United States Patent

[11] 3,597,925

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[21] Appl. No. **763,573**
[22] Filed **Sept. 30, 1968**
[45] Patented **Aug. 10, 1971**

[54] **RETAINING WALL BLOCK**
4 Claims, 52 Drawing Figs.

[52] **U.S. Cl.** **61/4,**
52/570, 52/610, 61/35
[51] **Int. Cl.** **E02b 3/12**
[50] **Field of Search** 61/35, 37,
39, 4, 5, 47; 52/590, 593, 610, 611, 570

[56] **References Cited**

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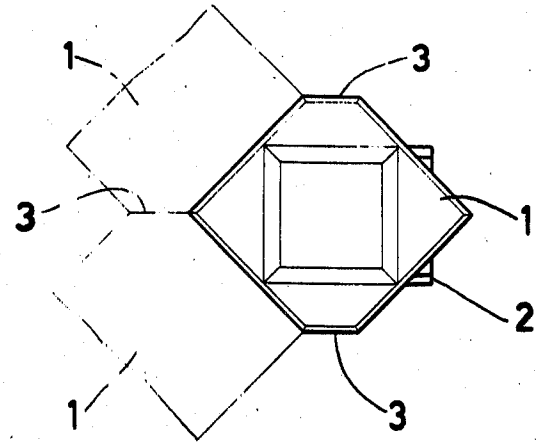
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Primary Examiner—David J. Williamowsky
Assistant Examiner—Philip C. Kannan
Attorney—Wenderoth, Lind & Ponack

ABSTRACT: A retaining wall block has a base portion and one or more bracing struts integral therewith. As the blocks are stacked, the struts overlap to thereby provided self-support for the wall. The sides of the base portion also have interengaging portions which provide support.



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12 Sheets-Sheet 1

Fig. 1.

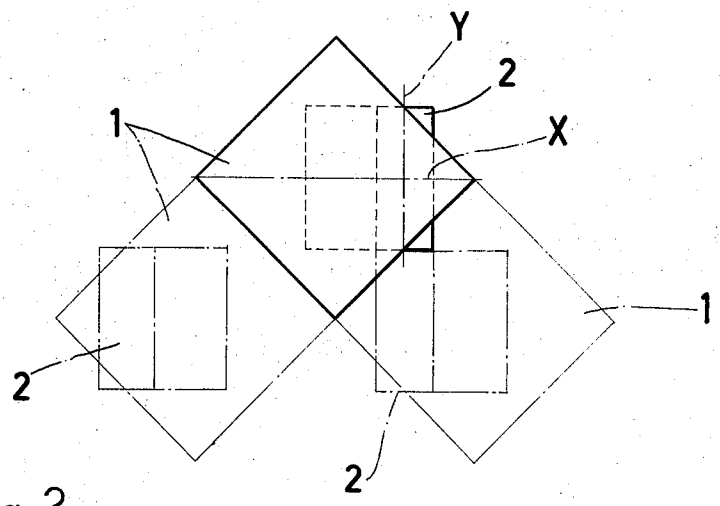


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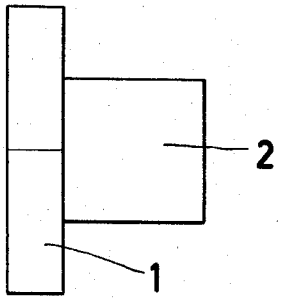


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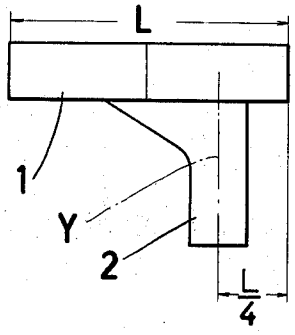
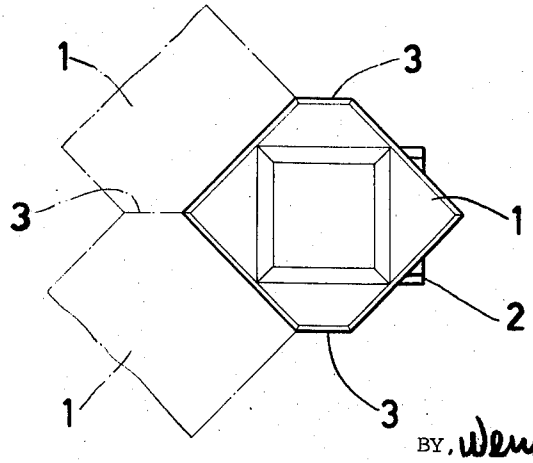


Fig. 4.



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Fig. 5.

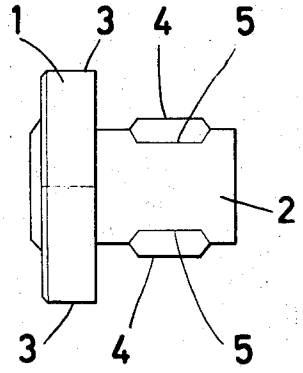


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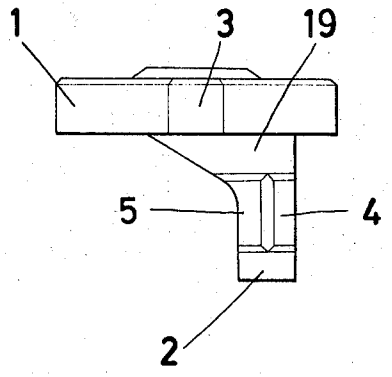


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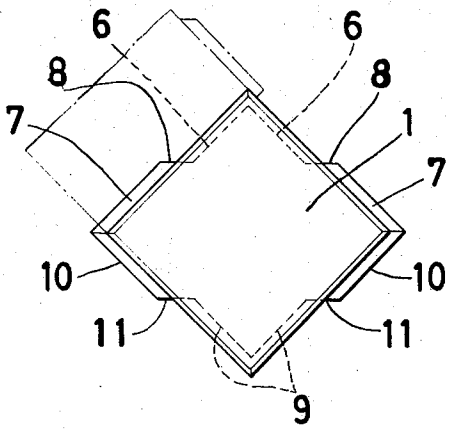


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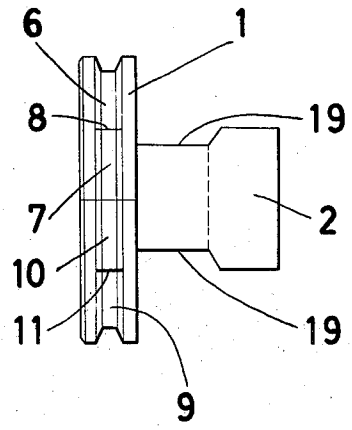
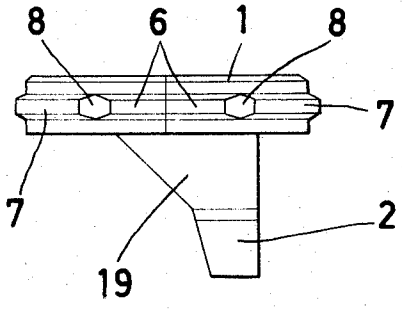


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Fig.10.

