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(54) Method for producing a floor part or ribbed floor, and sheet of a thermally insulating material for floor parts.

(57) Method to manufacture a component part for a floor which in combination with several other component parts to compose a concrete floor, which floor (1) is provided on the downward facing surfaces with thermally insulating material as an encasing covering, and which composed concrete floor consists of a concrete slab (2) which is provided underneath with concrete ribs (3) at regular intervals, first an element (5) is cut out of a sheet (4) of thermally insulating material from a side of the sheet in the lengthwise direction, which element is L-shaped, one leg (7) of the L-shaped element (5) being formed from a part of the height of the side (6) of the sheet (4), in such a way that the end of the short leg (7) coincides with the underside (8) of the sheet (4), and the long leg (9) of the L-shaped element (5) being cut out of the inside of the sheet (4). Then the element (5) cut in an L-shape is taken out of the sheet (4), the element (5) cut in an L-shape is then placed in such a way that one leg (9) points upwards and the other leg (7) outwards, and in that the recess (10) of a sheet (4) is then placed on the upward pointing leg (9) that they form a shuttering, which shuttering is finally filled with concrete. So component parts which in cross-section are L-shape, U-shape, T-shape can be manufactured.

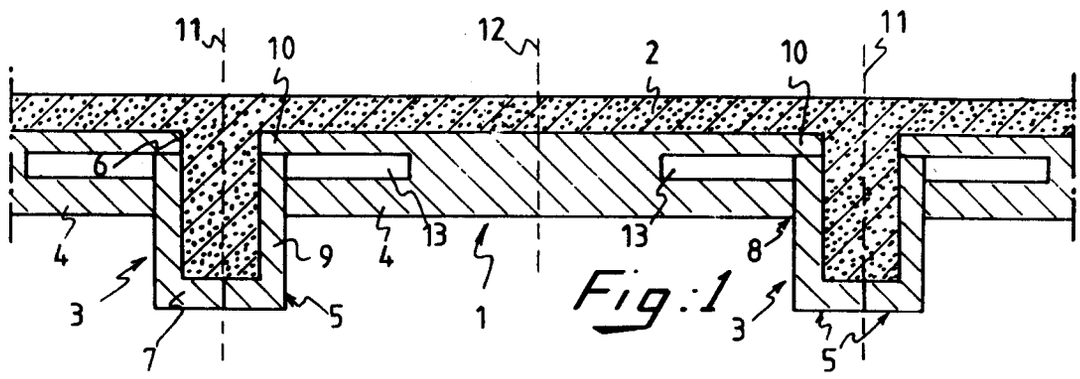

Fig. 1

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The invention relates to a method for producing a floor part which is used to be combined with several floor parts to form a concrete floor, which floor is provided on the downward facing surfaces with thermally insulating material as an encasing covering, and which concrete floor comprises a concrete slab which is provided on the underside with concrete ribs at regular intervals, and also a sheet of a thermally insulating material for use in one of the methods for producing a floor part or a concrete floor.

A concrete floor comprising a concrete slab provided at regular intervals on the underside with concrete ribs which can assume all kinds of shapes, which floor is provided on the underside with a layer of thermally insulating material, is generally known. In the recent past the most commonly used concrete rib has been one in which the cross-section corresponds to an inverted T-shape. Developments in building methods have led to more and more concrete ribs now being used with other cross-sections, depending on the spans and weights of floors. These floors are used as ground floors, also provided with a so-called encasing covering, and made of a thermally insulating material.

Such ribbed floors can be assembled on the building structure from a number of concrete ribs and parts of a thermally insulating material placed between said ribs, following which concrete is poured on the ribs and the parts placed there, said parts also serving as formwork. In order to increase the thermal insulation of the floor, the ribs are preferably also encased with thermally insulating material. The essentially sheet-type parts are generally provided on one side of each part with a flange-shaped extension which is pushed around the adjacent concrete rib during the placing of a sheet-type part.

