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NL-5600 AP Eindhoven(NL)(54) **Facade cladding system.**

(57) The invention relates to a facade cladding system provided with vertically extending carrying profiles (1) having a U-shaped cross section and secured to a building (2) or the like by means of connecting means and with ceramic tiles coupled to the carrying profiles (1) by means of coupling means. The carrying profiles are adjustable with respect to the connecting means in their longitudinal direction and transverse to their longitudinal direction. Each of the U-shaped carrying profiles has been provided with flanges (6,7) lying in one plane and joining the free ends of the legs of the carrying profile, in each of said flanges (6,7) being provided a row of keyhole-shaped recesses (10,11) extending one above the other. The keyhole-shaped recesses (10) in the one flange (6) are wider than the keyhole-shaped recesses (11) in the other flange (7). At the rear side of the ceramic tiles there are bonded mushroom-shaped coupling means, said coupling means fitting in said keyhole-shaped recesses.

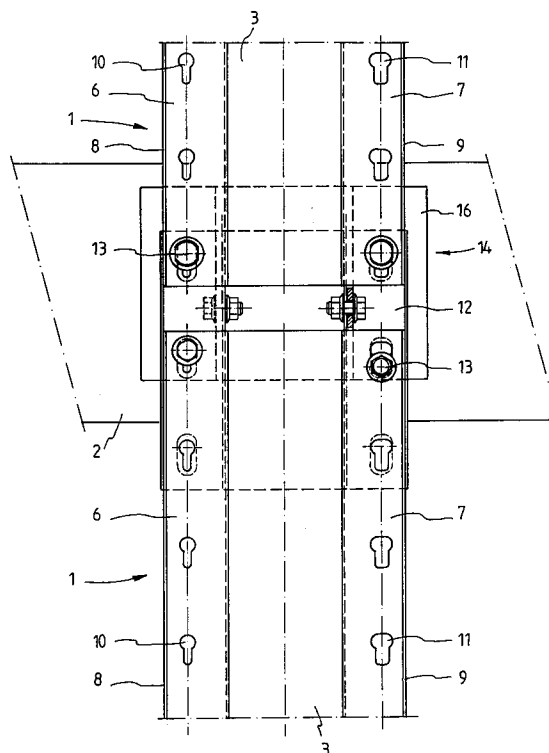


Fig 1

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The invention relates to a facade cladding system provided with vertically extending carrying profiles having a U-shaped cross section and secured to a building or the like by means of connecting means and with ceramic tiles coupled to the carrying profiles by means of coupling means, whereby a ceramic tile is supported by two spaced carrying profiles near its vertical edges.

A similar facade cladding system is known from DE-A-3703350. With this known system a clinker plate which will be exposed to view is attached, by means of a layer of mortar, to a carrier plate surrounded by an angle section. To said angle section there are secured hooks, by means of which the plate-shaped elements can be suspended from bolts which are inserted into parallel legs of a U-shaped profile secured to a wall of a building or the like by means of angle sections arranged on both sides of said U-shaped profile. In such cladding systems there is formed sufficient space between the plate-shaped elements and the further part of the building to permit a ventilation in said space.

However said known structure has various disadvantages. So the combination of a clinker plate, a layer of mortar and a carrier plate surrounded by an angle section leads to a relatively great weight of the plate-shaped cladding elements, involving also a heavy structure of the carrying profiles and the like.

A further disadvantage of said known structure is that the cladding elements can shift parallel to the longitudinal direction of the bolts whereon they are coupled. This can lead to an irregular arrangement of the cladding elements in the facade which is aesthetically unacceptable.

The object of the invention is to obtain a facade cladding system of the kind set forth wherein the drawbacks of the known construction can be overcome.

According to the invention this can be achieved in that the carrying profiles are adjustable with respect to the connecting means in their longitudinal direction and transverse to their longitudinal direction and each of the U-shaped carrying profiles has been provided with flanges lying in one plane and joining the free ends of the legs of the carrying profile, in each of said flanges being provided a row of keyhole-shaped recesses extending one above the other, whereby the keyhole-shaped recesses in the one flange are wider than the keyhole-shaped recesses in the other flange, whilst at the rear side of the ceramic tiles there are bonded mushroom-shaped coupling means, said coupling means fitting in said keyhole-shaped recesses.

In using the structure according to the invention the supporting profile can be precisely arranged in

a simple way, so that the ceramic tiles finally suspended on the carrying profile will come to lay precisely in a plane, which is not only aesthetically desirable, however also prevent occurring of undesired stresses in the thin ceramic tiles. Thereby the ceramic tiles can be coupled quickly and simply on the supporting profiles by means of the mushroom-shaped coupling means which can be easily provided on the ceramic tiles. As thereby the keyhole-shaped recesses in the one flange have been wider than the keyhole-shaped recesses in the other flange it is obtained, that the smallest of said keyhole-shaped recesses take care for precisely positioning the ceramic tiles, whilst by the wider form of the other keyhole-shaped recesses there can be taken up easily possible manufacturing tolerances and settings. Also there are prevented undesired shiftings of the mounted ceramic tiles. The facade cladding may have thereby a relatively light structure.