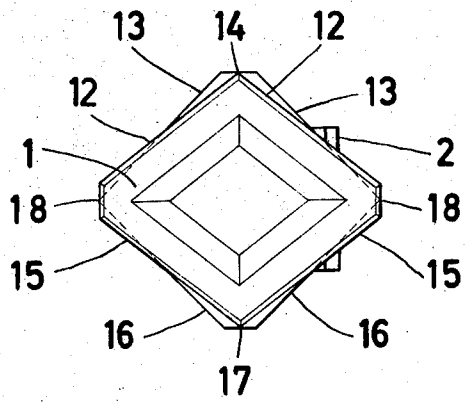


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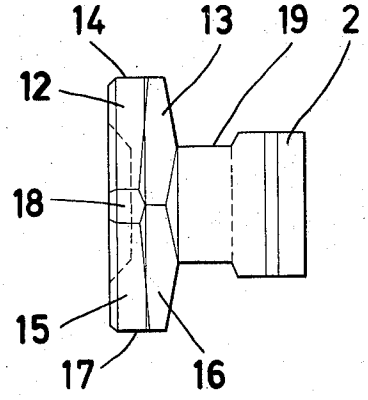


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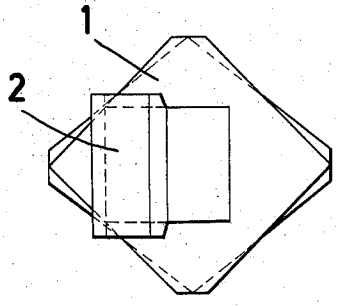


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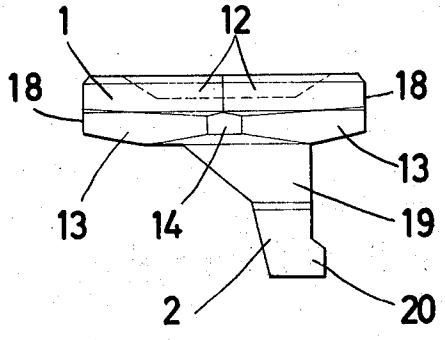
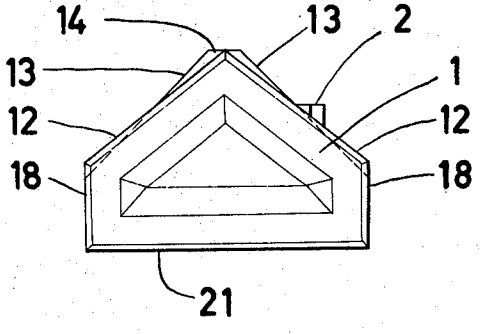


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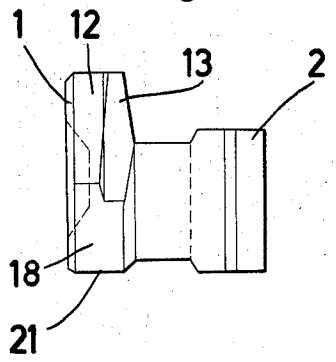


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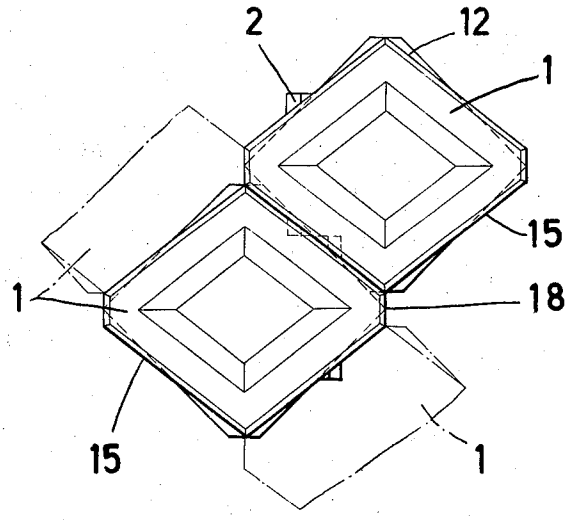


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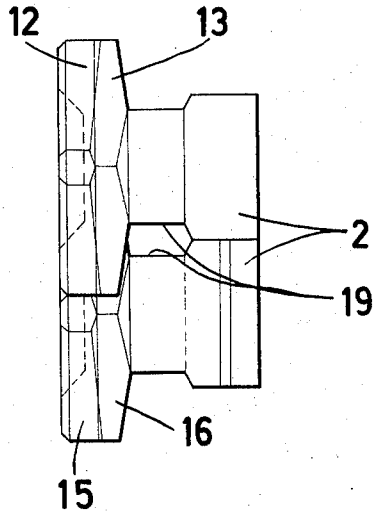


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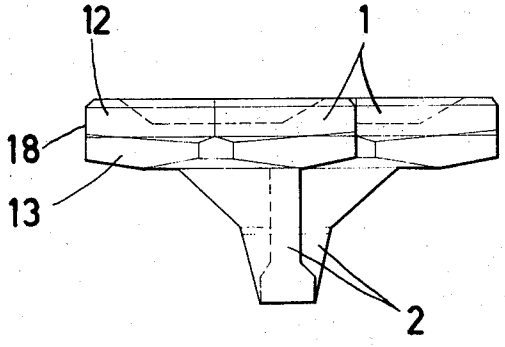
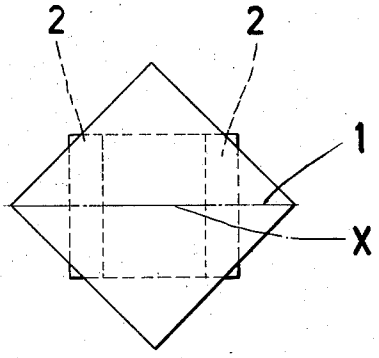


Fig.19.



