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(54) Method of manufacturing system floors.

(57) Method for manufacturing system floors, comprising prefabricated floor-elements. One or more prestressed concrete beams (7), provided with reinforcing media, extending from its upper side, by positioning means (9, 10, 11) are mounted upside down in a shuttering (1, 2, 3, 4) with preferably steel plate side walls. Then the shuttering, in which a (steel) reinforcement in the form of a mat has been introduced, is poured with concrete up to the required thickness. After vibrating and sufficiently hardening the floor element is removed from the shuttering.

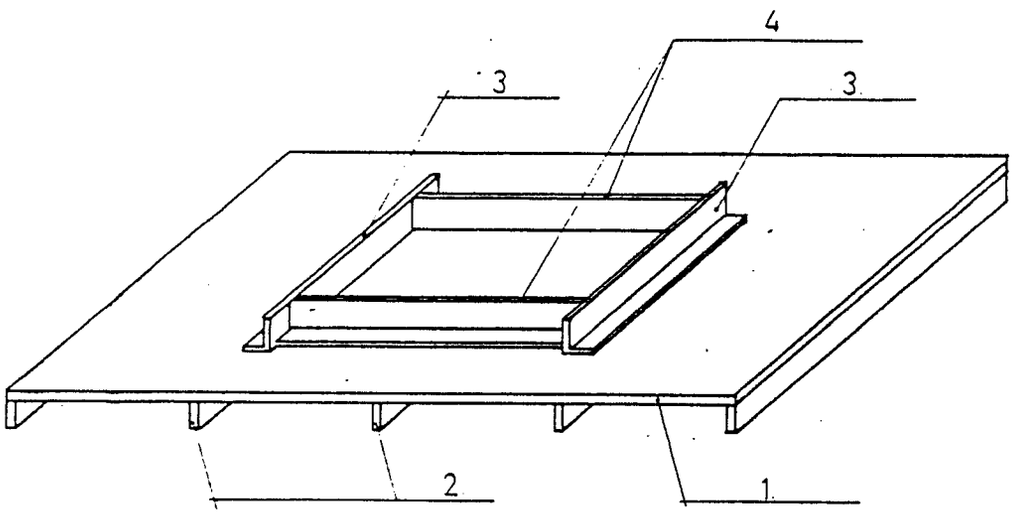

Fig. 1

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Method of manufacturing system floors

The invention relates to a method of manufacturing system floors comprising of at least one prefabricated floor element and which floor element or floor elements are thereafter mounted on site.

Such floor elements are known from a publication by J.J. Vriend, Building, part 1, 4th edition from the publishing company Kosmos, Amsterdam page 284 to 285.The element of pages 284 and 285, figs. 1 to 3 inclusive is built up of hollow bricks which are laid to form a vertical wall with the interposition of steel concrete-reinforcing bars therebetween and which after hardening out are transported to the building site and mounted on supporting-points. On the same page, fig. B4-11, there is shown a system in which reinforced concrete T - beams are placed on supporting walls with the upper surfaces abutting one another.

On pages 286 and 287, figs. A1 to A4inclusive, hollow floor slabs are described and which are also placed against one another on-supporting points.

In none of the systems is the upper surface smooth and flat and it is necessary to apply a finishing layer of several centimeters thick hereover, an operation which not only takes extra time but moreover results in one not being able to walk over the floor during the hardening out of this layer, the time of which can take eight days dependent on the chosen system and through which the building time is extended unnecessarily. After the lapse of this time there is still a considerable amount of moisture present which must be removed by heating before further finishing of the building work can take place.

All of these factors contribute to a strong rise in manufacturing costs, especially during the damp period of the year.

These disadvantages are eliminated according to one characterising feature of the invention inasmuch that at least one prestressed concrete beam is provided with reinforcing media extending from its upper surface and which beam at least during or after completely hardening out is mounted upside down in flat lying shuttering and at a distance from the bottom thereof equal to or smaller than the required thickness of the floor slab, which shuttering is provided with a flat, smooth and seamless bottom and sidewalls preferably of steel plate and after which this shuttering, into which a reinforcement has been introduced parallel to the bottom in the form of a mat of contructional steel for example, is or will be poured with a concrete layer of the required thickness of the floor slab which can then be vibrated and after sufficient hardening the floor element so obtained can be removed from the shuttering.