It is noted that in DE-A-3621010 it has been proposed to provide undercut recesses in the rear sides of ceramic plates to be used for facade claddings, said recesses functioning to receive the ends of mounting elements secured to carriers. In this case ceramic plates having a thickness of 9-12 cm are considered, however. With conventional ceramic tiles having a thickness of 8-10 mm, however, it will not be possible to use such a construction.

From EU-A-0221262 it is furthermore known to provide mounting elements on the rear sides of tiles, by using glaze as a bonding agent. Screws are mentioned as mounting elements. Said application does not indicate in what manner such tiles provided with screws can be combined with carriers in a simple manner to form an acceptable cladding system.

Further there is known from DE-A-3044664 a system for covering inner walls, whereby first there are fixed mounting plates to the inner wall, said mounting plates being provided with a great number of keyhole-shaped holes above and besides each other in a particular pattern. On said mounting plates there can be fixed tiles which on the rear sides has been provided with mushroom-shaped means fitting in the keyhole-shaped holes.

Said structure is not suitable for outer walls whereby there has to be a ventilation space between the ceramic tiles.

Further said keyhole-shaped holes provided in a regular pattern and the coupling means has to have sufficient play in order to take up manufacturing tolerances, so that a good fixing of the ceramic tiles will not be possible.

From US-A-2562754 there is known a facade cladding system whereby there are used carrying profiles having a U-shaped cross section, whereby

the free ends of the legs of said U-shaped carrying profiles are joined by flanges lying in a single plane. However said flanges are used for fixing the carrying profiles to the building or the like. For mounting the plate-shaped elements there have been provided holes in the webs of the carrying profiles connecting the legs of the carrying profile for accommodating coupling means bend from resilient steel wire by means of which the plate-shaped cladding elements are fixed to said profiles.

So in said known structure the carrying profiles can not be used as gutters for discharging rain-water or the like which enters through slits between adjacent plate-shaped elements and so the facade cladding has to be sealed by means of sealing material provided between the plate-shaped elements. By using the structure according to the invention the use of such sealing material can be avoided.

The invention will be explained in more detail hereafter with reference to an embodiment of the construction according to the invention illustrated in the accompanying figures.

Figure 1 is a front elevation view of abutting parts of upright carrying profiles intended to support plate-shaped elements.

Figure 2 is a side view of figure 1.

Figure 3 is a horizontal section of figure 1.

Figure 4 is a rear view of a part of a carrying profile.

Figure 5 is a smaller-scale rear view of a ceramic tile.

Figure 6 is a view of the tile depicted in figure 5, partly in section and partly in side elevation.

Figure 7 is a view of a mushroom-shaped coupling means.

Figure 8 is a view of figure 7, according to the arrow VIII in figure 7.

Figure 9 shows a damping means made of an elastomeric material.

The facade cladding structure comprises carrying profiles 1, which are intended to support the plate-shaped elements. For this purpose the carrying profiles are secured to the wall of a building or the like. In the illustrated embodiment the carrying profiles are mounted on horizontally extending beams or floors 2, which form part of a frame (not shown) of a building or the like.

Dependent on the length of the profiles used and the height of the clad facade several vertically arranged carrying profiles 1 may be arranged in line, as is depicted in figures 1 and 2. Furthermore it will be apparent that the upright profiles will be regularly spaced in horizontal direction, whereby the mutual centre distances of the carrying profiles, when measured in horizontal direction, will be adapted to the width of the plate-shaped elements to be supported by the carrying profiles.

As will be apparent in particular from figure 3 each carrying profile is provided with a web part 3 which, together with two legs 4 and 5 joining the ends of said web part and extending perpendicularly thereto, forms a U-shaped part of the carrying profile 1.

Flanges 6 and 7 extending parallel to the web part 3 join the ends of the legs 4 and 5 respectively remote from said web part 3, said flanges extending towards the outside from the ends of the legs 4 and 5 and being located in one plane. The ends of the flanges 6 and 7 are bent perpendicularly in a direction away from the web part 3, so as to form stiffening edges 8 and 9 respectively.

As appears in particular from figure 1 keyhole-shaped recesses 10 and 11 respectively are provided in the flanges 6 and 7 of the carrying profile, in such a manner that the wider parts of said recesses are located at the upper sides of said recesses, as will be apparent from figure 1.

As will furthermore be apparent from figure 1 the recess 11 is wider than the recess 10 along its entire height, for a purpose yet to be described in more detail hereafter.