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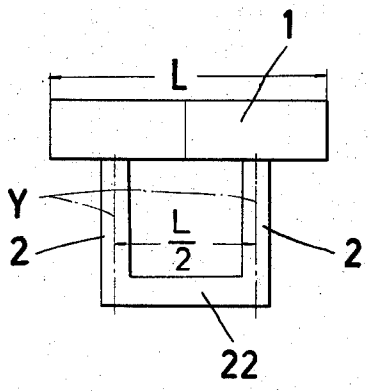


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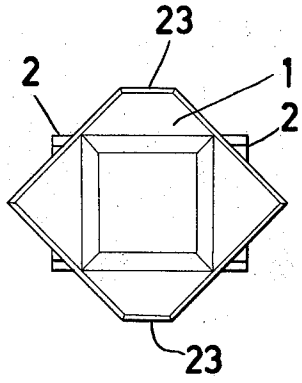


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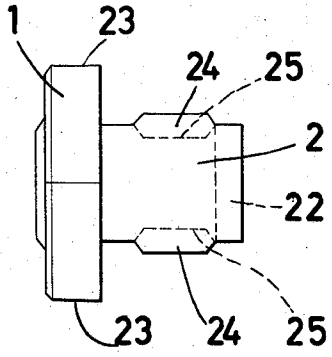


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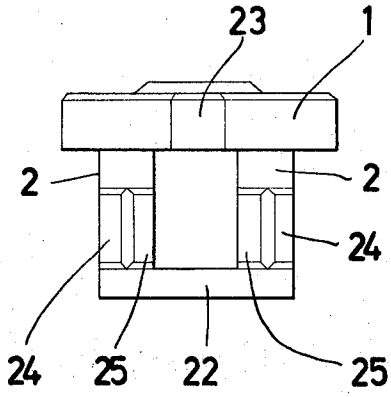
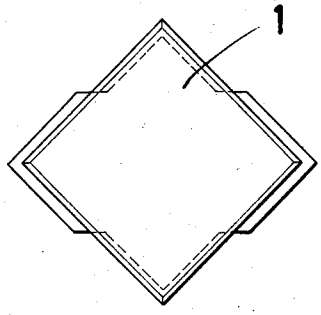


Fig.24.



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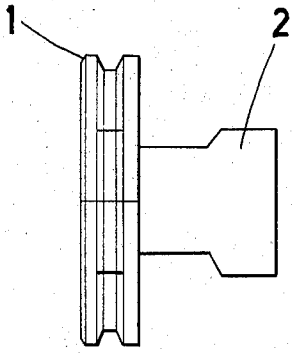


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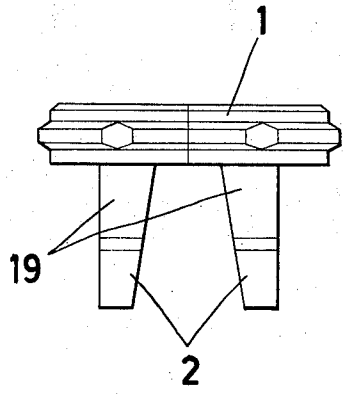


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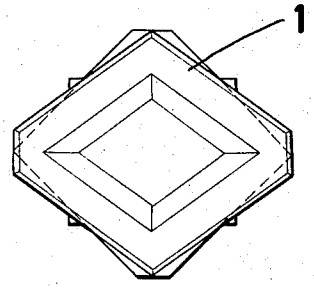


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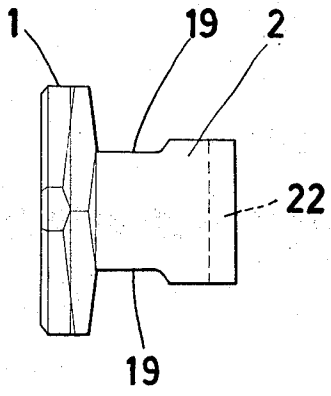
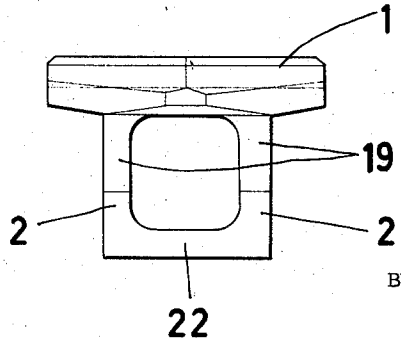


Fig.29.



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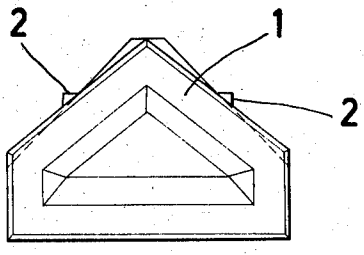


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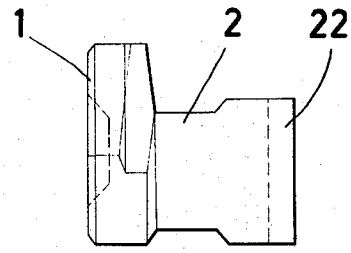


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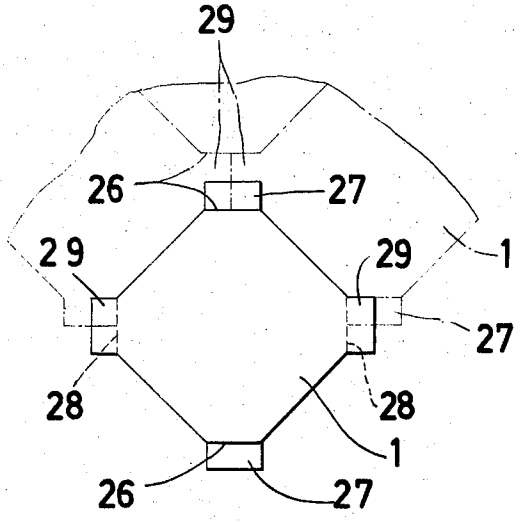


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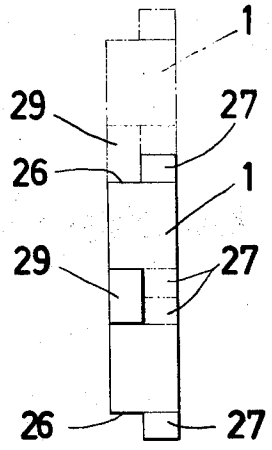
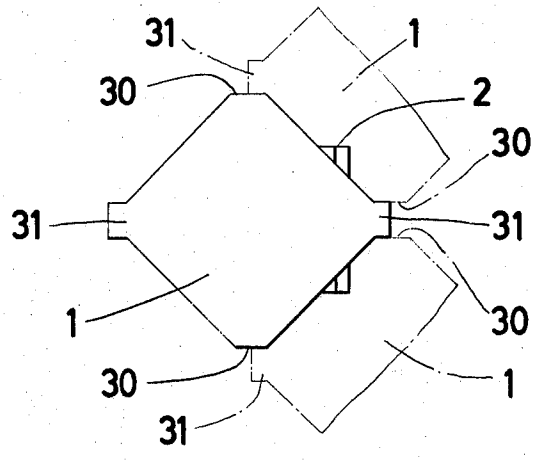


Fig.34.



