corner (19, 29) of said recess (16, 17).

14. A wall block according to any of claims 7-13, **characterised in that** said pin aperture comprises a pin retaining portion (39, 43) and a wider entrance portion (38, 42) for a tool for driving a pin into the pin retaining portion of the aperture and through said cover.

15. A wall block according to any of the preceding claims, **characterised in that** a number of pin apertures (12-15) are also provided in a rear wall (28) between the rear surface (5) and said recess/recesses (16, 17) of the block, extending vertically upwards a distance into said rear wall from the bottom surface (3) of the block.

16. A retaining wall consisting of wall blocks (1) laid to form tiers of wall blocks on top of one another, so that the blocks in each tier are displaced in the lateral direction relative to the blocks in over-lying and under-lying tiers a distance corresponding to half the length of a block, said wall blocks comprising:

a) a front surface (4) and a rear surface (5),
b) a top surface (2) and a bottom surface (3), spaced apart from each other by a distance that defines the thickness of the block (1), and
c) first and second end surfaces (6, 7), **characterised in that**
d) at least one recess (16, 17) is provided in the block (1), extending from the bottom surface (3) upwards into the block,
e) that the recess has a rear wall (16a, 17a), a recess roof (17e), an outer side wall (16b, 17b), and an inner side wall (16c, 17c),
f) that at least one pin hole (39, 39', 43, 43') extends into the block at a right angle relative to the top surface of the block, said pin hole being located such that its centre line (C) extends through the region of a rear, outer corner (19, 29) of said recess and
g) that in all the tiers consisting of wall blocks, except in the blocks in the top tier, a pin is inserted into said aperture, a projection portion of the pin extending beyond the top surface (2) of the wall block, said projecting pin portion lying flush against the rear wall of a wall block in an over-lying tier of wall blocks.

17. A retaining wall according to claim 16, **characterised in that** said at least one pin aperture (39', 43') extends from the top surface (2) of the block a distance downwards into the block, and that said pins are inserted from above down into the pin apertures.

18. A retaining wall according to claim 16, characterised in

a) that at least in all tiers of wall blocks beneath the top tier, at least one pin aperture (36, 37) extends into the block from an aperture entrance in the recess close to the rear recess wall (16a, 17a) up towards, but not all the way to the top surface (2) of the block,
b) that said pin aperture comprises at least a vertical pin retaining portion (39, 43) provided to be able to accommodate and to retain an interlocking pin (35) which is driven into the aperture through the aperture entrance,
c) that in all tiers of wall blocks, except in the blocks of the top tier, a pin (35) is driven from underneath into said pin apertures and beyond the top surface of the wall block, penetrating a cover (40) between the inner end of the aperture and the top surface of the block, said projection pin portion lying flush against the rear wall of a recess of a wall block in an over-lying tier of wall blocks, and
d) that in the wall blocks in the top tier of wall blocks no pin is driven into said pin apertures, penetrating the cover (40), so that said cover and hence the top surface of the wall blocks of said top tier of wall blocks is intact.

19. A retaining wall according to any of claim 16-18, **characterised in that** at least two recesses (16, 17)

are provided in the blocks (1), one on each side of a vertical plane of symmetry (S) through the blocks, said recesses extending upwards into the blocks from the bottom surface, that each of the two recesses in the blocks has a rear wall (16a, 17a) which is the inside of a common rear wall (28) of the block, and an outer wall (16b, 17b) which is the inside of a couple of outer walls (26, 27) of the block, that between the two recesses there is a partition wall (25), that the bottom surfaces of the rear wall (28), of the outer wall (26, 27), and of the partition wall (25) are aligned with one another, and that at least an outer wall (26, 27) of the block in each tier of blocks except the bottom tier at least partly rest against said partition wall (25) of the blocks of an under-lying tier.

Patentansprüche

1. Wandstein für eine Stützmauer, umfassend:

   a) eine vordere Oberfläche (4) und eine hintere Oberfläche (5);
   b) eine obere Oberfläche (2) und eine untere Oberfläche (3), die durch eine Entfernung voneinander beabstandet sind, welche die Dicke des Steins (1) definiert; und
   c) erste und zweite Endoberflächen (6, 7),
   dadurch gekennzeichnet, dass
   d) mindestens eine Vertiefung (16, 17) in dem Stein (1) bereitgestellt ist, die sich von der unteren Oberfläche (3) nach oben in den Stein hinein erstreckt,
   e) dass die Vertiefung eine hintere Wand (16a, 17a), ein Vertiefungsdach (17e), eine äußere Seitenwand (16b, 17b) und eine innere Seitenwand (16c, 17c) aufweist, und
   f) dass sich mindestens ein Stiftloch (39, 39', 43, 43') in einem rechten Winkel in Bezug auf die obere Oberfläche des Steins in den Stein hinein erstreckt, wobei das Stiftloch so angeordnet ist, dass sich seine Mittellinie (C) durch den Bereich einer hinteren äußeren Ecke (19, 29) der Vertiefung erstreckt.

2. Wandstein gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die hintere Wand der Vertiefung sich zwischen der hinteren äußeren Ecke und einer hinteren inneren Ecke erstreckt, wobei die hintere äußere Ecke eine Ecke zwischen der hinteren Wand und der äußeren Seitenwand definiert, und die hintere innere Ecke eine Ecke zwischen der hinteren Wand und der inneren Seitenwand ist.

3. Wandstein gemäß Anspruch 2, **dadurch gekennzeichnet, dass** die hintere Wand der Vertiefung zwischen der äußeren und inneren Ecke konkav gekrümmt ist.

4. Wandstein gemäß Anspruch 2, **dadurch gekennzeichnet, dass** die hintere Wand zwischen den Ekken eine Konkavität (33, 23) aufweist.

5. Wandstein gemäß irgendeinem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** sich die mindestens eine Stiftöffnung (39', 43') von der oberen Oberfläche (2) des Steins eine Strecke nach unten in den Stein hinein erstreckt.

6. Wandstein gemäß irgendeinem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** ebenso mindestens zwei Stiftöffnungen (12', 15') an dem hinteren Ende der ersten erwähnten Stiftöffnungen (39', 43') bereitgestellt sind, und das die zweiten Stiftöffnungen sich ebenso von der oberen Oberfläche (2) des Steins, aber weiter hinten in dem Stein, nach unten in eine hintere Wand (28) zwischen der hinteren Oberfläche (5) und der Vertiefung (16, 17) des Steins hinein erstrecken.

7. Wandstein gemäß irgendeinem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** mindestens eine Stiftöffnung (36, 37) sich von einem Öffnungseingang in der Vertiefung nahe der hinteren Vertiefungswand (16a, 17a) nach oben, aber nicht den ganzen Weg bis zu der oberen Oberfläche (2) des Steins in den Stein hinein erstreckt, dass die Stiftöffnungen mindestens einen vertikalen Stifthalteabschnitt (39, 43) aufweisen, der bereitgestellt ist, um einen Stift (35) unterbringen und halten zu können, der durch den Öffnungseingang in die Öffnung getrieben wird, und dass zwischen dem inneren Ende der Stiftöffnung und der oberen Oberfläche (2) des Steins eine Abdeckung (40) von Steinmaterial verbleibt, wobei diese Abdeckung so dünn bereitgestellt ist, dass sie von einem Stift durch Schlagen des Stifts durchdrungen werden kann.

8. Wandstein gemäß irgendeinem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** mindestens 2 Vertiefungen (16, 17) in dem Stein (1), eine auf jeder Seite einer vertikalen Symmetrieebene (S) durch den Stein, bereitgestellt sind, wobei sich die Vertiefungen von unterhalb in den Stein hinein erstrecken, dass jede der zwei Vertiefungen eine hintere Wand (16a, 17a) aufweist, welche die innere Oberfläche einer gemeinsamen hinteren Wand (28) des Steins ist, und eine äußere Wand (16b, 17b), welche eine innere Oberfläche von zwei äußeren Wänden (26, 27) des Steins ist, dass sich zwischen den zwei Vertiefungen eine Trennwand (25) befindet, und dass die unteren Oberflächen der hinteren Wand (28), der äußeren Wände (26, 27), und der Trennwand (25) miteinander ausgerichtet sind.