As furthermore appears from figures 1-3 the ends directed towards each other of aligned carrying profiles can be attached together by means of a coupling piece 12, whose section (figure 3) corresponds with the section of the carrying profile 1 and which abuts against the rear sides of the ends of the carrying profiles to be coupled together. The coupling piece 12 is thereby fixed to the relevant ends of the carrying profiles 1 by means of bolts 13 passed through the keyhole-shaped recesses 10 and 11. For connecting the carrying profiles to the building, to the beams or floors 2 in the present case, use is made of supports 14, which each have a plate 16 abutting against said beam or floor 2 and being secured to the beam or floor 2 by means of bolts 15. Two parallel wings 17 extending perpendicularly to the plate 16 are secured to the plate 16, the coupling pieces 12 fitting between said wings 17 (figure 3).

Slotted holes 18 extending perpendicularly to the longitudinal direction of the carrying profiles 1 are provided in the legs of the coupling piece 12 abutting against the legs 4 and 5 of the carrying profiles. Slotted holes 19 are provided in the wings 17 of the support 14, said slotted holes extending parallel to the longitudinal direction of the carrying profiles 1. The carrying profiles are secured to the support 14 by means of bolts 20 passed through said slotted holes 18 and 19 namely through slotted holes 18 situated in a part of the legs of the coupling piece 12 situated between the opposite end of the carrying profiles 1 fixed to said coupling piece 12. It will be apparent that by using said slotted holes 18 and 19 an accurate required ad-

justment to the carrying sections, both in vertical direction and in direction perpendicularly to the front surface of the facade eventually to be formed is possible.

Once the carrying profiles 1 are thus secured, arranged as required, to a building or the like the plate-shaped elements can be mounted on the carrying profiles.

The plate-shaped elements are formed by ceramic tiles 21, which have a thickness of e.g. 8 à 9 mm and a length and width of e.g. 44 mm. As will be apparent from figures 5 and 6 the tile is at its rear side provided with a thickened edge 22 extending along the circumference of the tile, as well as with e.g. three elevated ribs 23 extending across the rear side of the tile and e.g. three ribs 24 extending perpendicularly to said elevated ribs, whereby the ribs 23 and 24 intersect one another in nine points of intersection 25, said points of intersection being provided in a regularly distributed pattern on the rear side of the tile, as will be apparent from figure 5.

On the rear side of each tile a required number of mushroom-shaped coupling means 26 are provided, as is illustrated in figures 7 and 8. The mushroom-shaped means is provided with a circular base plate 27, in which two grooves 28 and 29 intersecting each other perpendicularly are provided. A connecting piece 30 joins the grooved side of the base plate, said connecting piece having a smaller diameter than the base plate 27, whilst near the connection of the connecting piece 30 to the base plate 27 a circular groove 31 is provided in the connecting piece.

A shaft 32 having a circular section connects to the side of the connection piece 30 remote from the base plate, said shaft at its end remote from the connecting piece 30 being provided with a thickened head 33 having a more or less conical section.

When the mushroom-shaped coupling means 26 illustrated in figures 7 and 8 are being provided on the rear side of the ceramic tile 21 a coupling means 26 is positioned in one of the points of intersection 25 in such a manner that the projecting ribs 23 and 24 slip into the grooves 28 and 29. The mushroom-shaped coupling means is thereby bonded to the rear side of the tile with a suitable bonding agent. Normally four coupling means will be bonded to the tile in the intersections 25 located nearest the four corner points of the tile. When finishing facade claddings at the corners, at the location of joints with windows or doors or the like, it may be necessary to use only part of the tile illustrated in figure 5. In that case the tile may be cut to the required size and coupling means may be provided in other intersections 25 in order to enable a good attachment of such part of a ce-

ramic tile after all.

Preferably damping means 34, such as are depicted in figure 9, are provided on the coupling means prior to the mushroom-shaped coupling means being mounted on the carrying profiles 1. Such a damping means 34 formed of an elastomeric material, such as a rubber or a plastic material, comprises a cylindrical shell 35, whereby an inwardly directed collar 36 joins one end of said shell 35. An upper wall 36' forming part of a cone shell joins the end of the cylindrical shell 35 remote from the collar 36. Said wall part 36' has a centrally located hole 37 in its centre.

As is illustrated in particular in figure 3 the damping means 34 may be provided on the mushroom-shaped connecting means 26 by sliding the damping means over the mushroom-shaped means 26 in such a manner that the collar 36 will come to lie in the groove 31, whilst the head 33 is passed through the opening 37.

It will be apparent that the ceramic tiles thus provided with coupling means can be coupled to the carrying profiles 1 whereby, as will be apparent in particular from figure 3, a carrying profile will support the ends of two ceramic tiles directed towards one another, whereby each tile is supported in two points located one above the other. In other words, a tile is supported by two spaced apart carrying profiles 1, whereby two mushroom-shaped connecting means located one above the other will be received in keyhole-shaped recesses 11, and the mushroom-shaped coupling means located one above the other at the other side of the tile will be accommodated in slotted holes 10. Because the one pair of mushroom-shaped coupling means of a tile is thus received in wide keyhole-shaped recesses and have some play therein, whilst the other mushroom-shaped coupling means are received in the narrower keyhole-shaped recesses with a tight fit, the tile in question is secured against lateral movement, whilst manufacturing tolerances and/of expansions as a result of heat and the like can still be taken up.