Through pouring the floor upsidedown, an extremely smooth walking surface is obtained and through which the application of a finishing layer is superfluous and which directly after mounting of the floor element on site permits the floor be walked over continuously and further drying out is unnecessary.

If it is requiredto produce the floor element in its entirety in prestressed concrete then the surface will not remain flat during hardening out, various residual stresses in the separate floor elements forming a single floor will cause various floor surface bowing effects to arise.

By first pouring the prestressed concrete beams in a separate mould and by allowing them to at least harden out sufficiently, the later occurring tendancy of the beams to bow is eliminated and thus the tendancy of the floor surface to do the same. Through this, substantially no more shrinkage and/or creep of the beams arise whilst at the same time the floor slab remains flat and smooth.

By the use of the smooth steel plate sidepieces, smooth floor-element sidewall-surfaces are obtained and thus good abuttment between adjacently lying ones.

According to another characterising feature of the invention, positioning means can be applied to the end surfaces of the beams and which can cooperate with positioning means of a clamping arrangement on the outer side of the shuttering between which the beams of prestressed concrete are clamped fast in immovable positions during pouring of the floor slab.

Through the application of these measures, predetermined fixed positions of the prestressed concrete beams with respect to the shuttering is achieved and which positions do not change during compacting of the poured concrete and through which adhesion of the floor slab concrete to the beams remains undisturbed.

According to a further characterising feature of the invention and in the interests of obtaining mounting edges, the lengths of the prestressed concrete beams are chosen to be, at their longest, equal to the length of the floor elements minus the sum of the widths of the mounting edges, whilst the height of the the shuttering at least in the positions of the mounting edges is at least equal to the required thickness of the floor slab and to which there may be fixed at this location a removable element preferably of steel plate with a smooth underside and which is present during pouring and compacting of the concrete layer.

In this manner a smooth mounting edge is obtained which has a constant overall thickness

and which, during mounting on horizontal concrete beams for example, ensures that the upper surfaces of the adjacent floor elements abut one another without gaps.

According to a further characterising feature of the invention, the bottom of the shuttering comprises preferably a flat, smooth steel plate which is provided on its underside with strengthening ribs and on which at least three upstanding sidewalls are arranged and of which at least one is removable, and wherein these sidewalls are joined in pairs.

It will be clear that the bottom can be of a smooth material on the condition that it is resistant to wet, freshly poured concrete although in practice a steel plate is preferred. The number of upstanding sidewalls depends on the form taken by the floor element. If it is triangular in form, then naturally three sidewalls are sufficient. At least one of these sidewalls is removable and through which, after hardening out, the floor element can be easily removed from the mould. Should the sidewalls not come free when required to, then the edges of the floor element will be damaged so that even then another finishing operation must be carried out on floor element when it is mounted in place.

Naturally, if its is so required, all the sidewalls can be made removable. The fixing herefor can be by any currently used method, such as by bolting or welding and suchlike etc. example.

The prestressed concrete beams can be laid on the bottom of the shuttering with the interposition of distance-pieces therebetween and after which the concrete layer for the floor is poured and then vibrated for compacting by a vibrating appliance.

According to yet a further characterising feature of the invention, a two-part clamping device is fitted on the outside of the shuttering for each prestressed concrete beam and the two parts of which clamping device are arranged on different sides of the shuttering. The facing sides of the device are each provided with positioning means for positioning the prestressed concrete beam or beams.

Through the application of these positioning means, the prestressed concrete beams are always maintained in the same position relative to the bottom of the shuttering which can then be vibrated as a whole without the prestressed concrete beams losing their mutually-correct positions.

To achieve good abuttment of the floor elements without vertical gaps and principally when these are being mounted on the prefabricated beams, it is essential that the thicknesses of the mounting edges of the floor elements are alike.