9. Wandstein gemäß Anspruch 8, **dadurch gekennzeichnet, dass** sich in dem Bereich jeder Vertiefung eine Stiftöffnung befindet, die sich von einem Öffnungseingang in der Vertiefung nahe der hinteren Vertiefungswand nach oben, aber nicht den ganzen Weg bis zu der oberen Oberfläche des Steins in den Stein hinein erstreckt, dass die Stiftöffnung mindestens einen vertikalen Stifthalteabschnitt (39, 43) aufweist, der bereitgestellt ist, um einen Stift (35) unterbringen und halten zu können, der durch den Öffnungseingang in die Öffnung getrieben wird, und dass zwischen dem inneren Ende der Stiftöffnung und der oberen Oberfläche (2) des Steins dort eine Abdeckung (40) von Steinmaterial verbleibt, wobei diese Abdeckung so dünn bereitgestellt ist, dass sie von dem Stift durchdrungen werden kann, wenn der Stift von einem Schlag getroffen wird.

10. Wandstein gemäß Anspruch 1, **dadurch gekennzeichnet, dass** eine integrierte Hauptvertiefung in dem Stein (1') bereitgestellt ist, umfassend Vertiefungsabschnitte (16', 17') auf jeder Seite einer vertikalen Symmetrieebene (S) durch den Stein, wobei sich die Vertiefung und der Vertiefungsabschnitt von der Unterseite nach oben in den Stein erstrekken.

11. Wandstein gemäß irgendeinem der Ansprüche 7 bis 10, **dadurch gekennzeichnet, dass** die Abdekkung (40) eine Dicke von 2-7 mm, bevorzugt nicht mehr als 5 mm, geeigneterweise nicht mehr als 4 mm aufweist, wenn der Stein aus Gußbeton besteht.

12. Wandstein gemäß irgendeinem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** die hintere Vertiefungswand bzw. die hinteren Vertiefungswände (16a, 17a) vertikal ist/sind.

13. Wandstein gemäß irgendeinem der Ansprüche 7 bis 12, **dadurch gekennzeichnet, dass** die Stiftöffnung(en) in einer hinteren Ecke (19, 29) der Vertiefung (16, 17) bereitgestellt ist/sind.

14. Wandstein gemäß irgendeinem der Ansprüche 7 bis 13, **dadurch gekennzeichnet, dass** die Stiftöffnung einen Stifthalteabschnitt (39, 43) und einen breiteren Eingangsabschnitt (38, 42) für ein Werkzeug zum Vortreiben des Stifts in den Stifthalteabschnitt der Öffnung und durch die Abdeckung aufweist.

15. Wandstein gemäß irgendeinem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ebenso eine Anzahl von Stiftöffnungen (12-15) in einer hinteren Wand (28) zwischen der hinteren Oberfläche (5) und der Vertiefung/den Vertiefungen (16, 17) des Steins bereitgestellt ist, die sich von der unteren Oberfläche (3) des Steins eine Strecke vertikal nach oben in die hintere Wand hinein erstrecken.

16. Stützmauer, bestehend aus Wandsteinen (1), die gelegt sind, um Lagen von Wandsteinen aufeinander zu bilden, so dass die Steine in jeder Lage in der seitlichen Richtung in Bezug auf die Steine in oberhalb liegenden und unterhalb liegenden Lagen um eine Strecke versetzt sind, die der halben Länge eines Steins entspricht, wobei die Wandsteine umfassen:

a) eine vordere Oberfläche (4) und eine hintere Oberfläche (5);
b) eine obere Oberfläche (2) und eine untere Oberfläche (3), die durch eine Entfernung voneinander beabstandet sind, welche die Dicke des Steins (1) definiert; und
c) erste und zweite Endoberflächen (6, 7),
dadurch gekennzeichnet, dass
d) mindestens eine Vertiefung (16, 17) in dem Stein (1) bereitgestellt ist, die sich von der unteren Oberfläche (3) nach oben in den Stein hinein erstreckt,
e) dass die Vertiefung eine hintere Wand (16a, 17a), ein Vertiefungsdach (17e), eine äußere Seitenwand (16b, 17b) und eine innere Seitenwand (16c, 17c) aufweist,
f) dass sich mindestens ein Stiftloch (39, 39', 43, 43') in einem rechten Winkel in Bezug auf die obere Oberfläche des Steins in den Stein hinein erstreckt, wobei das Stiftloch so angeordnet ist, dass sich seine Mittellinie (C) durch den Bereich einer hinteren äußeren Ecke (19, 29) der Vertiefung erstreckt, und
g) dass in allen den Lagen, die aus Wandsteinen bestehen, außer in den Steinen in der oberen Lage, ein Stift in die Öffnung eingesetzt ist, wobei sich ein vorragender Teil des Stifts über die obere Oberfläche (2) des Wandsteins hinaus erstreckt, wobei der vorragende Stiftteil bündig gegen die hintere Wand eines Wandsteins in einer oberhalb liegenden Lage von Wandsteinen anliegt.

17. Stützmauer gemäß Anspruch 16, **dadurch gekennzeichnet, dass** sich mindestens eine Stiftöffnung (39', 43') von der oberen Oberfläche (2) des Steins eine Strecke nach unten in den Stein hinein erstreckt, und dass diese Stifte von oberhalb nach unten in die Stiftöffnungen eingesetzt sind.

18. Stützmauer gemäß Anspruch 16, **dadurch gekennzeichnet**,

a) dass sich in mindestens allen Lagen von

Wandsteinen unterhalb der oberen Lage mindestens eine Stiftöffnung (36, 37) von einem Öffnungseingang in der Vertiefung nahe der hinteren Vertiefungswand (16a, 17a) nach oben, aber nicht den ganzen Weg bis zu der oberen Oberfläche (2) des Steins in den Stein hinein erstreckt,
b) dass die Stiftöffnung mindestens einen vertikalen Stifthalteabschnitt (39, 43) aufweist, der bereitgestellt ist, um einen Verriegelungsstift (35) unterbringen und halten zu können, der durch den Öffnungseingang in die Öffnung getrieben wird,
c) dass in allen Lagen von Wandsteinen, außer in den Steinen der oberen Lage, ein Stift (35) von unterhalb in die Stiftöffnungen und über die obere Oberfläche des Wandsteins hinaus getrieben ist, der eine Abdekkung (40) zwischen dem inneren Ende der Öffnung und der oberen Oberfläche des Steins durchdringt, wobei der vorragende Stiftabschnitt bündig gegen die hintere Wand einer Vertiefung eines Wandsteins in einer oberhalb liegenden Lage von Wandsteinen anliegt, und
d) dass in den Wandsteinen der oberen Lage von Wandsteinen kein Stift in die Stiftöffnungen getrieben ist, der die Abdeckung (40) durchdringt, so dass die Abdeckung und somit die obere Oberfläche der Wandsteine der oberen Lage von Wandsteinen intakt ist.

19. Stützmauer gemäß irgendeinem der Ansprüche 16 bis 18, **dadurch gekennzeichnet, dass** mindestens 2 Vertiefungen (16, 17) in den Steinen (1), eine auf jeder Seite einer vertikalen Symmetrieebene (S) durch die Steine, bereitgestellt sind, wobei sich die Vertiefungen von der unteren Oberfläche nach oben in die Steine hinein erstrecken, dass jede der zwei Vertiefungen in den Steinen eine hintere Wand (16a, 17a) aufweist, welche die Innenseite einer gemeinsamen hinteren Wand (28) des Steins ist, und eine äußere Wand (16b, 17b), welche die Innenseite eines Paars äußerer Wänden (26, 27) des Steins ist, dass sich zwischen den zwei Vertiefungen eine Trennwand (25) befindet, dass die unteren Oberflächen der hinteren Wand (28), der äußeren Wand (26, 27), und der Trennwand (25) miteinander ausgerichtet sind, und dass mindestens eine äußere Wand (26, 27) des Steins in jeder Lage von Steinen, außer der unteren Lage, mindestens teilweise gegen die Trennwand (25) des Steins einer unterhalb liegenden Lage anliegt.