Another known system is that in which concrete ribs with an inverted T-shaped cross-section are placed in the building structure at a certain distance from each other; C-shaped polystyrene sections abutting each other near the underside are then pushed around the flanges of the ribs projecting on either side of the ribs, following which the sheet-type elements to be placed between the ribs are laid on said sections. Such a system is known, for example from Dutch Patent Application 7,907,756 and Dutch Patent Application 8,006,287.

Another known design for producing ribbed floors is that in which the ribs, at least the bottom parts of the ribs, are poured into a U-shaped polystyrene casing in the concrete factory. The good adhesion of polystyrene to the concrete produces a concrete rib in the case of which the sheet-type parts to be inserted in the building structure between the regularly spaced ribs can fully or partially find their bearing on the legs of the U-shaped casing of a concrete rib without said casing becoming detached.

Another method which is increasingly being used nowadays for assembling ribbed floors is that in which floor parts are prefabricated as completely as possible in the concrete factory and then combined in the building structure. The parts are composed of a concrete slab which near the underside is provided with one or more concrete ribs at certain intervals lying parallel to each other and forming a homogeneous unit with the slab. The parts are also already provided on all bottom faces with a thermally insulating material. Floor parts of inverted U-shaped cross-section are generally used, so that two legs of floor parts placed next to each other go against each other and are fixed to each other. This produces ribs made up of two legs of two successive U-shapes, in which the join takes place over a large vertical surface and this fixing is very strong. In the case of floor parts of single or multiple T-shaped cross-section the seams which then have to be sealed between the ribs in the sheet-type part are smaller and consequently not so strong.

A disadvantage in the case of all these known ribbed floors and methods for producing ribbed floors and floor parts is the great degree of dependence on the cross-sections of the concrete ribs and the great degree of dependence on insulation thicknesses, and thus insulation values. These limitations are caused by the usual uniformity of the cross-sections of the insulating casings of the concrete ribs. It has been found that, as soon as there is any departure from the usual cross-sections of these insulation forms, obtaining suitable forms becomes difficult because of the investment and labour-intensiveness, and it also usually leads to material loss. There is, however, an increasing need both for better insulation of these thermally insulating floors and for different concrete structures, due to the fact that, for example, greater distances have to be spanned, in which case other widths, heights and section shapes of the concrete ribs are then desired. However, for economic reasons, the existing L-shaped and U-shaped forms of insulating material seem to decide how a ribbed floor will be constructed.

The object of the invention is a method for producing concrete ribbed floors or floor parts in which a ribbed floor of any desired shape or any desired cross-section can be assembled from several floor parts, while these floors or elements are provided with a thermal insulation layer of any desired thickness on the underside. Another object of the invention is to produce component parts of the thermal insulation layer so economically that as little waste as possible is also produced and transportation from the place of production to the des-

tination can take place as economically as possible.

These objects of the invention are achieved by a method for producing floor parts with which concrete ribbed floors can be assembled, characterised in that an element is cut out of a flat or curved sheet of thermally insulating material of which the cross-section in the horizontal plane is essentially rectangular, and in which an element is first cut out from a side of the sheet in the lengthwise direction, which element is L-shaped when viewed in cross-section at right angles to the lengthwise direction, one leg of the L-shaped element being formed from a part of the height of the side of the sheet, in such a way that the end of the short leg coincides with the underside of the sheet, and the long leg of the L-shaped element being cut out of the inside of the sheet, with the result that a stop or recess remains near the top side of the sheet; in that the element cut in an L-shape is then taken out of the sheet, in that an element cut in an L-shape is then placed in such a way that one leg points upwards and the other leg outwards, and in that the recess of a sheet is then placed on the upward pointing leg in such a way that the L-shaped element and the sheet form part of a shuttering which together with shuttering parts forms shuttering, which shuttering is finally filled with concrete, so that after hardening of the concrete a floor part with thermal insulation towards the underside, a so-called L-shaped or semi-T-shaped floor part, is produced.
Apart from L-shaped floor parts, U-shaped floor parts can also be produced by cutting out of each of the two opposite sides of the sheet in the lengthwise direction an element which, viewed in cross-section, is L-shaped at right angles to the lengthwise direction and then placing an L-shaped element on each side of the sheet under each of the recesses produced, one of the legs pointing upwards and the other leg downwards, and each of the recesses resting on one of the ends of one of the legs of one of the L-shaped insulating elements in such a way that the two L-shaped elements and the sheet form a part of a shuttering which together with remaining shuttering parts forms a shuttering, which shuttering is finally filled with concrete, so that after the concrete sets a floor element with a permanent casing of thermally insulating material is produced, so that what could be described as a U-shaped floor part is produced.