To this end and according to yet an even further characterising feature of the invention, the height of the adjacently arranged sidewalls, and if required the height of the connecting sidewall at the place where a mounting edge of a floor element is to be formed, must be equal to that of the desired thickness of the mounting edge and on which if required there may be mounted the removable element of preferably steel plate with a smooth underside and with a width which is at least equal to the mounting edge.

According to still a further characterising feature of the shuttering according to the invention, the sidewalls of the longitudinally running prestressed concrete beam or beams are provided with complementary sections running in the longitudinal direction and parallel to the bottom and at like distances therefrom.

The advantage of this arrangement is that the complimentary sections of the adjacent floor elements slide into one another and vertical movement relative to one another is prevented.

According to yet an even further characterising feature of the invention, a floor element is built up of at least one prestressed concrete beam on the top of which there is arranged a reinforced concrete floor slab with flat and smooth top and side surfaces and which forms a single entity with the prestressed beam or beams which can be provided with positioning means and a have a length which is at the most equal to the length of the floor slab.

According to still yet even further characterising feature of the invention, at least two smooth, flat mounting edges of like overall thickness are provided and that the prestressed concrete beams or beams have a length which is at the most equal to the length of the floor element minus the sum of of the widhts of the mounting edges.

Again in accordance with a characterising feature of the invention, the longitudinally running sidewalls of the prestressed concrete beam or beams are provided with complementary sections in the longitudinal direction and parallel therewith.

The advantage of this arrangement is that on sliding of two adjacent floor elements toward one another, these complimentary sections grip one another and through which on subjecting the floor elements to loading between the mounting edges these remain fixed with relative to one another.

The invention will be better understood with reference to the accompanying drawings in which

Fig. 1 illustrates the manner in which a shuttering is built up according to the invention.

Fig. 2. is a front view of the shuttering of fig.1. fitted with a clamping device.

Fig. 3. illustrates an end of the prestressed concrete beams provided with different positioning means.

Fig. 4. illustrates the shuttering with a removable steel plate element for use if required.

Fig. 5. illustrates a floor element the prestressed concrete beams of which extend over the full length of the floor slab.

Fig. 6. illustrates a floor element the beams of which are free of the mounting edgesand,

Fig. 7. illusyrates a floor element with complementary seotions along two sidewalls.

Fig. 1. shows a shuttering according to the invention and comprising a steel plate bottom to which strengthening ribs 2 are welded to the underside thereof, further strengthening ribs (not shown) are are welded vertically with respect thereto so that the bottom 1 is rigid in all directions. Sidewalls 3 of angle-iron are fixed to the bottom 1. This fixing can be achieved in various manners by the use of bolts, clamps or by welding. The same is applicable to the sidewalls 4 which in this case are also made of angle-iron. If sidewalls 3 and 4 are welded then the floor element can only be removed in the vertical direction and its edges can easily be damaged. This can be avoided by making at least two adjacent sidewalls removable so that the floor element can first be removed from the other sidewalls before hoisting out.

Fig, 2 is a front view of the arrangement of fig. 1 without the sidewalls 4. It can be clearly seen how a clamping device comprising two parts 5 and 6 can clamp the prestressed concrete beam 7 in the desired position so that the whole of the shuttering can be vibrated without the position of the prestressed concretebeam 7 relative to shuttering does not change neither can it come loose from the poured floor slab. If it is required to position the prestressed concrete beam 7 without the aid of the parts of the clamping device 5 and 6, then this can be done with supporting blocks of cement or concrete as shown by the dotted line 8. In this case, it is impossible to vibrate the shuttering as a whole and the use of a vibrating appliance is indicated here.

When clamping by means of the clamping device 5 and 6, it is necessary to ensure that the prestressed concrete beam 7 cannot move with respect to this clamping device. To this end, both the prestressed concrete beam 7 and the clamping device 5 and 6 are provided with complementary positioning means. A trio of possible types of such positioning means are illustrated in fig. 3. In fig.3a.the positioning device is in the form of four pins 9 introduced into the end of the prestressed concrete beam 7 to co-operate with the complementary positioning means in the clamping device 5 and 6 which are in the form of four holes. Fig.3b.shows positioning means in the form of recesses 10 of rectangular cross-section and into which a complementary extension of the clamping device 5 and 6 fits. It is self-evident that the positioning means for the prestressed concrete beam 7 and the clamping device 5 and can be interchanged. Fig. 3b. shows a positioning means in the form of a groove 11 of rectangular cross-section and which for example may extend over a distance of ten centimeters in the longitudinal direction in the side of the prestressed concrete beam 7 and co-operates with a complementary strip of rectangular cross-section fixed to the clamping device 5 and 6.