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Fig.35.

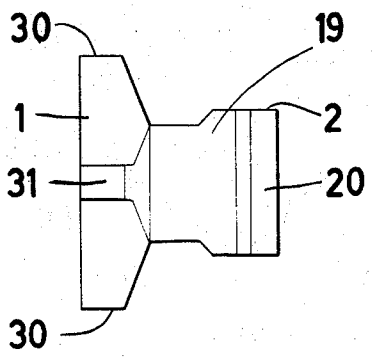


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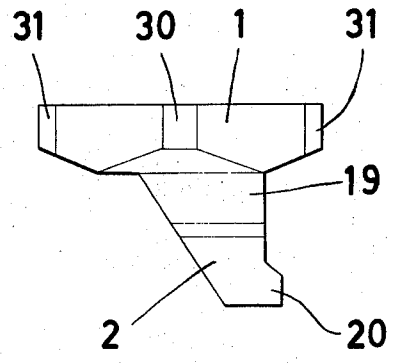


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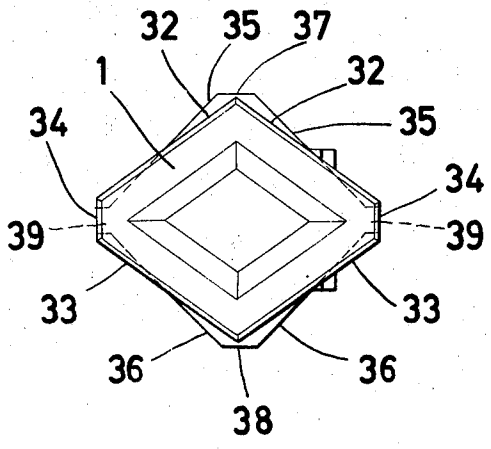


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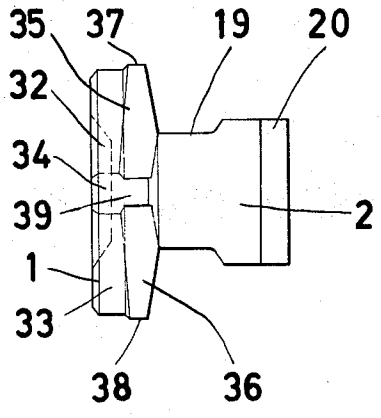
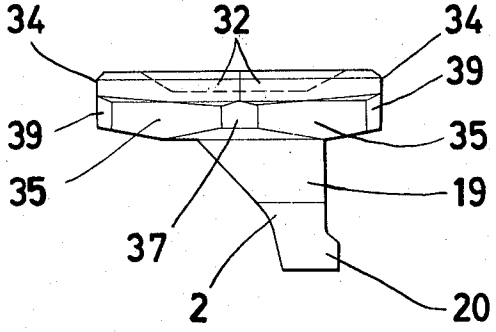


Fig.39.



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Fig.40.

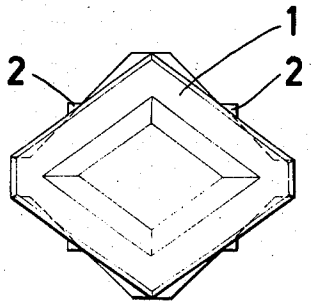


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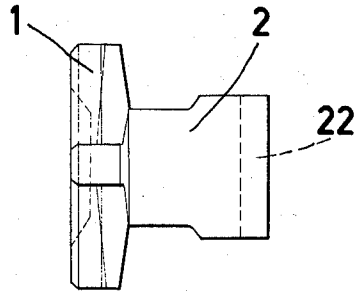


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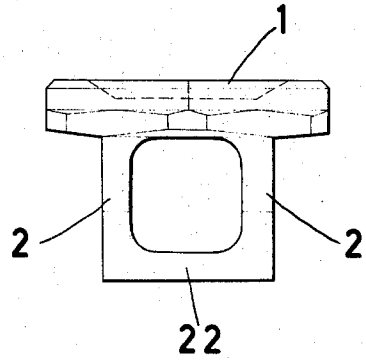


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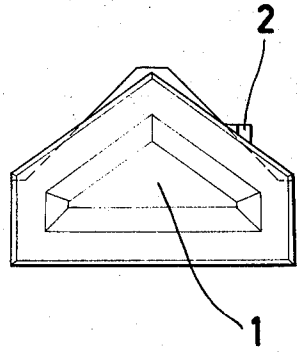
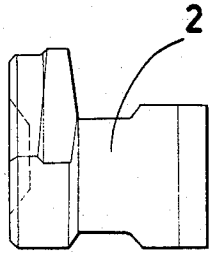


Fig.44.



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Fig.45.

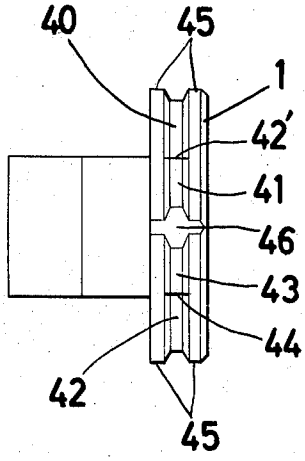


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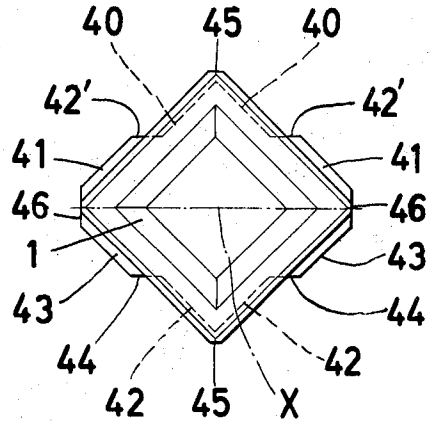


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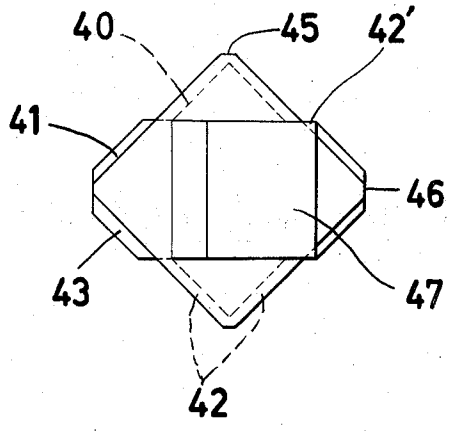
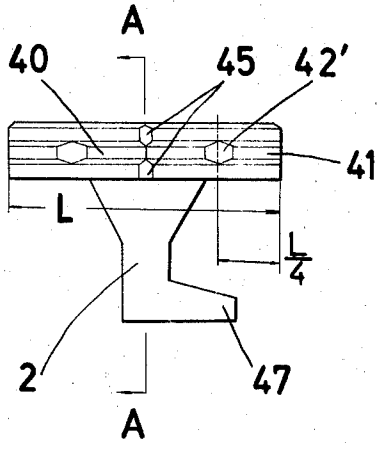


Fig.47.