Through a combination of the method for producing L-shaped floor parts and U-shaped floor parts, other floor parts, or floors on the building, can also be produced by placing several sheets next to each other, each of the two opposite sides of each sheet resting on the vertically placed leg of an L-shaped element, of which the other leg is directed outwards, and the horizontal legs of the L-shaped elements of the successive sheets being placed with the ends against each other and together with shuttering parts forming a shuttering, with the result that, after the shuttering has been filled with concrete, floor parts or floors can be produced directly on the building, which floors or floor parts are produced with one or more ribs which give a T-shaped cross-section and at the underside are provided with a thermally insulating encasing covering.

It is also possible to prefabricate the concrete ribs by a phased method, in which the pouring of the concrete takes place partially on the building structure. For this, the L-shaped insulating sections are set up in pairs in a U-formation, in such a way that concrete ribs are formed therein, at least the bottom part of said ribs being encased. After these ribs which are insulated at the underside have been placed at certain intervals parallel to each other in the building structure, the sheets with the recesses are placed on the ends of the vertical legs of the insulating sections, following which the remaining concrete is poured.

In a variation on a phased method, in which the concrete is poured partially on the building structure and the concrete ribs are prefabricated, it is possible to fit all insulation forms in the building structure. After being erected in the building structure, the ribs are encased with the L-shaped insulating sections, in such a way that the latter abut each other in a U-shaped formation under and around the rib. A preferred embodiment here is a flange-shaped provision in the cross-section of the L-shapes on the inside of the end of the vertically disposed leg, as a result of which a good fixing of the L-shapes in the structure is obtained. After placing of the sheet forms with their recesses on the ends of the vertical legs of the L-shaped sections, the remaining concrete is poured.

The sheets can also be produced in a factory, after which the sheets with cut-out L-shaped elements are taken to the production place, where the floor parts or floors are produced. Due to the fact that the L-shaped parts fit in the sheets, the space during transportation can be used very economically. After the sheets have been used for producing floor parts or floors, in which case the L-shaped parts are taken out of the sheets and then processed in the desired structure, hollow spaces are left in the insulating covering. These spaces enclosed by insulating material will, however, also provide good thermal insulation. These spaces can be shut off or filled up with insulating material if desired. A good possibility is also to use these channels for cables or pipes and thermal insulation of said cables or pipes.

The invention will be explained in greater detail with reference to the drawing. In the drawing:

Figure 1
shows in cross-section a part of a concrete ribbed floor, provided on the underside with a thermally insulating layer according to the invention;
Figure 2
shows in vertical cross-section a sheet of thermally insulating material in which two L-shaped section parts are cut away for use for a ribbed floor;
Figures 3, 4 and 5
show three other possible embodiments of sheets of thermally insulating material for use for a ribbed floor, with an L-shaped part cut out on one side, and at the other side an L-shaped part cut out and then placed in the correct position;
Figures 6, 7 and 8
show another three possible embodiments of the cross-sections of the cut-out L-shaped section parts.