Revendications

1. Bloc mural pour mur de soutènement, comprenant :
a) une surface avant (4) et une surface arrière (5),
b) une surface supérieure (2) et une surface inférieure (3), espacées l'une de l'autre d'une distance qui définit l'épaisseur du bloc (1), et
c) des première et deuxième surfaces d'extrémité (6, 7),
caractérisé en ce que
d) au moins une dépression (16, 17) est ménagée dans le bloc (1) et s'étend depuis la surface inférieure vers le haut dans le bloc,
e) la dépression comporte une paroi arrière (16a, 17a), un plafond de dépression (17e), une paroi latérale extérieure (16b, 17b), et une paroi latérale intérieure (16c, 17c), et
f) au moins un trou de cheville (39, 39', 43, 43') s'étend dans le bloc à angle droit par rapport à la surface supérieure du bloc, ledit trou de cheville étant placé de telle sorte que son axe médian (C) traverse la région d'un coin extérieur arrière (19, 29) de ladite dépression.

2. Bloc mural selon la revendication 1, **caractérisé en ce que** la paroi arrière de la dépression s'étend entre ledit coin extérieur arrière et un coin intérieur arrière, ledit coin extérieur arrière définissant un coin entre ladite paroi arrière et ladite paroi latérale extérieure, et ledit coin intérieur arrière étant un coin prévu entre ladite paroi arrière et ladite paroi latérale intérieure.

3. Bloc mural selon la revendication 2, **caractérisé en ce que** la paroi arrière de la dépression est incurvée concave entre ledit coin extérieur et ledit coin intérieur.

4. Bloc mural selon la revendication 2, **caractérisé en ce que** la paroi arrière présente une concavité (33, 23) entre lesdits coins.

5. Bloc mural selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** au moins une ouverture de cheville (39', 43') s'étend depuis la surface supérieure (2) du bloc vers le bas sur une certaine distance dans le bloc.

6. Bloc mural selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** au moins deux ouvertures de cheville (12', 15') sont également ménagées en arrière des premières ouvertures mentionnées de cheville (39', 43'), et **en ce que** lesdites deuxièmes ouvertures de cheville s'étendent également depuis la surface supérieure (2) du bloc, mais plus en arrière dans le bloc, vers le bas dans une paroi arrière (28) entre la surface arrière (5) et ladite dépression (16, 17) du bloc.

7. Bloc mural selon l'une quelconque des revendica-

tions 1 à 4, **caractérisé en ce que** au moins une ouverture de cheville (36, 37) s'étend vers le haut dans le bloc depuis une entrée d'ouverture ménagée dans la dépression près de la paroi arrière (16a, 17b) de la dépression, mais pas sur tout le chemin menant à la surface supérieure (2) du bloc, **en ce que** lesdites ouvertures de cheville comprennent au moins une portion verticale de retenue de cheville (39, 43) prévue pour être apte à recevoir et retenir une cheville (35) qui est enfoncée dans l'ouverture par ladite entrée d'ouverture, et **en ce qu'**il reste entre l'extrémité intérieure de l'ouverture de cheville et la surface supérieure (2) du bloc un opercule (40) constitué par le matériau du bloc, lequel opercule est prévu pour avoir une faible épaisseur de façon à pouvoir être transpercé par une cheville lorsque l'on frappe celle-ci.

8. Bloc mural selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** au moins deux dépressions (16, 17) sont ménagées dans le bloc (1), une de chaque côté d'un plan de symétrie vertical (S) passant par le bloc, lesdites dépressions s'étendant vers le haut dans le bloc depuis le bas, **en ce que** chacune des deux dépressions présente une paroi arrière (16a, 17a), qui est la surface intérieure d'une paroi arrière commune (28) du bloc, et une paroi extérieure (16b, 17b) qui est une surface intérieure de deux parois extérieures (26, 27) du bloc, **en ce qu'**il est prévu entre les deux dépressions une paroi de séparation (25) et **en ce que** les surfaces inférieures de la paroi arrière (28), des parois extérieures (26, 27), et de la paroi de séparation (25) sont alignées entre elles.

9. Bloc mural selon la revendication 8, **caractérisé en ce qu'**il est prévu dans la région de chaque dépression une ouverture de cheville qui s'étend vers le haut dans le bloc depuis une entrée d'ouverture ménagée dans la dépression près de la paroi arrière de la dépression, mais pas sur tout le chemin menant à la surface supérieure du bloc, **en ce que** ladite ouverture de cheville comprend au moins une portion verticale de retenue de cheville (39, 43) prévue pour être apte à recevoir et retenir une cheville (35) qui est enfoncée dans l'ouverture par l'entrée d'ouverture, et **en ce qu'**il reste entre l'extrémité intérieure de l'ouverture de cheville et la surface supérieure (2) du bloc un opercule (40) constitué par le matériau du bloc, lequel opercule est prévu pour avoir une faible épaisseur de façon à pouvoir être transpercé par une cheville lorsque l'on frappe celle-ci.

10. Bloc mural selon la revendication 1, **caractérisé en ce qu'**une dépression intégrée plus grande est ménagée dans le bloc (1'), laquelle dépression comprend des portions de dépression (16', 17') de chaque côté d'un plan de symétrie vertical (S) passant par le bloc, ladite dépression et ladite portion de dépression s'étendant vers le haut dans le bloc depuis le bas.

11. Bloc mural selon l'une quelconque des revendications 7 à 10, **caractérisé en ce que** ledit opercule (40) a une épaisseur de 2 à 7 mm, de préférence non supérieure à 5 mm, de façon appropriée non supérieure à 4 mm, lorsque le bloc mural est en béton coulé.

12. Bloc mural selon l'une quelconque des revendications 1 à 11, **caractérisé en ce que** ladite paroi de dépression arrière et lesdites parois de dépression arrières (16a, 17a), respectivement, sont verticales.

13. Bloc mural selon l'une quelconque des revendications 7 à 12, **caractérisé en ce que** ladite ouverture de cheville ou lesdites ouvertures de cheville sont ménagées dans un coin extérieur arrière (19, 29) de ladite dépression (16, 17).

14. Bloc mural selon l'une quelconque des revendications 7 à 13, **caractérisé en ce que** ladite ouverture de cheville comprend une portion de retenue de cheville (39, 43) et une portion d'entrée plus large (38, 42) destinées à un outil servant à enfoncer une cheville dans la portion de retenue de cheville de l'ouverture et à travers ledit opercule.

15. Bloc mural selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**un certain nombre d'ouvertures de cheville (12 à 15) sont également ménagées dans une paroi arrière (28) entre la surface arrière (5) et ladite dépression ou lesdites dépressions (16, 17) du bloc, lesquelles ouvertures de cheville s'étendent verticalement vers le haut sur une certaine distance dans ladite paroi arrière depuis la surface inférieure (3) du bloc.

16. Mur de soutènement constitué de blocs muraux (1) posés de façon à former des couches de blocs muraux les uns sur les autres, de sorte que les blocs de chaque couche sont déplacés latéralement par rapport aux blocs de couches sus-jacentes et sous-jacentes sur une distance correspondant à la moitié de la longueur d'un bloc, lesdits blocs muraux comprenant :

a) une surface avant (4) et une surface arrière (5),
b) une surface supérieure (2) et une surface inférieure (3), espacées l'une de l'autre d'une distance qui définit l'épaisseur du bloc (1), et
c) des première et deuxième surfaces d'extrémité (6, 7),

caractérisé en ce que

d) au moins une dépression (16, 17) est ménagée dans le bloc (1) et s'étend depuis la surface inférieure vers le haut dans le bloc,
e) la dépression comporte une paroi arrière (16a, 17a), un plafond de dépression (17e), une paroi latérale extérieure (16b, 17b), et une paroi latérale intérieure (16c, 1 7c), et
f) au moins un trou de cheville (39, 39', 43, 43') s'étend dans le bloc à angle droit par rapport à la surface supérieure du bloc, ledit trou de cheville étant placé de telle sorte que son axe médian (C) traverse la région d'un coin extérieur arrière (19, 29) de ladite dépression,
g) au moins dans toutes les couches de blocs muraux, à l'exception des blocs de la couche supérieure, une cheville est insérée dans ladite ouverture, une portion saillante de la cheville s'étendant au-dessus de la surface supérieure (2) du bloc mural, ladite portion de cheville saillante affleurant la paroi arrière d'un bloc mural d'une couche sus-jacente de blocs muraux.