It will be clear that the invention is not limited to the foregoingly described embodiments but that numberless variations hereof are possible.

The positioning means in the prestressed concrete beam 7 may also be used if required in combination with a hoisting-gear to lift the floor elements out of the shuttering and to turn them over after they have hardened out.

Fig.4.shows how to obtain smooth mounting edges of unform thickness. The sidewalls 4 are milled off to a height 'd' equal to the required thickness of the mounting edges and to which steel elements 12 in the form of angle-irons with smooth undersides are fixed. It is also possible to allow these steel elements 12 to extend over the sidewalls and, if the latter are removable, to weld the steel elements fast thereto.

Fig,5,shows a floor element in accordance with the invention in which the prestressed concrete beam 7 extends over the whole of the length of the floor slab 13 whilst fig. 6. shows a floor element the length of the prestressed concrete beam 7 of which is equal to the length of the floor element minus the sum of the widths of the mounting edges 14. It will be clear that the floor elements shown here are as they come out of the shuttering, thus upsidedown.

Fig.7.shows a floor element of which the sidewalls extending in the longitudinal direction of the prestressed concrete beams 7 are provided with complementary sections 15 and 16 running parallel therewith and at equal distances from the upper surfaces at equal distances therefrom. If two adjacent floor elements are pushed against one another, then these complementary sections slide into one another and remain fixed relative to one another when a load is imposed on the floor elements between the mounting edges.

If the floor elements are to be insulated on the undersides, then the prestressed concrete beams may be poured into a shuttering provided with a lining of insulating material with a more or less porous surface. After hardening out of the concrete mass, the insulating material is bonded fast to it. After pouring the floor slab, the insulating material is applied to that part of the floor slab exposed clear of the prestressed concrete beams with the exception of the mounting edges thereof.

Claims

1. A method of manufacturing system floors comprising at least one prefabricated floor element and which floor element or floor elements are thereafter mounted at the working site, characterised in thus that at least one prestressed concrete beam (7) is provided with reinforcing media extending from its upper side and which beam at least during or after completely hardening out is mounted upside down in a flat lying shuttering (1,2,3,4) at a distance from the bottom thereof equal to or smaller than the required thickness of the floor slab (13) and which shuttering (1,2,3,4) is provided with a flat, smooth and seamless bottom (1) and side walls (3,4) preferably of steel plate and after which this shuttering (1,2,3,4), in which a reinforcement has been introduced parallel to the bottom (1) in the form of a mat of constructional steel, is or will be poured with a concrete layer of the required thickness which concrete layer can then be vibrated and after sufficiently hardening out the floor element so obtained can be removed from the shuttering (1,2,3,4).

2. A method as claimed in claim 1 characterised in this that positioning means (9,10,11) are introduced into the ends of the prestressed concrete beams (7) and which co-operate with positioning means of a clamping device (5,6) on the outside of the shuttering (1,2,3,4) and between which said device (5,6) the prestressed concrete beams (7) are clamped fast in immovable positions during the pouring and vibrating of the floor slab (13).

3. A method as claimed in claim 1 or claim 2 characterised in this that in order to provide mounting edges, the lengths of the prestressed concrete beams (7) are chosen to be at their longest equal to the length of the floor element (13) minus the sum of the widths of the mounting edges (14), whilst the height of the sidewalls (3,4) of the shuttering (1,2,3,4) at least at the positions of the mounting edges (14) thereof is equal to the desired thickness (d) of the floor slab (13) and that of a removable element (12) preferably of steel with a smooth underside and fixed at the positions of the sidewalls (3,4) and present during pouring and compacting the concrete layer.