Figure 1 shows a part of a concrete ribbed floor 1, comprising a concrete slab 2 and two ribs 3. The underside of the floor is provided with a thermally insulating casing, of which three sheets 4 of a thermally insulating material can be seen here. L-shaped elements 5 are cut out of each sheet 4 in the lengthwise direction of the sheet 4. The L-shaped element is L-shaped when viewed in cross-section at right angles to the lengthwise direction. One leg 7, generally the short leg, of the L-shaped element 5 is formed from a part of the height of the side 6 of the sheet 4, in such a way that the end of one leg 7 coincides with the underside 8 near the side of the sheet 4. The other leg 9, generally the long leg, of the L-shaped element 5 is cut out of the inside of the sheet 4. The L-shaped element is cut out of the sheet in such a way that the whole side 6 is not cut away, but a stop or recess 10 is left near the top side of the sheet 4. Before the floor is poured, the L-shaped elements 5 are removed from the sheets 4, the L-shaped elements are then combined two by two to a U-shape, the U-shapes being placed at such a distance from each other that a sheet can be placed between two legs of successive U-shapes where the U-shapes have been taken out, in such a way that the two recesses 10 on either side of the sheet each rest on a leg 9 of one of the L-shaped elements 5. The U-shapes are placed at such a distance from each other that the underside of each sheet is placed in a tight fit between the legs of the two U-shapes. With the casing thus formed for a floor, this casing together with other parts of a formwork forms the formwork for the floor to be poured. The concrete is then poured, following which a floor provided with a thermally insulating casing on the underside is produced after the concrete sets.

As shown schematically in Figure 1, floor parts which can be L-shaped or U-shaped, depending on the use, can be produced in concrete factories. For this purpose, L-shaped parts can be made by dividing the floor according to the dashed lines 11 and 12 shown in Figure 1. U-shaped parts can also be formed by dividing the floor according to the dashed lines 11. The floor parts with casing can then be transported to the building structure and incorporated, following which the successive parts can be connected to each other using mortar. This is a method which is known per se.

After the sheets 4 have been used for producing floor parts or floors, in the course of which the L-shaped parts 5 are removed from the sheets 4 and then processed in the desired construction, hollow spaces 13 are left in the insulating covering. These spaces 13 enclosed by insulating material will, however, also provide good thermal insulation. These spaces 13 can be sealed or filled up with insulating material if desired. The use of these channels for pipes or cables and thermal insulation of said pipes or cables is also a good possibility.

Figure 2 shows a sheet which is rectangular both in longitudinal section and in cross-section, in which an L-shaped element 5 is cut out of the sheet 4 on both sides. For this cutting process, which is generally carried out in one operation by computer or CNC-controlled glow-wire machines if, for example, polystyrene is used, the L-shaped elements when cut away, regardless of the profiling of their cross-sections such as thicknesses, squareness and the like, come to lie completely nested in the sheet form. In Figure 2 the dashed lines show how an L-shaped element can be removed from the polystyrene sheet and, unlike the situation shown in Figure 1, in which the longitudinal leg is placed vertically, the long leg is placed horizontally. It is also shown in Figure 2 by dashed line 14 that such a sheet can also be cut curved out of, for example, a large block of polystyrene. The curved dashed line indicates that the sheet 4 is curved only at the underside. Due to the fact that in the cut-out position of the L-shaped elements these elements are nested in the sheet 4, the very compact structure of the sheets with the L-shapes of the thermally insulating material is a major advantage of this bulky lightweight material during transportation from the factory where the L-shaped sheets are made to the concrete factory.

Figure 3 shows a curved sheet 34 in which L-shaped elements nested on either side are cut out. One of the L-shaped elements is taken out of the sheet 4 and turned into the position used to produce a concrete floor with thermally insulating casing provided on the underside. With the sheet shown in Figure 3 and the L-shaped elements 35 cut out of it a concrete construction whose beams

taper slightly downwards is obtained.

Figure 4 shows yet another possible method of cutting L-shaped elements 45 out of a curved sheet 44, the recess 40 being slightly shortened so that it can be adapted to the width of the top side of the vertically placed L-shaped leg. This excess length can be left intact if desired and used for concrete ribs already prefabricated in the factory, which ribs are already provided with a casing. As indicated by dashed lines 43, the curvature can be made double, but the nesting of several sheets on top of one another is retained, so that several of these sheets can be cut in a simple manner from a large block of polystyrene.