17. Mur de soutènement selon la revendication 16, **caractérisé en ce que** ladite au moins une ouverture de cheville (39', 43') s'étend de la surface supérieure (2) du bloc sur une certaine distance vers le bas dans le bloc, et **en ce que** lesdites chevilles sont insérées de haut en bas dans les ouvertures de cheville.

18. Mur de soutènement selon la revendication 16, **caractérisé en ce que**

a) au moins dans toutes les couches de blocs muraux au-dessous de la couche supérieure, au moins une ouverture de cheville (36, 37) s'étend dans le bloc vers le haut depuis une entrée d'ouverture ménagée dans la dépression près de la paroi de dépression arrière (16a, 17a), mais pas sur tout le chemin menant à la surface supérieure (2) du bloc,
b) ladite ouverture de cheville comprend au moins une portion verticale de retenue de cheville (39, 43) prévue pour être apte à recevoir et retenir une cheville de blocage (35) qui est enfoncée dans l'ouverture par l'entrée d'ouverture,
c) dans toutes les couches de blocs muraux, à l'exception des blocs de la couche supérieure, une cheville (35) est enfoncée depuis le bas dans lesdites ouvertures de cheville et au-dessus de la surface supérieure du bloc mural, en enfonçant un opercule (40) entre l'extrémité intérieure de l'ouverture et la surface supérieure du bloc, ladite portion de cheville saillante affleurant la paroi arrière d'une dépression d'un bloc mural d'une couche sus-jacente de blocs muraux, et
d) dans les blocs muraux de la couche supérieure de blocs muraux, aucune cheville n'est enfoncée dans lesdites ouvertures de cheville, en enfonçant l'opercule (40), de sorte que ledit opercule et donc la surface supérieure des blocs muraux de ladite couche supérieure de blocs muraux sont intacts.

19. Mur de soutènement selon l'une quelconque des revendications 16 à 18, **caractérisé en ce que** au moins deux dépressions (16, 17) sont ménagées dans les blocs (1), une de chaque côté d'un plan de symétrie vertical (S) passant par les blocs, lesdites dépressions s'étendant vers le haut dans les blocs depuis la surface inférieure, **en ce que** chacune des deux dépressions dans les blocs présente une paroi arrière (16a, 17a), qui est l'intérieur d'une paroi arrière commune (28) du bloc, et une paroi extérieure (16b, 17b) qui est l'intérieur d'un couple de parois extérieures (26, 27) du bloc, **en ce qu'**il est prévu entre les deux dépressions une paroi de séparation (25), **en ce que** les surfaces inférieures de la paroi arrière (28), de la paroi extérieure (26, 27), et de la paroi de séparation (25) sont alignées entre elles, et **en ce que** au moins une paroi extérieure (26, 27) du bloc de chaque couche de blocs à l'exception de la couche inférieure repose au moins partiellement contre ladite paroi de séparation (25) des blocs d'une couche sous-jacente.

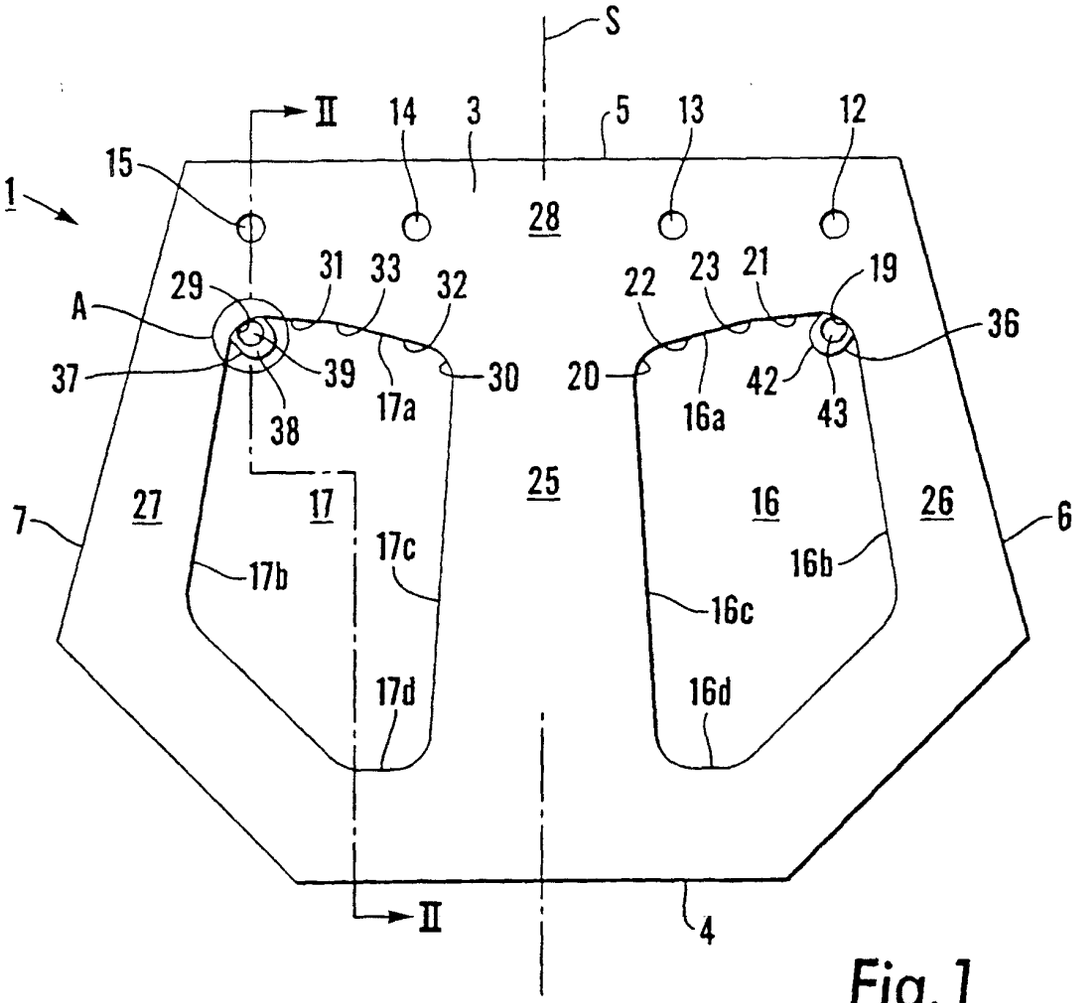
S
II
14
3
5
13
12
15
1
28
29
31
33
32
22
23
21
19
A
36
37
39
17a
30
20
42
38
16a
43
25
27
17
16
26
7
6
17c
16b
17b
16c
17d
16d
II
4