4. Shuttering for carrying out the method as claimed in any one of claims 1, 2 or 3 inclusive characterised in this that the bottom comprises a flat, smooth and seamless bottom (1) preferably of steel plate which may be provided on its underside with strengthening ribs (2) onto which at least three upstanding sidewalls (3,4) are arranged and of which at least one is removable and in which the sidewalls (3,4) are joined in pairs.

5. Shuttering for carrying out the method as claimed in claim 2 characterised in this that for each prestressed concrete beam (7) a two-part clamping device (5,6) is fitted to the outside of the shuttering (1,2,3,4) and which two parts are arranged on opposite sides of the shuttering (1,2,3,4) and provided on the facing sides thereof with positioning means for positioning the prestressed concrete beams (7).

6. Shuttering as claimed in claim 4 of claim 5 for carrying out the method as claimed in claim 2 characterised in this that the height of the adjacently arranged sidewalls and if required the height of the connecting sidewall at a position where a mounting edge (14) of a floor is to be formed is equal to that of the required thickness (d) of the mounting edge (14) and if required a removable element (12) arranged hereon and preferably of steel with a smooth underside and the width of which is at least equal to the width of the mounting edge (14).

7. Shuttering as claimed in any one of claims 4, 5 or 6 characterised in this that in the longitudinal direction of the prestressed concrete beam or beams (7), the sidewalls (4) are provided with complementary sections (15,16) running in the longitudinal direction and parallel to the bottom (1) and at like distances therefrom.

8. A floor element manufactured by the method claimed in claim 12 or claim 2 characterised in this that the floor element is built up of at least one prestressed concrete beam (7) onto the top of which a reinforced concrete floor slab (13) with flat and smooth top and side surfaces is placed to form a single entity with the prestressed concrete beam or beams (7) and the ends of which said prestressed concrete beam or beams (7) can be provided with positioning means (9,10,11) and which at the most have a length equal to that of the floor slab (13).

9. A floor element as claimed in claim 8 characterised in this that at least two smooth, flat mounting edges (14) of like overall thicknesses are provided and that the prestressed concrete beam or beams (7) at the most have a length of which is equal to the length of the floor element (13) minus the sum of the widths of the mounting edges (14).

10. Floor elements as claimed in claim 8 or claim 9 characterised in this that the longitudinally running sidewalls of the prestressed concrete beam or beams (7) are provided with complementary sections (15,16) running in the longitudinal direction and parallel therewith.