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Fig.49.

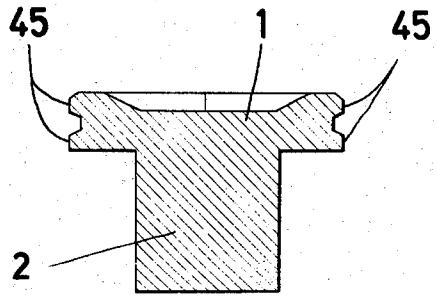


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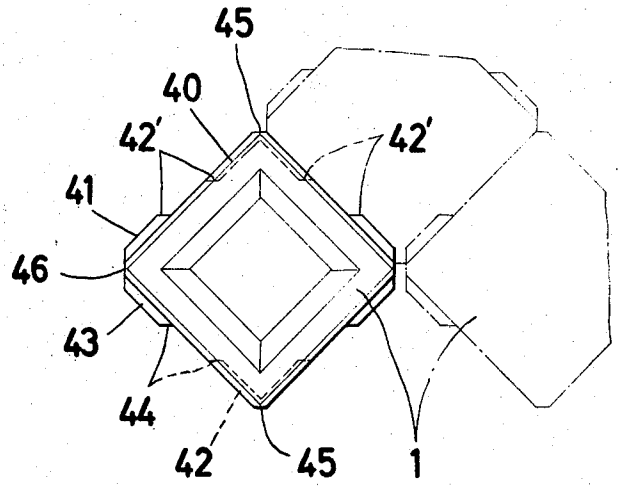
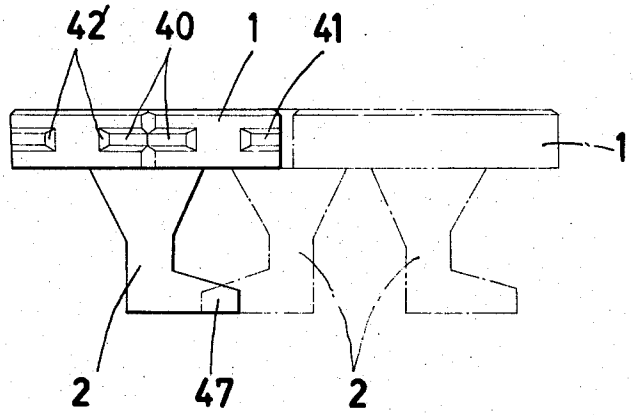


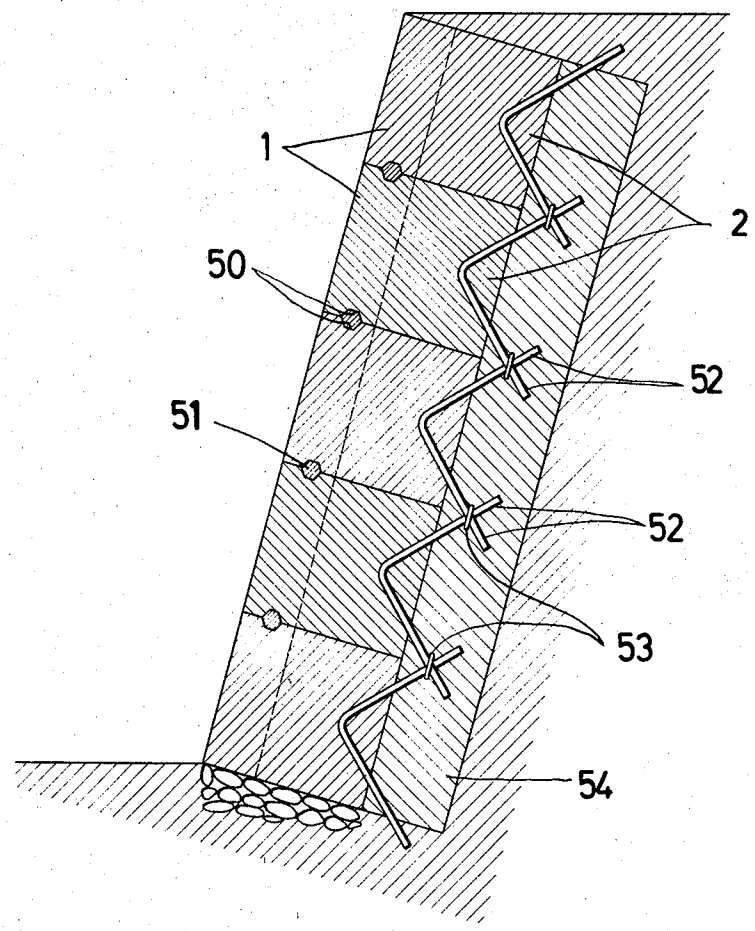
Fig.51.



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Fig.52.



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Attorneys

RETAINING WALL BLOCK

The present invention relates to a block for use in a retaining wall consisting of a base body of a regular square, a rhomb or the like in which a regular tetragon is fundamental in each shape, and a bracing strut integrated with the base body at the rear face thereof.

In the wall formed with conventional blocks, the lower blocks receive a force laterally from the sand pressure or by gravity from the upper blocks, so that there is risk that the rows of blocks become gradually loose toward both sides.

This disadvantage is overcome when a retaining wall is formed from blocks of the present invention. It is an object of the present invention to provide a block having a bracing strut integral with the base body and arranged to overlap with similar bracing struts of other blocks.

Another object of this invention is to prevent the lower blocks from being expanded toward both sides by mounting a horizontal plane portion to the base body and by receiving the load from the upper portion in a state that the plane portions of the individual base bodies of the upper and the lower blocks are overlapped respectively.

Other objects and advantages of this invention will become apparent from a detailed explanation of the embodiments of the present invention taken together with the accompanying drawings.

FIG. 1 is a front view showing a fundamental shape of the valley-piling block according to this invention, FIG. 2 being its side view, and FIG. 3 is a plane view of the same.

FIG. 4 is a front view showing the second embodiment according to the present invention, FIG. 5 being its side view and FIG. 6 is a plane view of the same.