Fig. 1

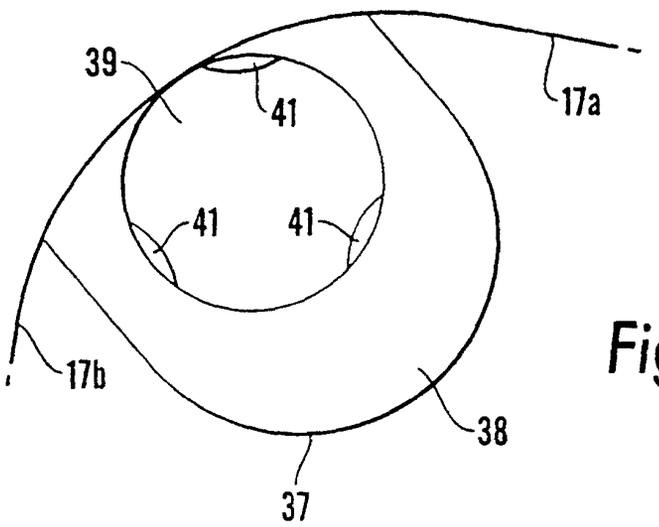
39
41
17a
41
41
17b
38
37

Fig. 1A

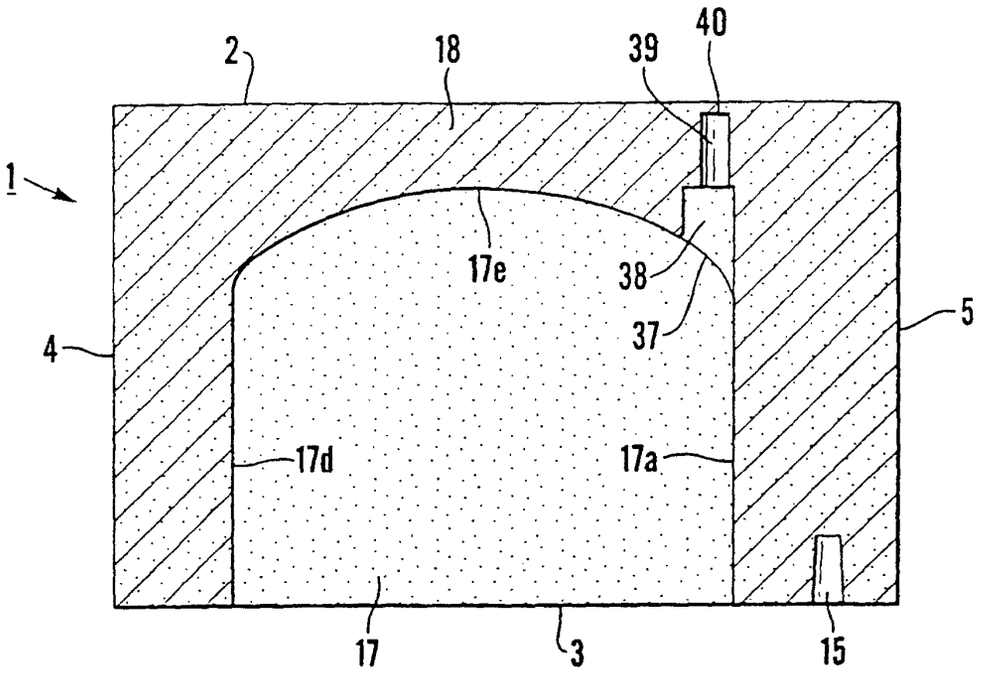
2
18
39
40
1
17e
38
37
5
4
17d
17a
17
3
15

Fig.2

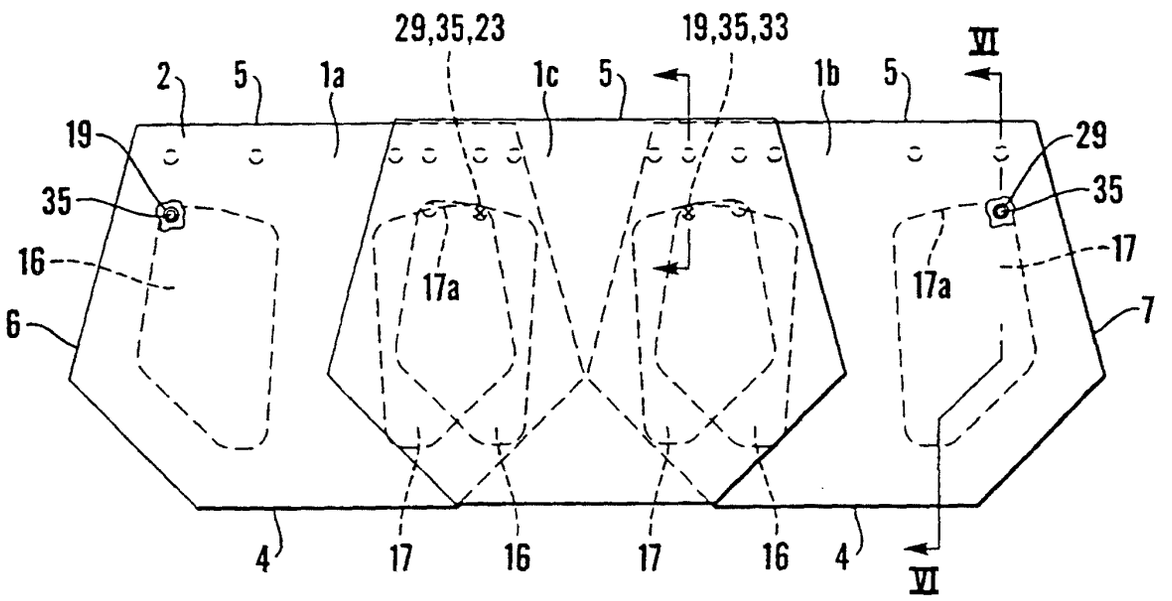
29,35,23
19,35,33
VII
2
5
1a
1c
5
1b
5
19
29
35
35
16
17a
17a
17
6
7
4
17
16
17
16
4
VII