As is furthermore illustrated in figure 4 knurls 38 are provided on the rear sides of the flanges 6 and 7, near the widest parts of the keyhole-shaped recesses. In this way friction between the flanges 6, 7 and the coupling pieces 12 near said mounting bolts can be increased.

As will be furthermore be apparent from figure 3, the elastomeric damping means 34 will be retained between the connecting pieces 30 of the coupling means and the flanges 6 and 7 respectively after the tiles have been provided. Because of this it is prevented that the tiles can flap with respect to the carrying profiles and possibly produce unpleasant noise thereby.

As is apparent from figures 2 and 3 the con-

struction has been made such that the boundary edges of tiles disposed above and beside one another are spaced apart by some distance. Said distance has been made so that a tile limits a possible upward movement of a tile therebelow, e.g. due to wind load, in such a way that tiles can not work loose unintentional. However when a particular tile is broken it is only necessary to move two tiles disposed thereabove upwards a little, eliminating the interspaces between the tiles, after which the broken tile can be removed and a new tile can be provided without having to remove other tiles from the facade construction. After the new tile has been provided the two tiles located thereabove can be moved back again into their correct position.

As is furthermore illustrated in figure 3 an insulating material 39 may be provided in a conventional manner behind the facade cladding thus formed of ceramic plates.

Claims

1. A facade cladding system provided with vertically extending carrying profiles (1) having a U-shaped cross section and secured to a building or the like by means of connecting means (12, 14) and with ceramic tiles (21) coupled to the carrying profiles (1) by means of coupling means (26), whereby a ceramic tile (21) is supported by two spaced carrier profiles (1) near its vertical edges, characterized in that the carrying profiles (1) are adjustable with respect to the connecting means in their longitudinal direction and transverse to their longitudinal direction and each of the U-shaped carrying profiles (1) has been provided with flanges (6, 7) lying in one plane and joining the free ends of the legs (4, 5) of the carrying profile (1), in each of said flanges (6, 7) being provided a row of keyhole-shaped recesses (10, 11) extending one above the other, whereby the keyhole-shaped recesses (11) in the one flange (7) are wider than the keyhole-shaped recesses (10) in the other flange (6) whilst at the rear side of the ceramic tiles (21) there are bonded mushroom-shaped coupling means (26), said coupling means (26) fitting in said keyhole-shaped recesses.
2. A facade cladding system according claim 1, characterized in, that the connecting means (12, 14) comprise coupling pieces (12) mounted on the carrying profiles (1) as well as supports (14) fixed to the building, whereby the coupling pieces and the supports have been connected with each other by means of bolts, which are passed through slotted holes (18,

19) extending in the longitudinal direction of the carrying profiles (1) and perpendicular to said longitudinal direction of the carrying profiles (1).

3. A facade cladding system according claim 2, characterized in, that the ends of aligned carrying profiles (1) directed towards each other have been coupled with each other by means of coupling pieces (12) having a cross section corresponding with the cross section of the carrying profiles (1), whilst in parts of the legs of the coupling piece (12) situated between the ends of the carrying profiles (1) directed towards each other, there has been provided slotted holes (18) extending transverse to the longitudinal direction of the supporting profiles (1) for fixing plate-shaped parts (17) of the support (14) lying against the outer sides of said legs of the coupling piece (12), whilst in said plate-shaped parts (17) there has been provided slotted holes (19) extending in the longitudinal direction of the carrying profiles (1).
4. A facade cladding system according any of the preceding claims, characterized in, that a ceramic tile (21) is at its rear side provided with ribs (23, 24) intersecting each other perpendicularly, which are provided in a regular pattern, and that a coupling means (26), on its surface to be bonded to the tile, is provided with two grooves (28, 29) intersecting each other perpendicularly, in such a manner that parts of two intersecting ribs are received in said grooves (28, 29).
5. A facade cladding system according to any one of the preceding claims, characterized in that the ceramic tile (21) is provided with four coupling means (26), which are arranged in pairs, one pair above the other.
6. A facade cladding system according to any one of the preceding claims, characterized in that damping elements (34) made of an elastomeric material are provided on the mushroom-shaped coupling means (26).
7. A facade cladding system according to any one of the preceding claims, characterized in that the flanges (6, 7) of the carrying profiles (1) are knurled (38) at the side remote from the ceramic tiles, near the widest upper parts of the keyhole-shaped recesses (10, 11).
8. A ceramic tile (21) provided with mushroom-shaped coupling means (26), obviously intend-

ed for being used in a facade cladding system according to any of the preceding claims.

9. A carrying profile (1) provided with keyhole-shaped recesses (10, 11) obviously intended for being used in a facade cladding system according to any one of the preceding claims.