FIG. 7 is a front view showing the third embodiment according to this invention, FIG. 8 being its side view, and FIG. 9 is a plane view of the same.

FIG. 10 is a front view showing the fourth embodiment according to this invention, FIG. 11 being its side view, FIG. 12 being a rear view of the same, and FIG. 13 is a plane view thereof.

FIG. 14 is a front view of the end block formed in a shape of an equilateral triangle having the plane base, and other parts are similar to those of the fourth embodiment, and FIG. 15 is its side view.

FIG. 16 is a front view showing the combination method of the blocks shown in said fourth embodiment, FIG. 17 being its side view, and FIG. 18 is a plane view of the same.

FIG. 19 is a front view showing the fifth embodiment of the present invention, and FIG. 20 is its plan view.

FIG. 21 is a front view showing the sixth embodiment of this invention, FIG. 22 being its side view, and FIG. 23 is a plane view of the same.

FIG. 24 is a front view of the seventh embodiment according to this invention, FIG. 25 being its side view, and FIG. 26 is a plane view.

FIG. 27 is a front view of the eighth embodiment of this invention, FIG. 28 being its side view, and FIG. 29 is a plane view of the same.

FIG. 30 is a front view of the upper or the lower terminal block adaptable to the block shown in the eighth embodiment, and FIG. 31 is its side view.

FIG. 32 is a front view of the ninth embodiment, and FIG. 33 is its side view.

FIG. 34 is a front view showing the 10th embodiment, FIG. 35 being its side view and FIG. 36 is a plane view of the same.

FIG. 37 is a front view showing the 11th embodiment, FIG. 38 being its side view and FIG. 39 is a plane view.

FIG. 40 is a front view showing the 12th embodiment, FIG. 41 being its side view, and FIG. 42 is a plane view of the same.

FIG. 43 is a front view of the upper or the lower terminal block adaptable to the block shown in the 12th embodiment, and FIG. 44 is a side view of the same.

FIG. 45 is a side view showing the 13th embodiment, FIG. 46 being its front view, FIG. 47 being a plane view of the same, FIG. 48 being a rear view of the same and FIG. 49 is a section view taken along the line A–A of FIG. 47.

FIG. 50 is a front view showing the 14th embodiment, and FIG. 51 is a plane view of the same.

FIG. 52 is a longitudinally sectional side view showing an embodiment of piling up of the blocks according to the present invention.

A block having a fundamental shape according to the present invention shown FIGS. 1 to 3 inclusive projects a bracing strut 2 meeting at right angles with a diagonal line X of a base body 1 at the rear face of the regularly tetragonal base body 1, and the rear face of the regularly tetragonal base body 1, and the position of the bracing strut 2 is determined such that the centerline Y of the bracing strut is set aside from one end of the diagonal by a quarter of the length of the diagonal of the base body. 1. The base body 1 may be a rhomb having a difference between a horizontal diagonal and a vertical one, though it is a regular square in the drawings shown.

The bracing strut 2 has a length that each end portion of the upper and lower struts 2, contact when the blocks are stacked as shown in the dotted line of FIG. 1. When the blocks are stacked as shown in FIG. 1, the bracing strut 2 of the upper block is placed on the bracing strut 2 of the lower block, and the bracing struts 2 are vertically and continuously piled up in a straight line, so that the load from the upper part is supported with the bracing struts 2, and the blocks are able to stand by themselves.

In the second embodiment shown in FIGS. 4 to 6 inclusive, the upper and the lower corners of the base body 1 are cut off horizontally to form planes 3, while on the upper and the lower faces of the bracing strut 2 are formed convex 4 and concave portions 5. Since the bracing strut 2 is set to one side of the base body, the blocks of the second embodiment are piled in a manner similar to that shown in FIG. 1. However, planes 3 of the upper and the lower base bodies 1 contact in piling, and the convex portion 4 and the concave portion 5 of the upper and the lower bracing struts 2 are fitted respectively, so that the load is supported by the planes and the upper and lower struts. Also, sideways and front to back displacement of the blocks is prevented by the fitting of the convey portion 4 and the concave portion 5.

In the third embodiment shown in FIGS. 7 to 9 inclusive are formed respectively grooves 6, which reach from the upper end of both upper oblique sides of the base body 1 to their middle parts, and projecting portions 7, which reach from their middle parts to their lower parts, and the border between the groove 6 and the projecting portion 7 is made to be a horizontal plane 8.

Then, to both lower oblique sides of the base body 1 are formed grooves 9, which reach from their lower ends to their middle parts, and projecting portions 10, which reach from their meddle parts to their upper parts, and between the groove 9 and the projecting part 10 is formed a horizontal plane 11 respectively. Also, to the upper and the lower parts of the base body side of the bracing strut 2 are formed grooves 19 extending laterally.

In this case the bracing struts 2 are overlapped vertically similarly to that in the previous example and the blocks are stacked. In this case, however, the block wall is constructed in such manner that the grooves 6 and the projecting portions 7 which are formed at the upper oblique sides of the lower base body 1 are fitted to the projecting portion 10 and the grooves 9 which are formed at the lower oblique sides of the upper base body 1, and that the planes 8, 11 also contact, respectively.

The load from the upper part is received by means of the contact of the overlapped bracing struts, and of the planes 8, 11 respectively as described above, so that there never occurs a force expanding the blocks laterally. And then in this case, by engaging the grooves 6, 9 with the projecting portions 10, 7, each base body 1 can be prevented from front to back displacement.

Between the upper and the lower bracing struts is formed a communicating path by the grooves 19, which can be utilized as a water-discharging hole or to pour concrete for reinforcement.

In the fourth embodiment shown in FIGS. 10 to 13 inclusive, both upper oblique sides of the base body 1 have slowly sloped front inclining planes 12 against a horizontal plane and steeply sloped rear inclining planes 13, and the upper end of the base body 1 is cut off horizontally to form a plane 14.

Also, both lower oblique sides of the base body 1 have slowly sloped front inclining planes 15 against a horizontal plane and steeply sloped rear inclining planes 16, and the lower end of the base body 1 is cut off horizontally to form a plane 17 and both lateral ends of the base body 1 are cut off vertically to form planes 18.

The intersection of planes 12 is in the same plane as plane 14, the intersection of planes 15 is in the same plane as plane 17, and the intersection of planes 13 and 16 are in the same planes as planes 18.

And in this case, are also formed similarly to those in the third embodiment grooves 19 at the upper and the lower parts of the bracing strut 2. Further, at the side face of the end portion of the bracing strut 2 is formed a protrusion 20.