Fig.3

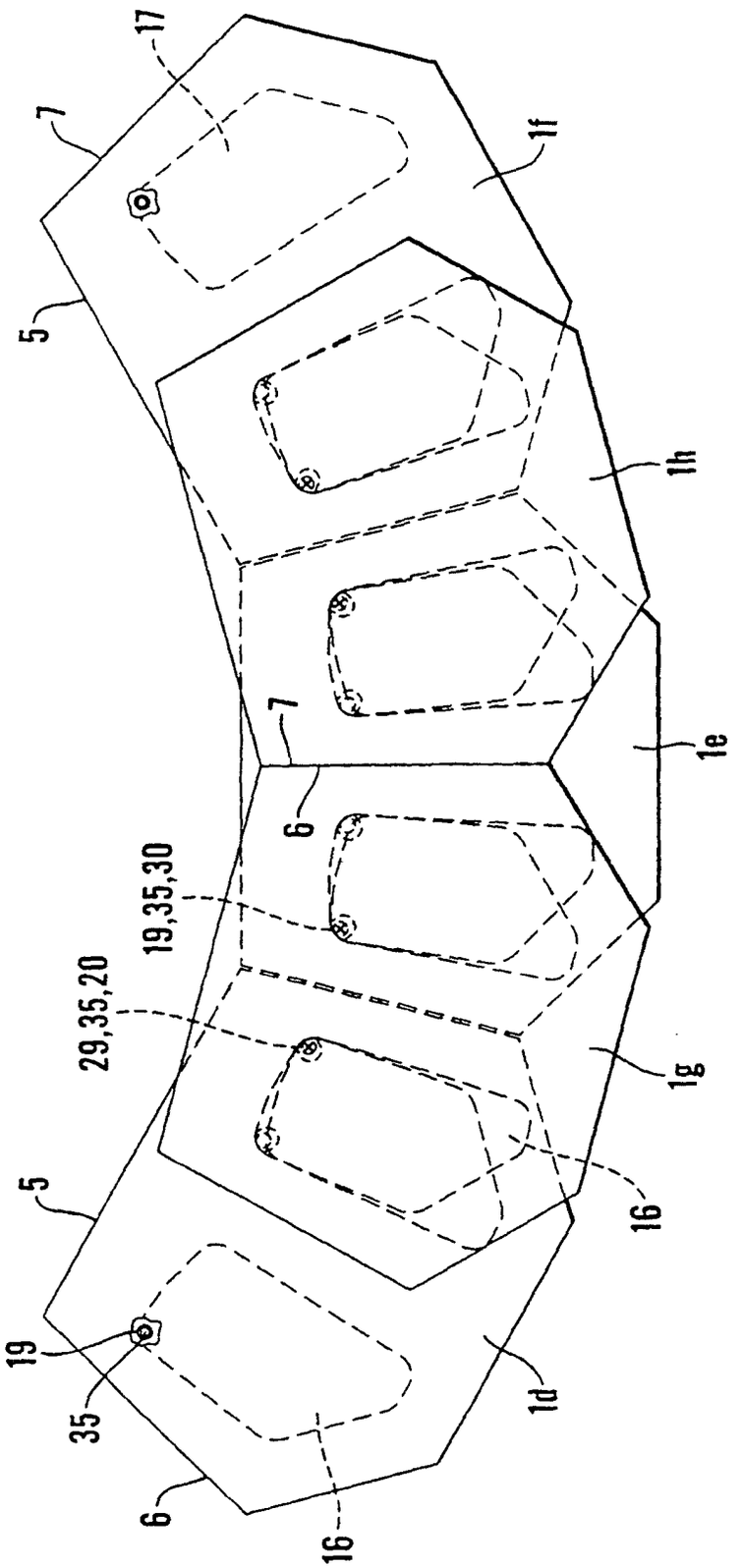

Fig.4

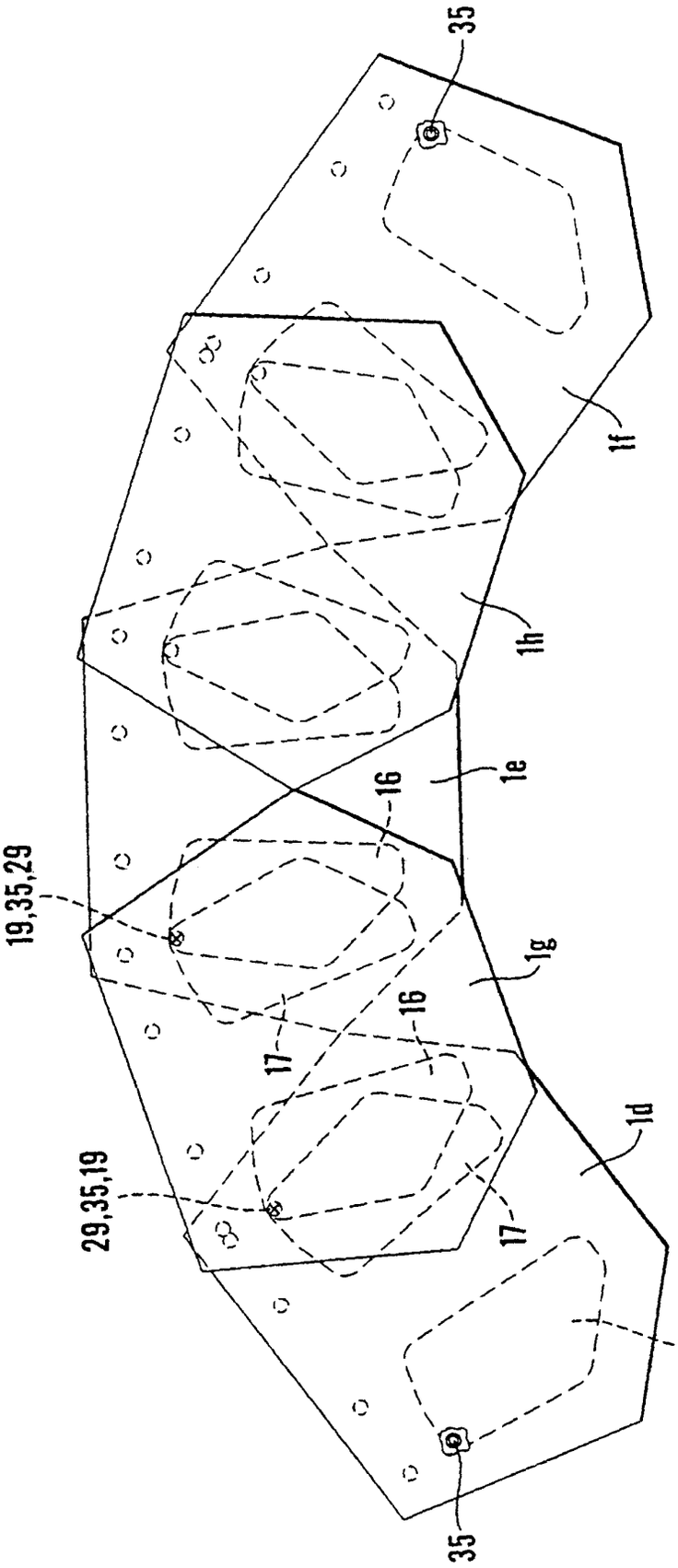

Fig.5

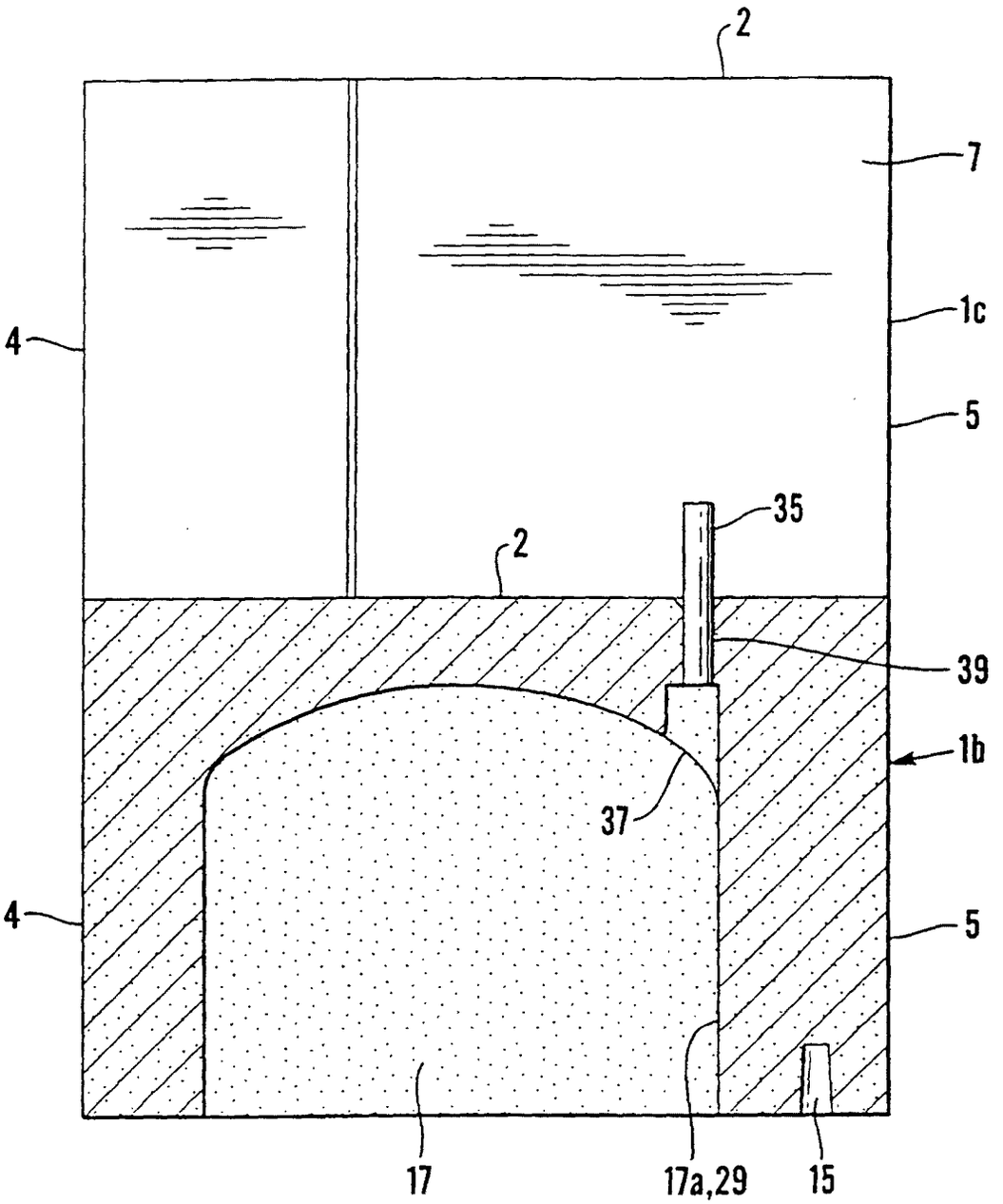

Fig.6