Figure 5 shows in cross-section a sheet 54, which is trapezoidal in cross-section. L-shaped elements 55 are cut out of both sides, which elements can interact with the sheets 54 after said L-shaped elements have been removed from them and the sheets are placed on either side with the recess 50 on the end of one of the legs 59 of an L-shaped element 55.

Figures 6, 7 and 8 then show in vertical section a part of a sheet 64, 74, 84, from which other kinds of L-shaped elements 65, 75 and 85 are cut. The L-shaped element 65 which is shown nested in the sheet 64 has two flange-shaped extensions 66, 67. These flanges 66, 67 are formed in such a way that, after the L-shaped elements 65 have been removed from the sheets 64 and the L-shaped elements 65 have been placed in the correct position, the flange-shaped projections 66 and 67 can interact with the sheet. The projection 67 then just fits into the hollow space which has been produced in the sheet after the removal of the L-shaped element 65. A better seal of the air channel is obtained in this way, and the support and connection to the sheet of the L-shaped elements is also stronger.

The L-shaped element 75 has flanges 76 and 77, in which the flange 77 can be used to hang the L-shaped element on a prefabricated concrete rib, following which the sheets 74 with the recess 70 can be placed on the L-shaped elements 75 which are slid around the beams.

Figure 8 shows yet another possible way of cutting the L-shaped element 85 out of a sheet 84. As shown in the drawings, it is possible according to the invention to cut the L-shaped element out of the sheets in different ways.

Through use of the method and the sheets according to the invention, it has become possible to produce floors with casing of different cross-sections economically, with the result that it has become possible to construct floors which can meet different standards.

Claims

1. Method for producing a floor part which is used to be combined with several floor parts to form a concrete floor, which floor is provided on the downward facing surfaces with thermally insulating material as an encasing covering, and which concrete floor is composed of a concrete slab which is provided on the underside with concrete ribs at regular intervals, **characterised in that** an element is first cut out of a flat or curved sheet of thermally insulating material of which the cross-section in the horizontal plane is essentially rectangular, and in which first an element is cut out from a side of the sheet in the lengthwise direction, which element is L-shaped, viewed in cross-section at right angles to the lengthwise direction, one leg of the L-shaped element being formed from a part of the height of the side of the sheet, in such a way that the end of the short leg coincides with the underside of the sheet, and the long leg of the L-shaped element being cut out of the inside of the sheet, with the result that a stop or recess remains near the top side of the sheet; in that the element cut in an L-shape is then taken out of the sheet, in that an element cut in an L-shape is then placed in such a way that one leg points upwards and the other leg outwards, and in that the recess of a sheet is then placed on the upward pointing leg in such a way that the L-shaped element and the sheet form part of a shuttering which together with shuttering parts forms shuttering, which shuttering is finally filled with concrete, so that after hardening of the concrete a floor part with a bottom of thermal insulation material, a so-called L-shaped or semi-T-shaped floor part, is produced.

2. Method according to Claim 1, **characterised in that** an element is cut out of each of the two opposite sides of the sheet in the lengthwise direction, which element, viewed in cross-section, is L-shaped at right angles to the lengthwise direction, and an L-shaped element is then placed on each side of the sheet under each of the recesses produced, one of the legs pointing upwards and the other leg downwards, and each of the recesses resting on one of the ends of one of the legs of one of the L-shaped insulating elements in such a way that the two L-shaped elements and the sheet form a part of a shuttering which together with the remaining shuttering parts forms a shuttering, which shuttering is finally filled with concrete, so that after the concrete sets a floor element with a

bottom of a permanent casing of thermally insulating material is produced, what could be described as a U-shaped floor part.

3. Method according to Claim 1 or 2, **characterised in that** several sheets are placed next to each other, each of the two opposite sides of each sheet resting on the vertically placed leg of an L-shaped element, of which the other leg is directed outwards, and the horizontal legs of the L-shaped elements of the successive sheets being placed with the ends against each other and together with shuttering parts forming a shuttering, with the result that, after the shuttering has been filled with concrete, floor parts or floors can be produced directly on the building, which floors or floor parts are produced with one or more ribs which give a T-shaped cross-section, with an encasing covering or bottom, of a thermally insulating materiaal.