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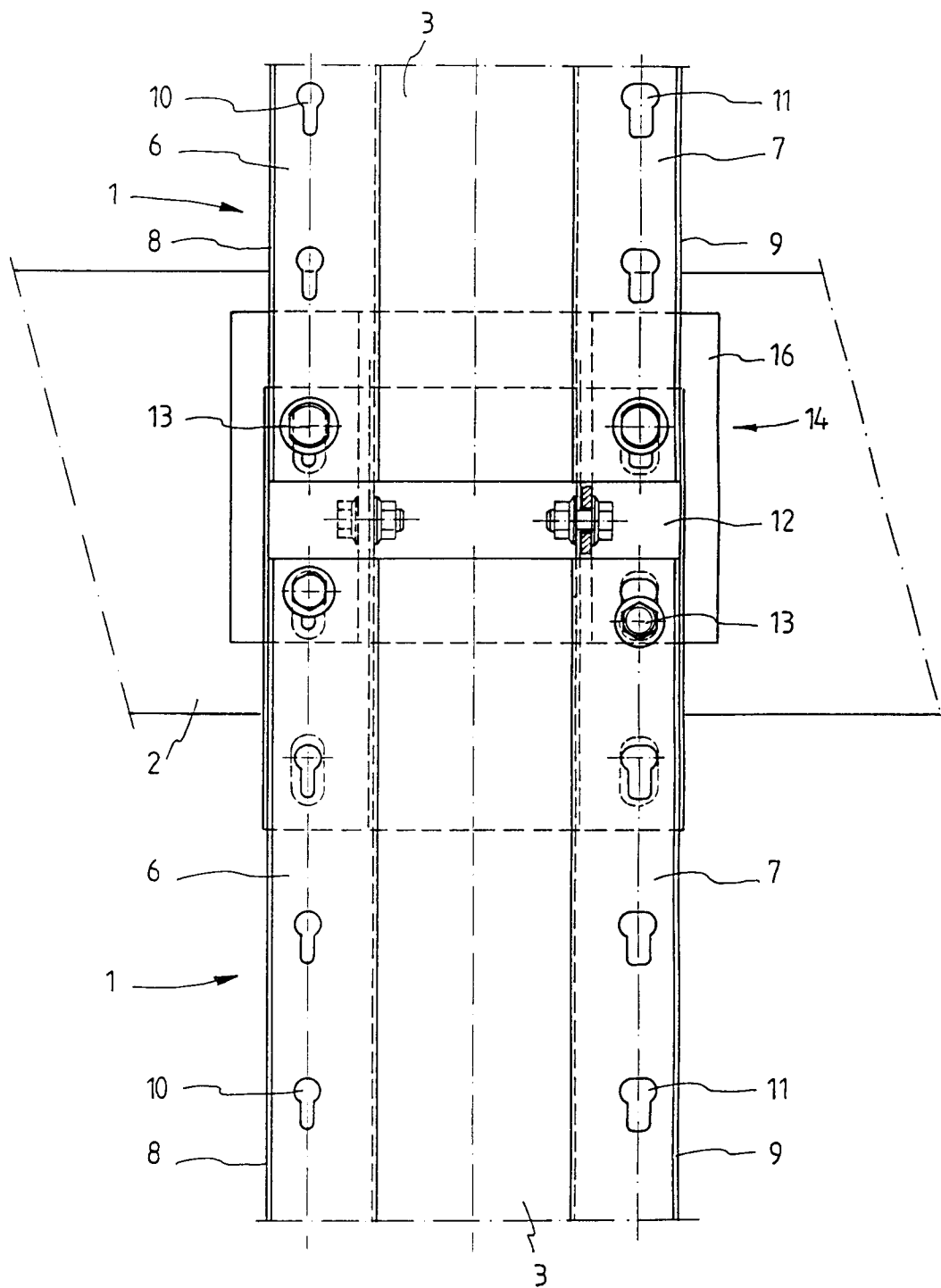