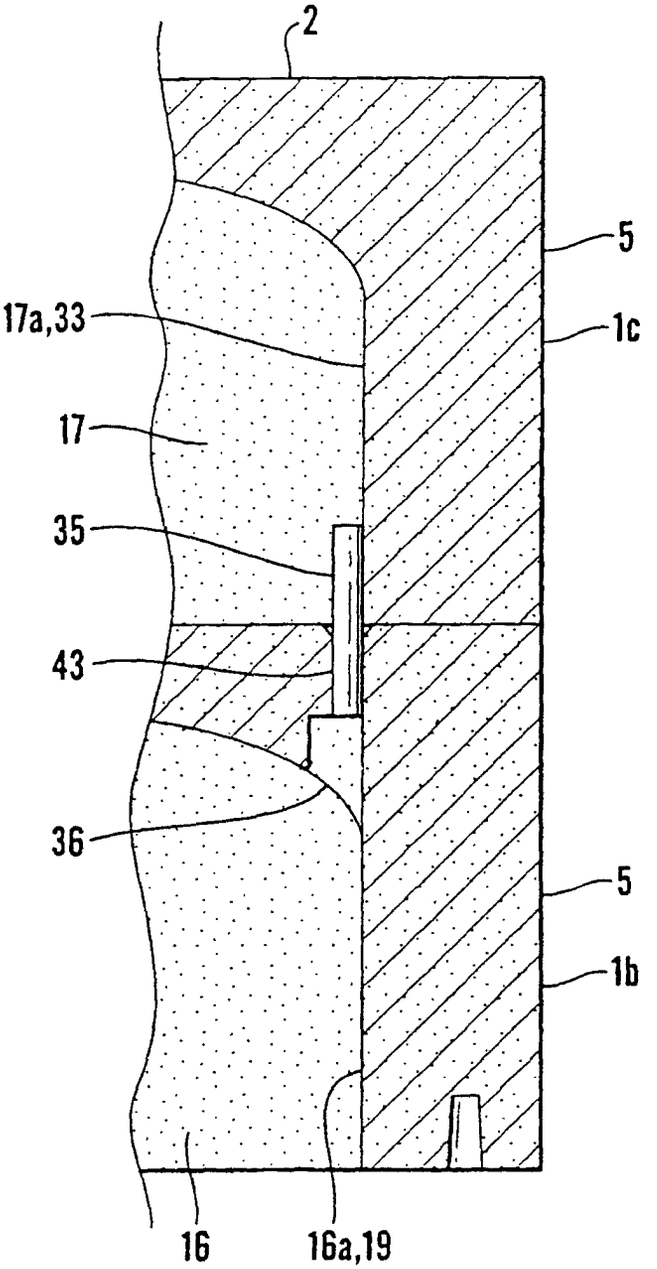

Fig. 7

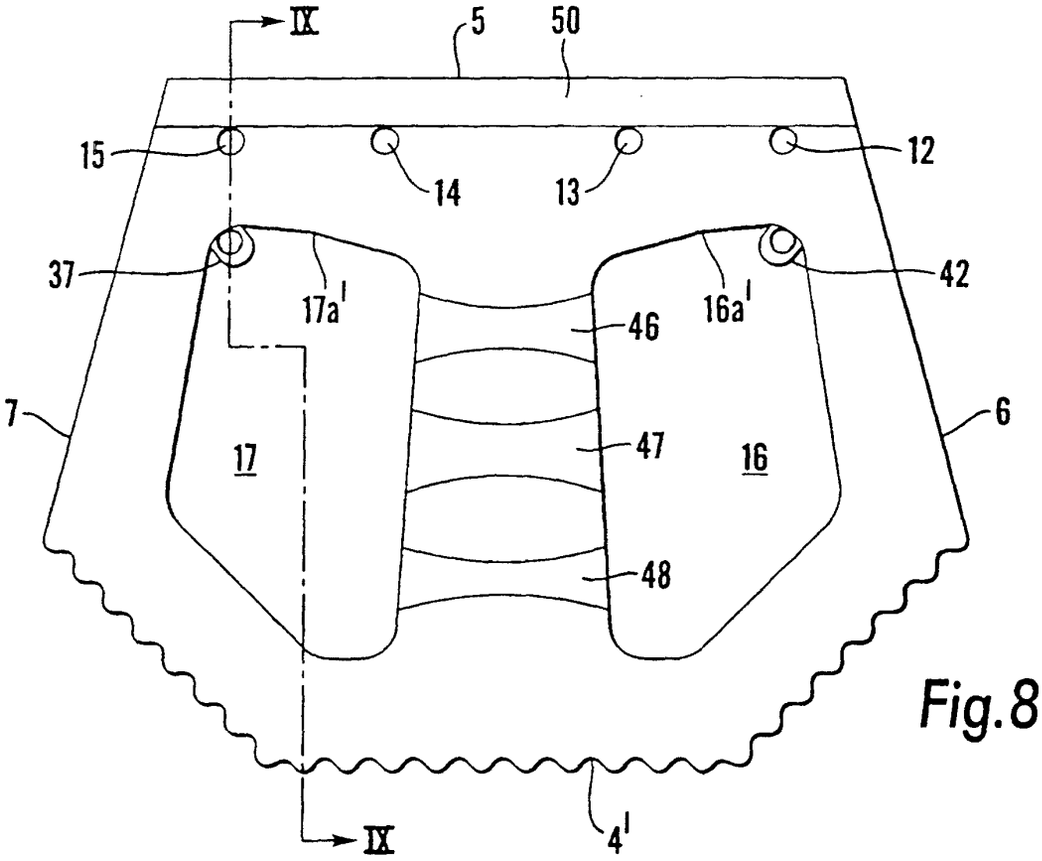
IX
5
50
15
14
13
12
37
17a'
16a'
42
46
7
17
47
16
6
48
IX
4'