4. Method according to any of the preceding claims, **characterised in that** the hollow spaces or cavities are filled up with parts of an insulating material, or are filled with foam.

5. Sheet of a thermally insulating material for use in one of the methods for producing a floor part or a concrete floor, **characterised in that** the flat or curved sheets, viewed in the horizontal plane in cross-section, are essentially rectangular, and in that an element is cut out from one of the sides of the sheet in the lengthwise direction, which element is L-shaped, viewed in cross-section at right angles to the lengthwise direction.

6. Sheet according to Claim 4, **characterised in that** an element is cut out of each of the two opposite sides of the sheet in the lengthwise direction, which element is L-shaped when viewed in cross-section at right angles to the lengthwise direction.

7. Sheet according to one of Claims 4 or 5, **characterised in that** the angle between the two legs of the L-shape of an L-shaped insulating element lies between 60° and 120°.

8. Sheet according to any of Claims 4, 5 or 6, **characterised in that** the two legs of the L-shaped insulating element are of equal thickness.

9. Sheet according to any of Claims 4, 5, 6 or 7, **characterised in that** one of the legs of the L-shaped insulating element is provided near the outside with a bulge or flange.

10. Sheet according to any of Claims 4, 5, 6, 7 or 8, **characterised in that** one of the legs of the L-shaped insulating element is provided near the outside with several flanges.

11. Sheet according to any of Claims 4, 5, 6, 7, 8 or 9, **characterised in that** one of the legs of the L-shaped insulating element is provided with a flange on the inside.

12. Sheet according to any of Claims 4, 5, 6, 7, 8, 9 or 10, **characterised in that** one of the legs or both of them taper or flare upwards.