Stacking of these blocks is carried out similarly to those in the other examples, and the bracing struts 2 are over lapped as shown in FIGS. 16 to 18. Then, the base body 1 is prevented from front to back displacement by each contact of the upper front inclining plane 12 and the upper rear inclining plane 13 of the lower base body 1 with the lower rear inclining plane 16 and the lower front inclining plane 15 of the upper base body 1, and the blocks are also prevented from lateral movement by contact of the right and the left planes 18.

The effect of the upper and the lower grooves 19 of the bracing strut 2 in this embodiment is also similar to that in the third embodiment. But, the effect of the protrusion 20 is to reinforce the connection of the bracing strut 2 and concrete or gravel poured into the rear side of each base body 1.

FIGS. 14 and 15 show an end block, of which both upper oblique sides are similar to those of the base body 1 shown in FIGS. 10—13, and the bracing strut 2 is similar, so that its explanation is omitted. However, the lower side forms a bottom level 21 extending over the whole length, and both side planes are extended downwards from the planes 18 and meet at right angles with the bottom level 21. This block can be used at the lowermost part of the wall formed with the blocks if its bottom level 21 is placed downwardly while it can be used at the uppermost part of the wall if its bottom level 21 is placed upwardly.

The block of FIGS. 10—13 may be modified in a manner similar to that described above from a side block or a cover block. Also, the blocks of the first, second and third embodiments may be similarly modified to form end, side or cover blocks.

In the fifth embodiment shown in FIGS. 19 and 20, the base body 1 is similar to the fundamental shape of FIGS. 1 to 3 inclusive, but the shape of the bracing strut 2 is different.

Namely, in this case, a pair of bracing struts 2 is formed in a projecting state to the rear face of the base body 1, and the ends of said both bracing struts are connected with a connecting portion 22. The distance between the centerlines Y of these bracing struts 2 is a half of the length L of the diagonal line X of the base body 1, but these bracing struts may be used without the connecting portion 22.

In the stacking of the blocks shown in this embodiment, the bracing struts 2 at the rear face of each base body 1 overlap, Since on the right and the left bracing struts 2 of the lower base body 1 are placed the bracing struts 2 corresponding to the upper right and left base bodies 1, each base body 1 can stand alone stably with a pair of the bracing struts 2. Between the right and the left bracing struts 2 is poured concrete or the like for connecting the blocks, so that each base body 1 is extremely strongly connected.

The sixth embodiment as shown in FIGS. 21 to 23 inclusive is a modified form of the fifth embodiment.

In said sixth embodiment, the upper and the lower corners are cut horizontally to form planes 23 and at the upper and the lower faces of the bracing struts 2 are formed a convex portion 24 and a concave portion 25.

By the contact of the upper and the lower planes 23, the lower base bodies 1 are prevented from lateral movement, owing to the load from the upper part, and by means of the bracing struts, the blocks are supported stably. Further, by fitting of the convex portion 24 and the concave portion 25 of the upper and the lower bracing struts each block is prevented from the side to side or front to back displacement.

In the seventh embodiment shown in FIGS. 24 to 26 inclusive, a pair of bracing struts is mounted in a projecting state to the rear face of the base body 1, but the end portions of the bracing struts 2 are not connected.

The base body 1 in this embodiment is similar in shape to that of the base body 1 of the third embodiment, and its effect is entirely similar. Therefore, its illustration is omitted. Also, the bracing struts 2 have grooves 19 similarly to that of the third embodiment. The effect of the bracing struts 2 in the seventh embodiment are entirely similar to those of the sixth embodiment.

In the eighth embodiment shown in FIGS. 27 to 29 inclusive, the shape of the base body 1 is entirely similar to that in the fourth embodiment shown in FIGS. 10 to 13 inclusive, and its effect is also the same one, so that its explanation is omitted.

Then, in the eighth embodiment the bracing struts 2 are connected with the connecting portion 22 similarly to that of the fifth embodiment, and at the upper and the lower parts of the root of the bracing struts 2 are formed grooves 19.

FIGS. 30 and 21 show the block of the eighth embodiment formed as an upper or a lower end block, and is used in forming the wall with the blocks of the eighth embodiment. Therefore , the shape of the base body 1 is similar to that in FIGS. 14 and 15 and the bracing strut 2 is similar to that in the eighth embodiment, so that their explanation is omitted.

In the ninth embodiment shown in FIGS. 32 and 33, the shape of the base body 1 is different from the other examples.

The fundamental shape of the base body 1 is a regular tetragon and is thus similar to the other examples, but the front half of the upper and the lower corners of the base body 1 are cut off horizontally to form planes 26, while to the rear half of the upper and the lower corners of the base body 1 are cut off horizontally to form planes 26, while to the rear half of the upper and the lower corners are formed square convex portions 27 having the same widths as planes 26. Also, the rear half of the right and the left corners of the base body 1 are cut off vertically to form planes 28, while to the front half are formed square convex portions 29 having the same widths as the planes 28.

When these blocks are stacked the convex portion 29 of the other base body 1 overlaps the convex 27 portion, the plane 26 is in contact with the upper and the lower faces of the convex portion 29, and the plane 28 and both side faces of the convex portion 27 overlap, thereby the lower base body 1 is prevented from side to side movement owing to the load from the upper block, and by engagement of the convex portions 27, 29, the base body 1 is prevented from the front to back displacement.

Also, a base body having no bracing strut was shown in FIGS. 32 and 33, but it can be modified by mounting the same bracing strut as that in the other examples.

In the 10th embodiment shown FIGS. 34 to 36 inclusive, the upper and the lower corners of the body 1 are cut off to form planes 30, to the right and the left corners of the base body 1 are formed square convex portions 31, and the bracing strut 2 at the rear face of the base body 1 has the grooves 19 and the projecting portion 20 similar to those of the fourth embodiment.

When these blocks are stacked, convex portions 31 are positioned between planes 30 of upper and lower blocks. Thereby the lead from the upper block is received, and the

lower base body 1 is prevented from being expanded laterally and loosened.

In the 11th embodiment show figs. 37 to 39 inclusive, the shape of the base body 1 is different from the other examples and the shape of the bracing strut 2 is the same as the bracing strut 2 in the 10th example.

Namely, the front half of the base body 1 in said 11th example is of a rhomb consisting of the upper right and left front inclining planes 32 and the lower right and left front inclining planes 33, both side corners are cut off to form vertical planes 34.

Then, in the rear half of the base body 1, the upper rear inclining planes 35 are steeper than inclining planes 32, and lower rear inclining planes 36 are also steeper than inclining planes 33.

The upper end of upper rear inclining planes 35 protrudes beyond the inclining planes 32 and is cut off horizontally to form a plane 37. Also, the lower end of lower rear inclining planes 36 protrudes beyond the inclining planes 33 is cut off horizontally to form a plane 38.