Fig.8

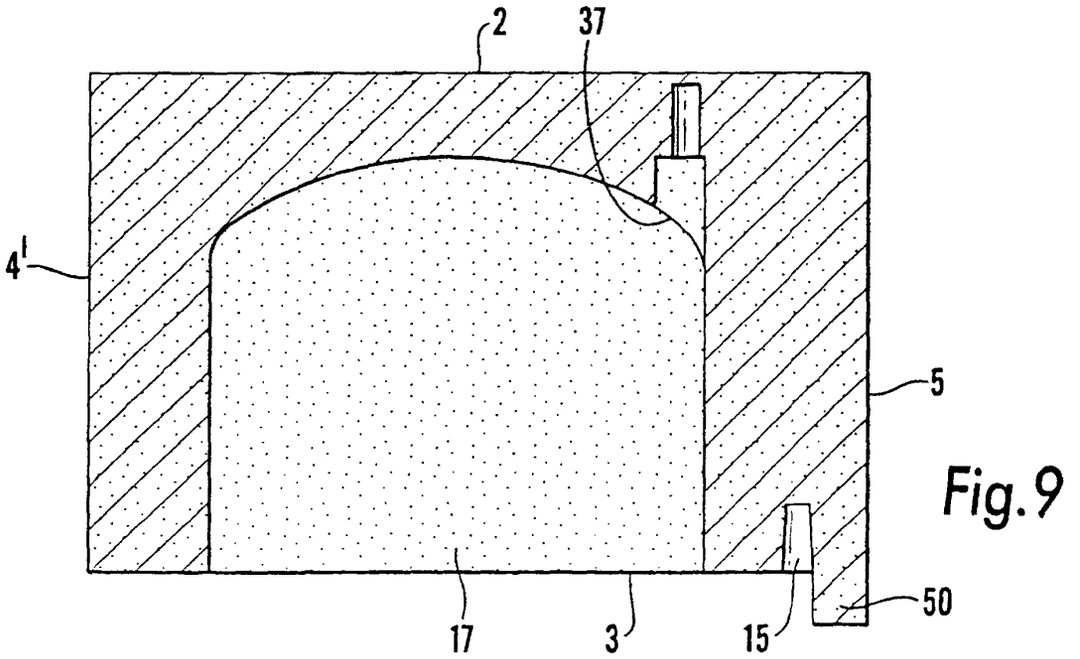
2
37
4'
5
17
3
15
50

Fig.9

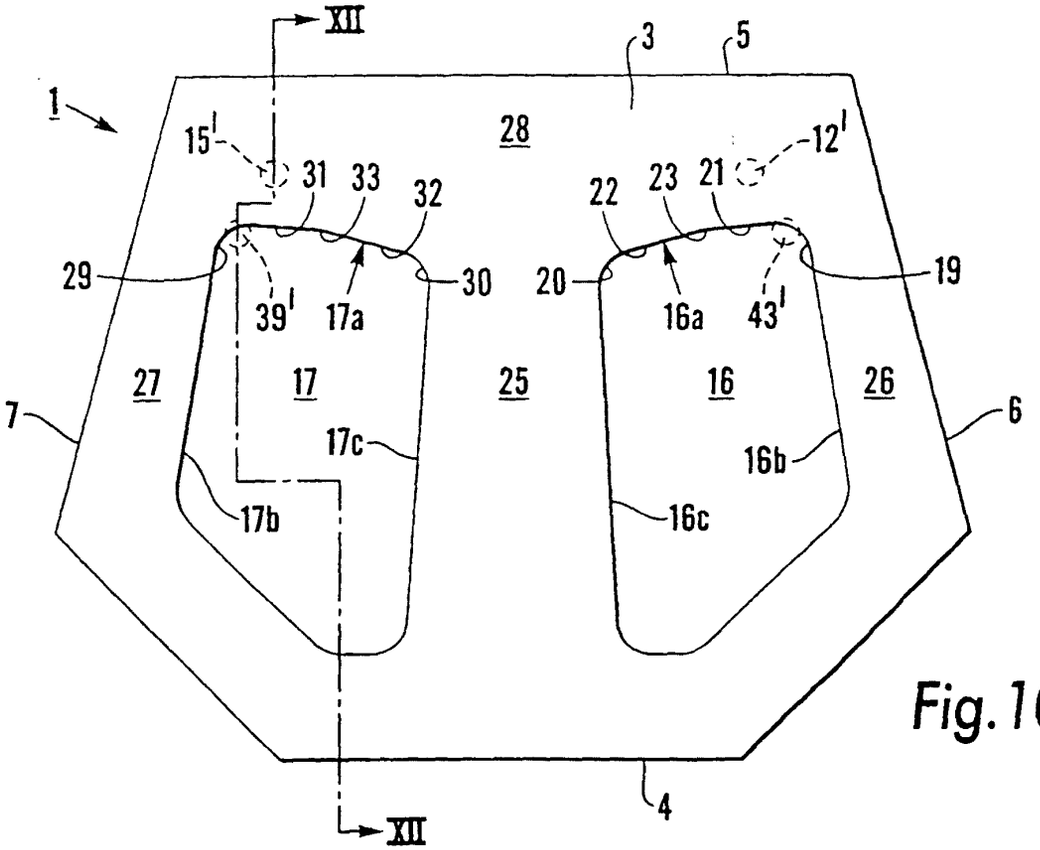
XII
3
5
1
15'
28
12'
31
33
32
22
23
21
29
30
20
19
39'
17a
16a
43'
27
17
25
16
26
7
6
17c
16b
17b
16c
XII
4

Fig.10

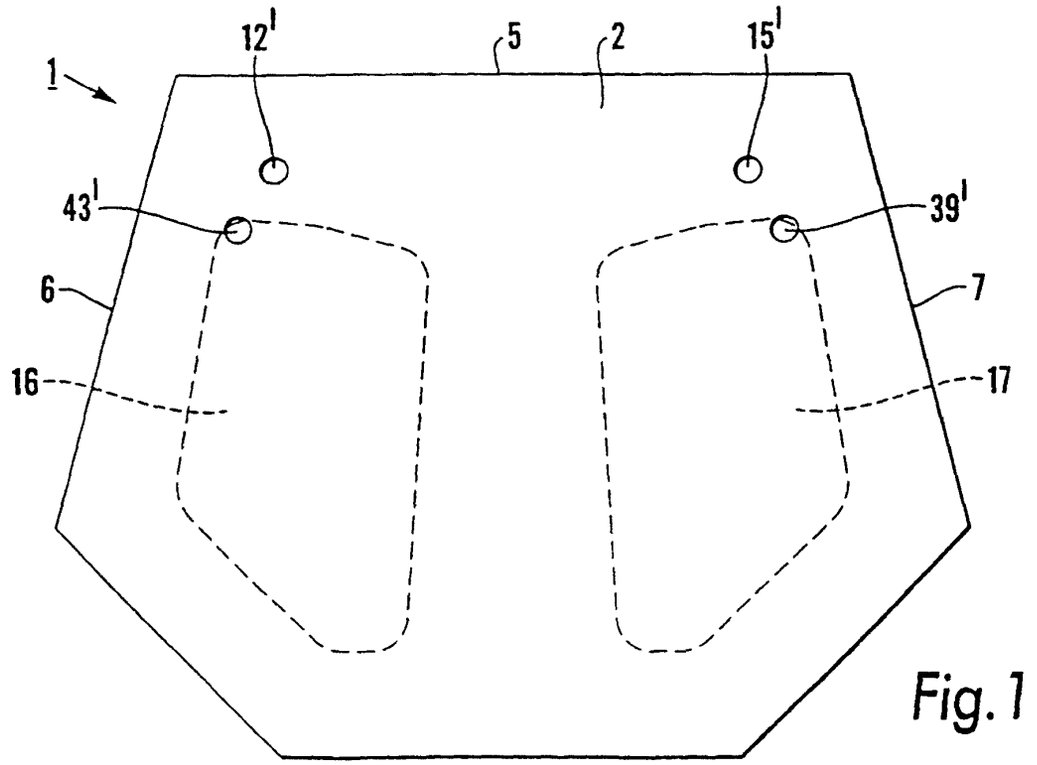
12'
5
2
15'
1
43'
39'
6
7
16
17

Fig.11

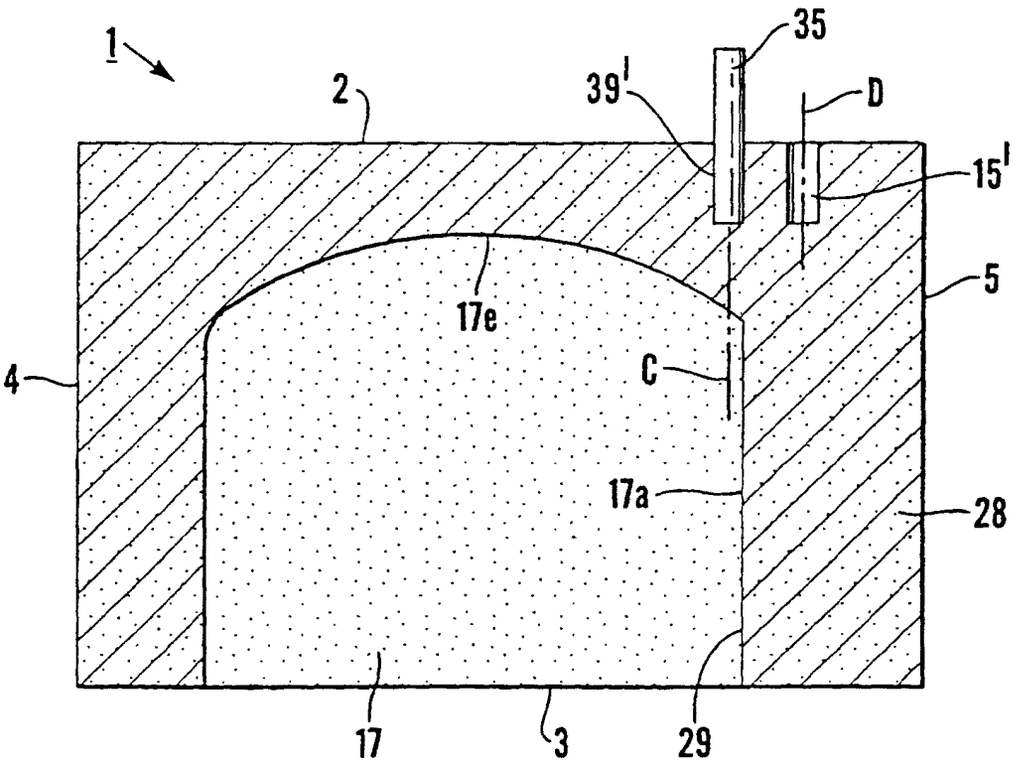

Fig. 12