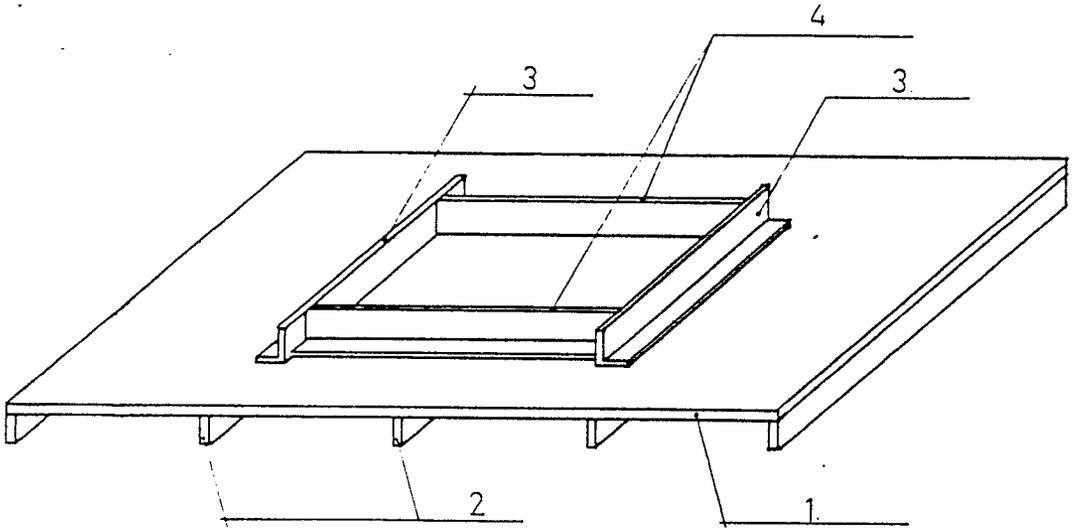

Fig. 1

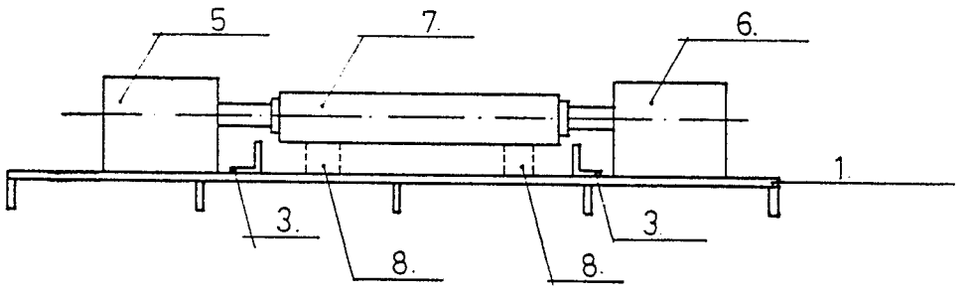

Fig. 2

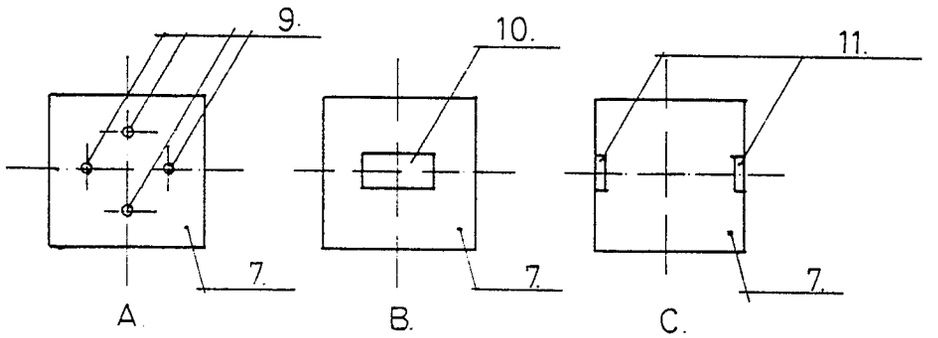

Fig. 3

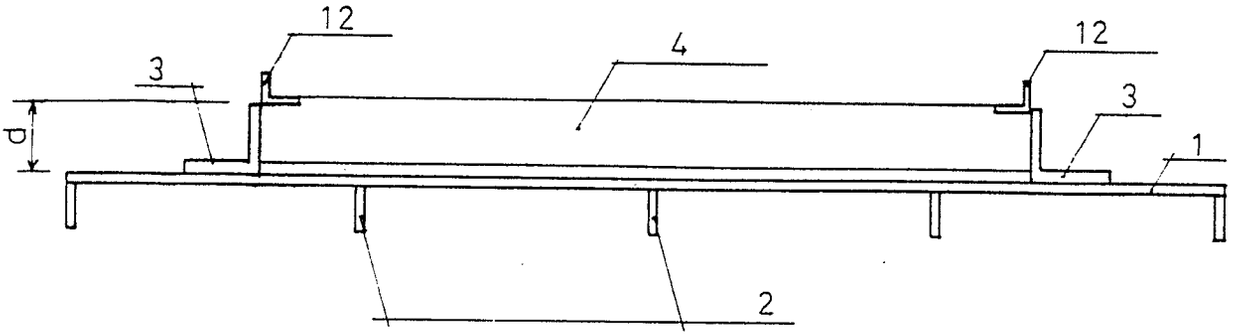