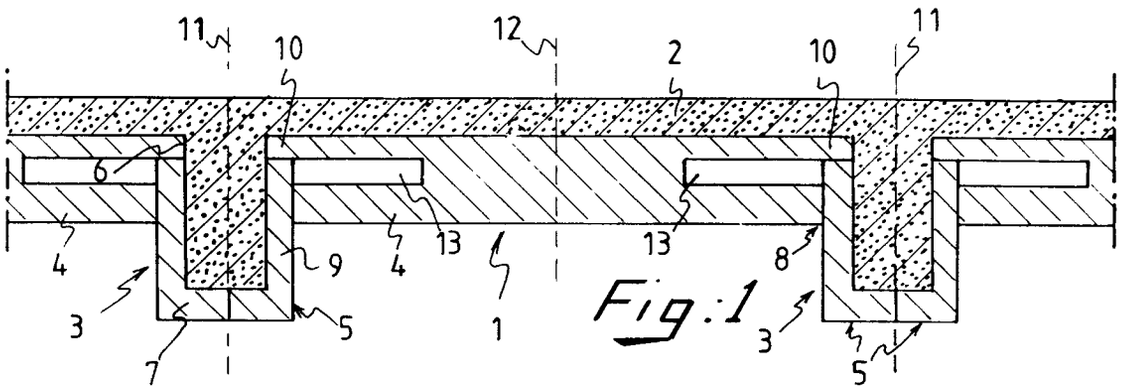

Fig.1

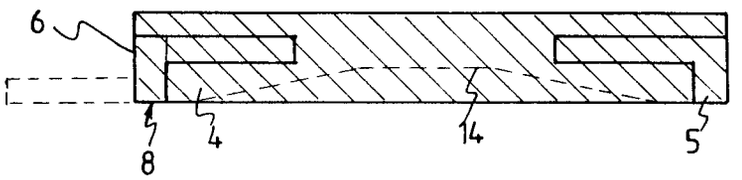

Fig.2

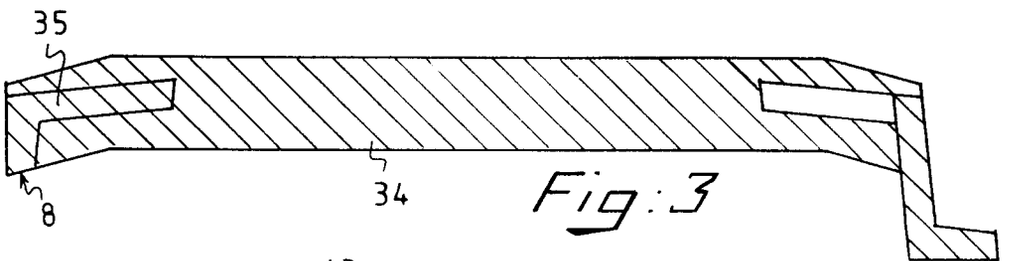

Fig.3

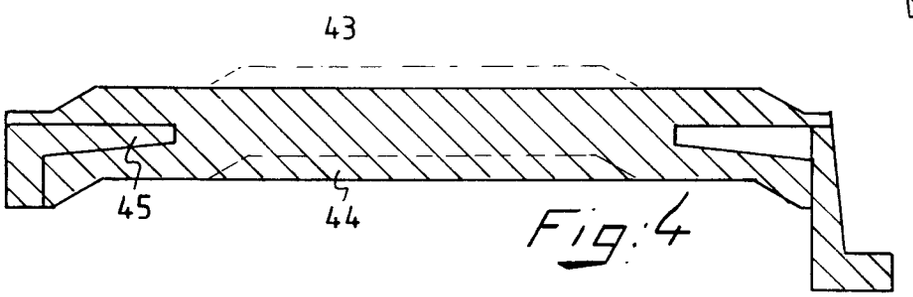

Fig.4

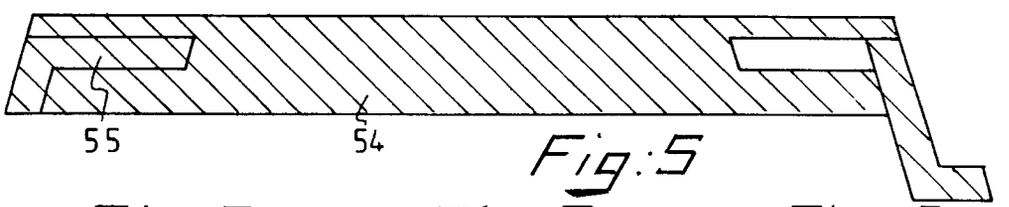

Fig.5

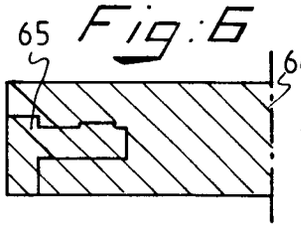

Fig.6

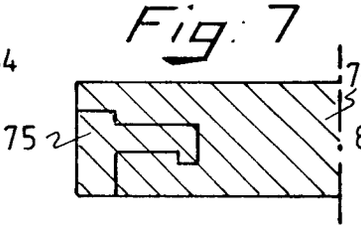

Fig.7

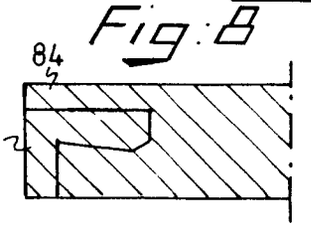

Fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 20 0613

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)
A,D	NL-A-8 006 287 (VAN ARNHEM B.V.) * page 1, line 21 - page 2, line 4 * * page 2, line 40 - page 3, line 17; figures 1-3 *	1,5,11	E04B5/36
A	DE-A-2 653 828 (TRÄULLIT AB) * claims 1-2; figures 3,6,7 *	1	
A	FR-A-2 166 335 (SATTANINO) * page 1, line 6 - page 1, line 14 * * page 1, line 40 - page 2, line 3 * * figures 1-5 *	1,5	
A	NL-A-8 002 014 (OMNIA-ADVIESBUREAU BV)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E04B
E04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 NOVEMBER 1992	HENDRICKX X.

CATEGORY OF CITED DOCUMENTS

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