Fig 1

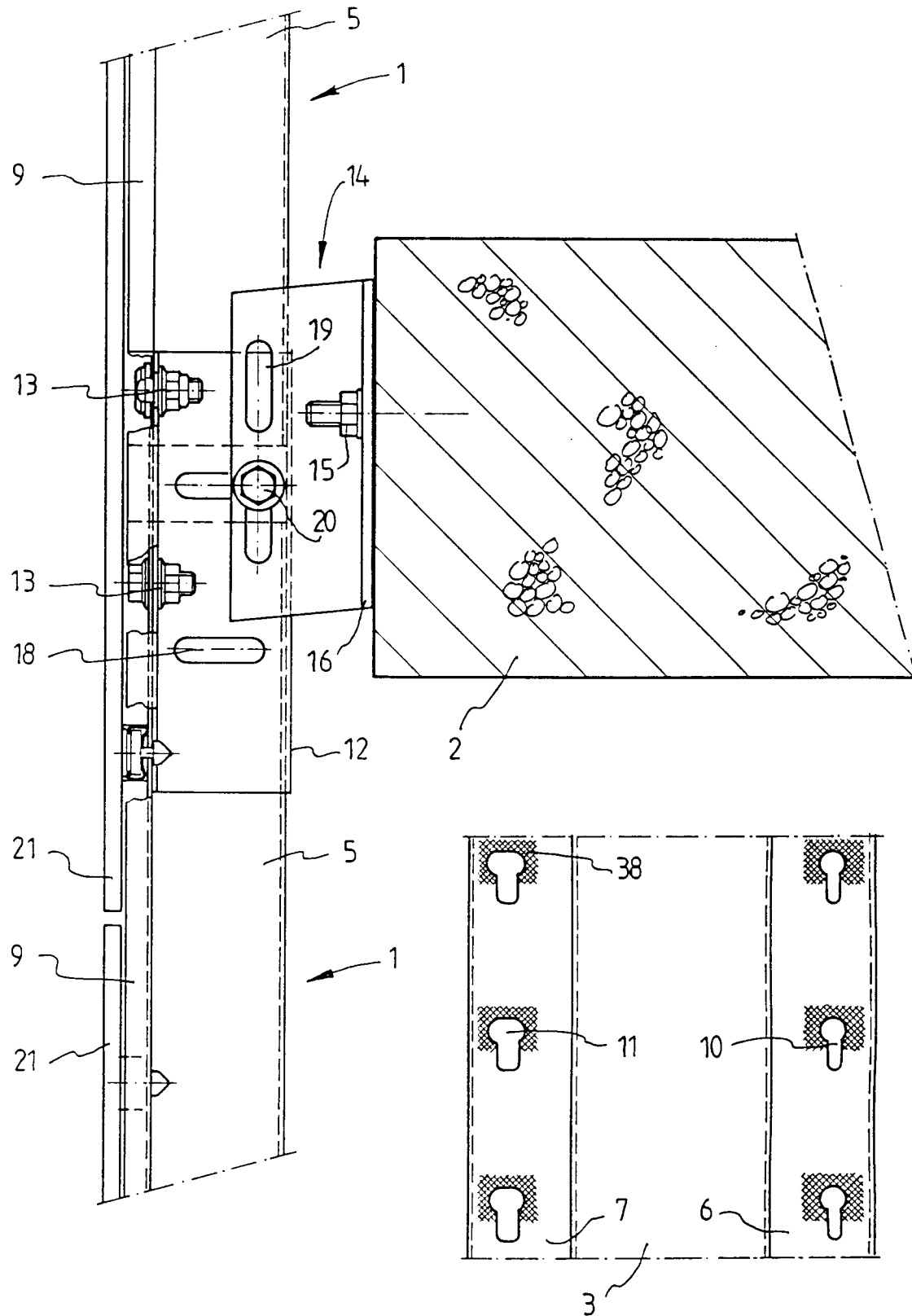


Fig 2

Fig 4

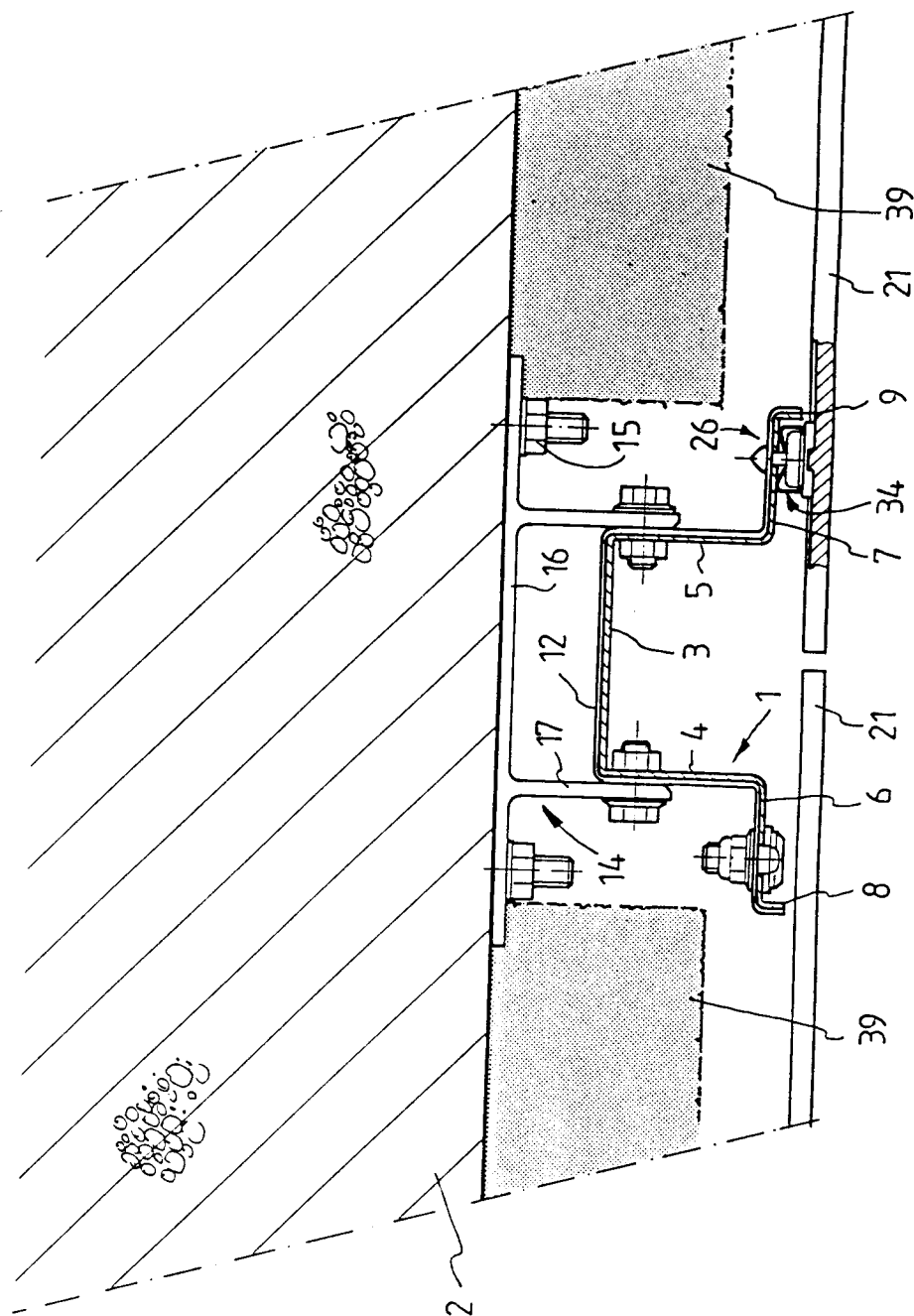


Fig 3

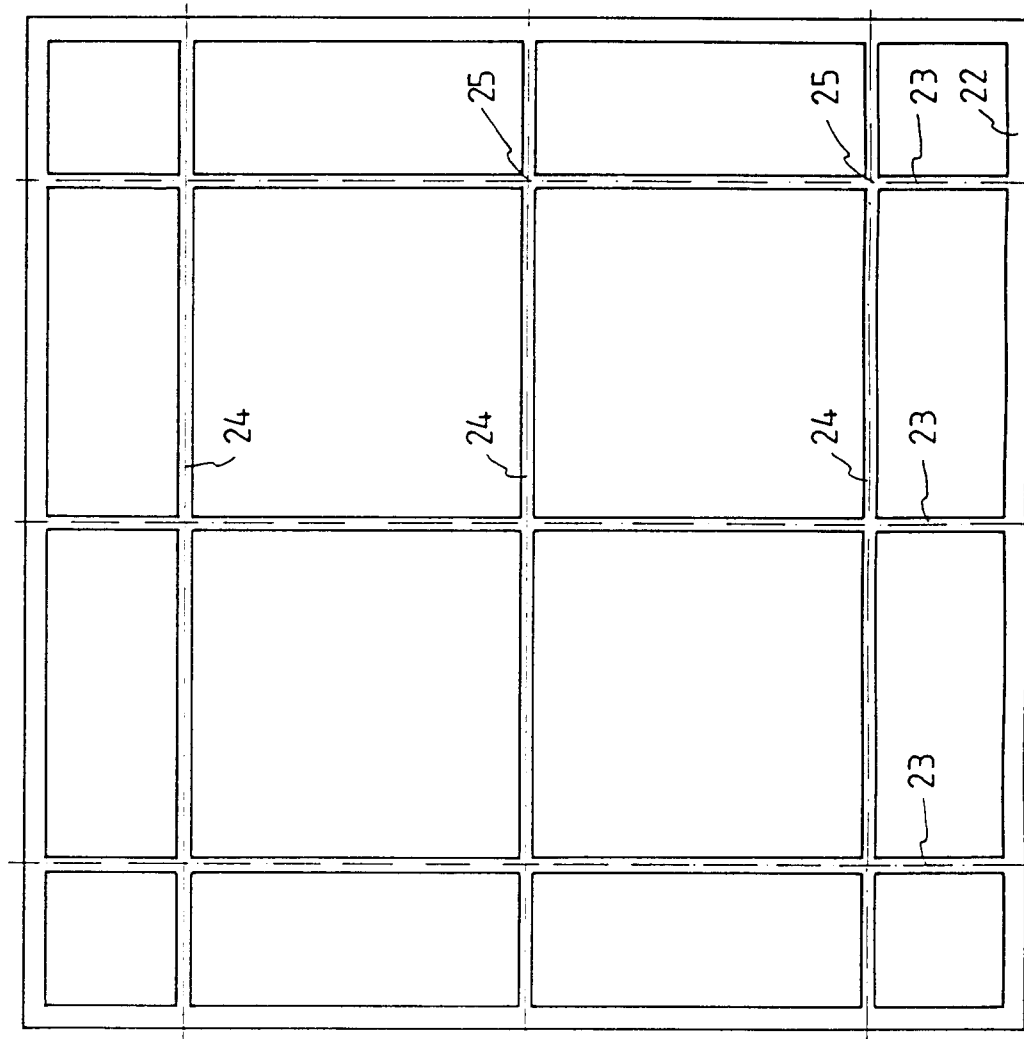


Fig 5

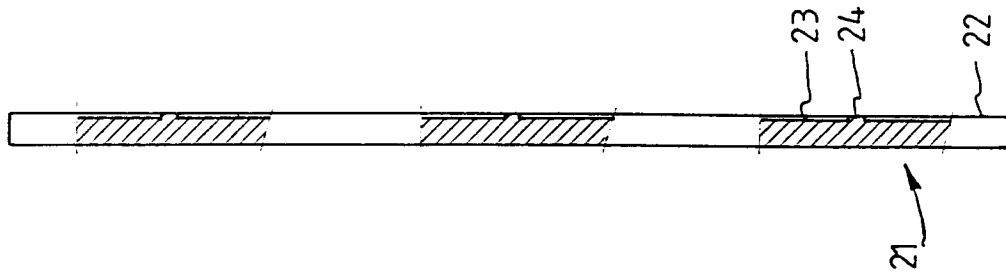
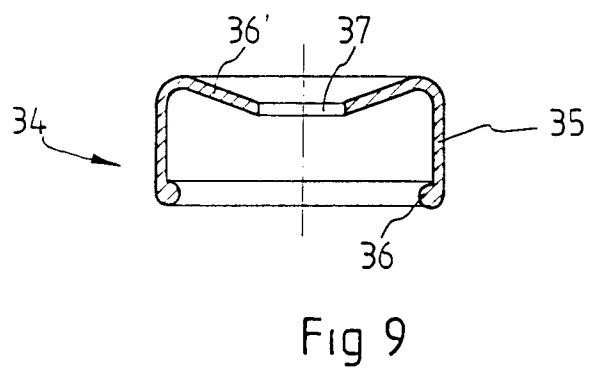
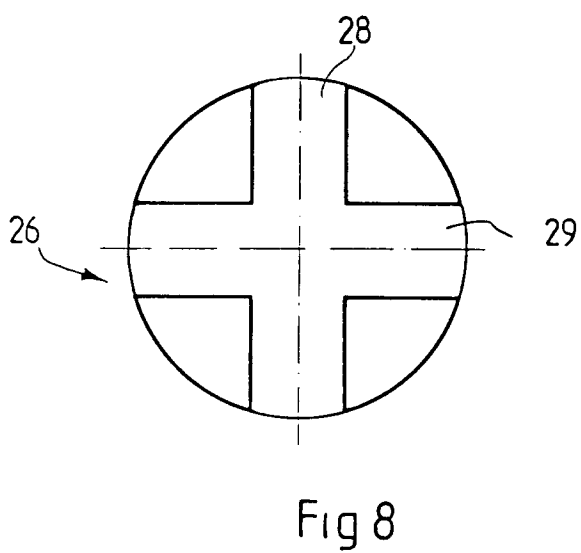
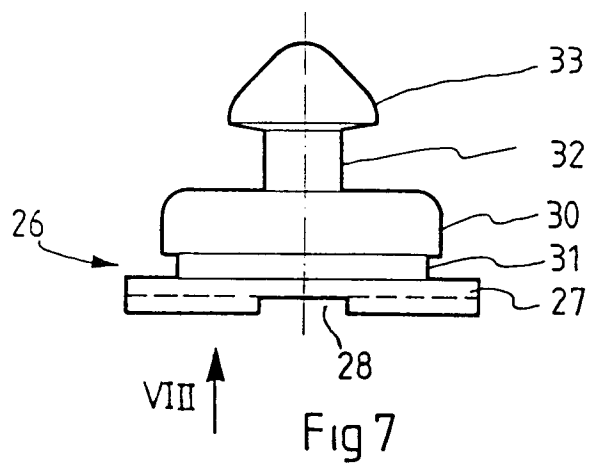


Fig 6





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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3433

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US-A-2 562 754 (VAN UUM ET AL.) * column 2, line 39 - column 3, line 20; figures 2,3,9,12 *	1,9	E04F13/14 E04F13/08
D,A	DE-A-3 044 664 (HATTENSAUER) * page 8, line 11 - page 8, line 1; figures 8,9 * * page 13, line 29 - page 15, line 3 *	1,8,9	
A	FR-A-2 206 772 (CERNESSON) * figure 1 *	5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E04F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01 APRIL 1992	Examiner MYSLIWETZ W. P.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document I : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			