Fig. 4

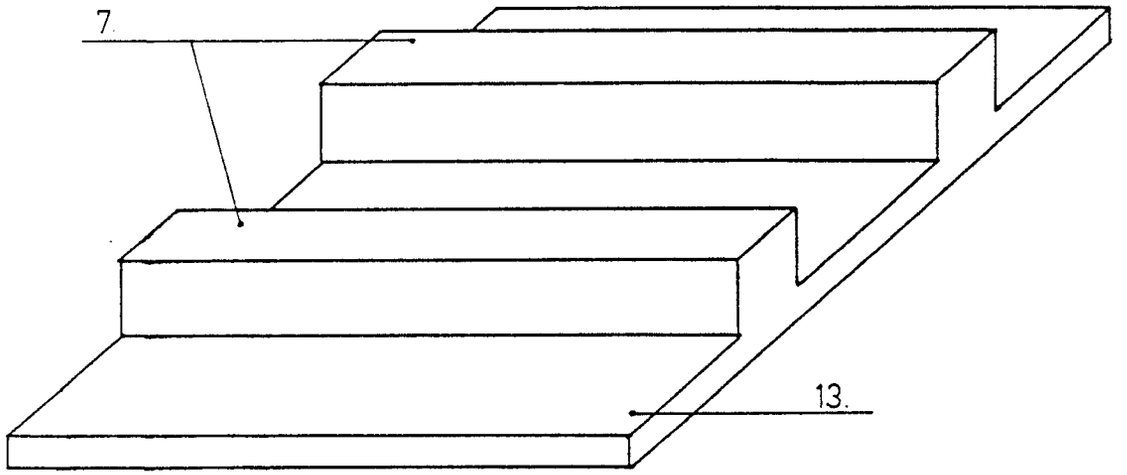

Fig. 5

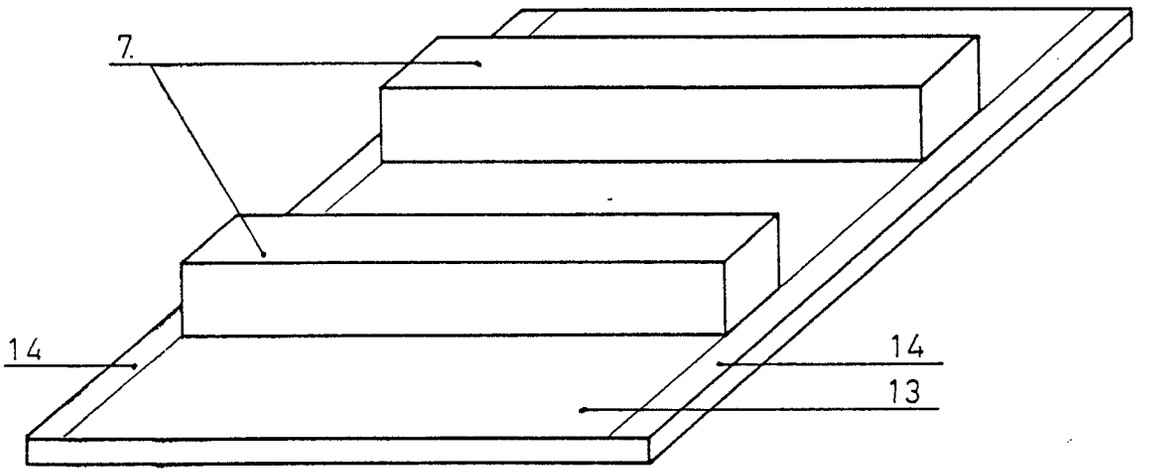

Fig. 6

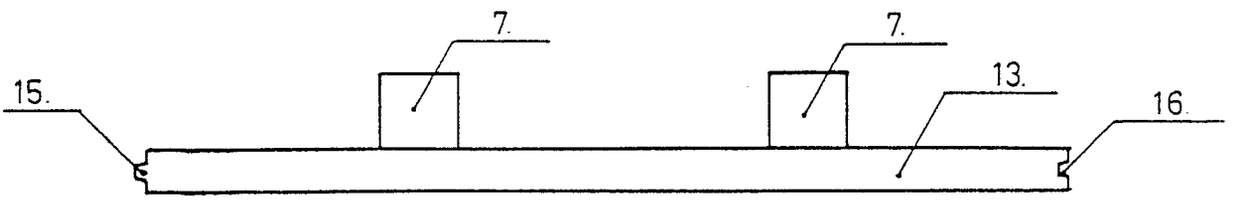

Fig. 7