To the right and the left corners of the base body 1 formed with the upper and the lower rear inclining planes 35 and 36 are formed in a projecting state square convex portions 39 having their outer end planes formed to be identical with planes 34.

Since the front face of the base body 1 is of similar shape to that of the base body 1 in the fourth embodiment shown in FIGS. 10 to 13 inclusive, the stacked blocks overlap as in the fourth embodiment. Since the rear face of the base body 1 is of the same shape as that of the 10th embodiment show 34 to 36 stacked blocks also overlap similar to the 10th embodiment.

Therefore, the blocks are prevented from loosening owing to the load from the upper block similar to that of the 10th embodiment.

The 12th embodiment shown in FIGS. 40 to 42 inclusive is such that a pair of the bracing struts 2 and the connecting portion 22 are mounted to the base body 1 of the 11th embodiment shown in FIGS. 37 to 39 as in the eighth embodiment shown in FIGS. 27 to 29. The effects obtained are similar to these embodiments so that their detailed explanation is omitted.

The block shown in FIGS. 43 and 44 is an end block which is formed from the block of the 11th embodiment. Therefore, the upper half shape of this base body 1 is similar to the upper half of the base body 1 in the 11th embodiment, and its lower part is similar to the base body of the other upper or lower end blocks. Also, the bracing strut 2 is similar to that in the 11th embodiment, and if the bracing strut 2, is modified in the 12th embodiment, it can be used with the block of the 12th embodiment.

The 13th embodiment shown in FIGS. 45 to 49 inclusive is constructed in such manner that to both upper oblique sides of the base body 1 are formed grooves 40, which reach from the upper ends to their intermediate parts and projecting parts 41, which reach from the intermediate to the lower parts, and the border between the groove 40 and the projecting part 41 is made to be horizontal plane 42'.

To both lower oblique sides of the base body 1 are also formed grooves 42, which reach from the lower ends to the intermediate ends and projecting portions 43 which reach from the intermediate to the upper parts and between the groove 42 and the projecting portion is formed a horizontal plane 44.

Further, the upper and the lower corners of the base body 1 are slightly cut off to form planes 45, and the right and the left corners formed with the projecting portions 41, 43 are vertically cut to form planes 46.

The bracing strut 2 is mounted at the center of the rear face of the base body 1 differently from the other embodiments, and a projecting wall 47 is formed to be L shape from the end portion thereof toward the side thereof. Said projecting wall 47 is formed to reach the part which is a quarter of the 4 length L of the diagonal of the base body 1 from one end of the diagonal.

The blocks in this example are stacked in such a manner that the grooves 40, 42 of the base body 1 are fitted to the projecting portions 43, 41, while the bracing struts 2 are piled up in such manner that the projecting walls 47 of the bracing struts 2 of the upper and the lower blocks are placed in the opposite direction to overlap the end portions of the upper and the lower projecting walls 47. Thereby the blocks are firmly piled up without lateral loosening of the blocks by supporting the load from the upper part by means of the planes 42' and 44 and the projecting walls 47.

In the 14th embodiment of FIGS. 50 and 51, the bracing struts 2 are entirely similar to those of the 13th embodiment and the base body 1 is also almost similar to that the 13th embodiment, and to each oblique sides are mounted the grooves 40, 42 and the projecting portions 41 43. These are, however, short and do not reach the intermediate parts of the oblique sides. Therefore, the two spaced horizontal planes 42' 44 are each formed between the grooves and the projecting portions shown in FIG. 50. But, the effects owing to overlapping of the bracing struts 2 and fitting of the grooves and the projecting portions are completely similar to those in the 13th embodiment.

FIG. 52 shows an embodiment of the stacking of method using blocks according to the present invention. In the example shown in the drawing a groove 50 which reaches over the whole periphery is made at the outer periphery of the base body 1 of the block, and when the blocks are piled up, the grooves 50 located at the upper and the lower sides and at the right and the left sides are opposite to one another to form holes, into which some filling material, such as a mortar, an adhesive or a braidlike filler is filled to form a waterproof wall. Such groove 50 can be formed in each embodiment of the present invention illustrated hitherto, but in some embodiments the waterproof filler can be filled by using shoulders at the outside of the base body 1 without forming the groove 50.

Further, in the example of FIG. 52 it is shown that a reinforced iron 52 projects from the rear end of the bracing strut 2. In stacking the blocks in this case, the upper and the lower parts of the reinforced irons 52 of the bracing struts 2 overlapped up and down are connected that they are bound by a wire 53 or by welding.

Thus, even by connecting the upper and the lower reinforced irons 52, such connecting of the upper and the lower blocks is strengthened, and moreover when the reinforced irons 52 are covered with a concrete layer 54 and the rear faces of the bracing strut 2 are connected as shown in FIG. 52, the wall made up with the blocks can be excessively strengthened by permitting the bracing struts of the blocks piled up and down to be integrated as a post by means of the reinforced irons 52 and the concrete layer 54. Thus, protrusion of the reinforced iron toward the rear face of the bracing strut 2 can be used in all other embodiments.

Also the blocks of each embodiment can be manufactured with reinforced concrete.

Since the blocks according to the present invention can stand alone by receiving the load from the upper part through overlapping of the bracing struts 2 formed at the rear face of the base body as mentioned above, it is easy to stack the blocks and a stable wall is constructed. The lower base bodies are prevented from lateral displacement due to the load from the upper part by forming horizontal planes at suitable positions of the base body, so that the blocks never loosen. Thus, the blocks are self-supporting, so that if pebbles, concrete or the like are poured into the space formed between the bracing struts 2 of each block, an exceedingly firm wall can be formed.

What I claim is:

1. A block consisting of a base body having the form of a polygon with two opposite corners thereof cut off to form planes parallel to a diagonal line between two other opposite corners, and a bracing strut integral with said base body and having a centerline, said centerline intersecting said diagonal line at right angles at a point which is spaced one-quarter of the length of said diagonal line from one end thereof.

2. A block as claimed in claim 1, wherein said bracing strut has upper and lower faces generally parallel with said planes, and each of said faces has a concave portion and a convex portion therein.

3. A block as claimed in claim 1, wherein said base body has at said two other opposite corners square convex portions, and wherein said bracing strut has upper and lower faces, each of said faces having grooves therein, and a vertical projecting portion.

4. A block as claimed in claim 3, wherein said base body further comprises a section on the side of said base body opposite said bracing strut, said section in the form of a polygon with opposite surfaces thereof in the same planes as the ends of said square convex portions and with opposite corners thereof in said planes of said two opposite corners of said base body.