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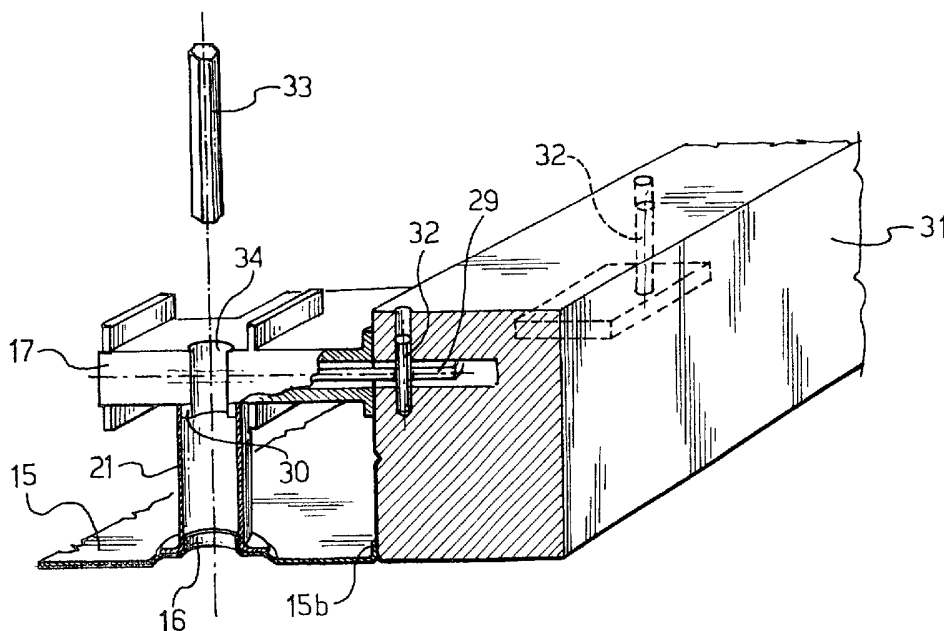
— *of inventorship (Rule 4.17(iv)) for US only*

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(54) Title: PROCESS FOR CONTINUOUS MANUFACTURING OF INSULATING PANELS WITH LATCH FASTENERS



(57) Abstract: A method for continuous manufacturing of insulating panels provided with latch fasteners (17), includes an operating step during which the fasteners are fixed to a metal strip or sheet (15) advancing along the manufacturing line, by means of a spacer (21) associated thereto. In this manner when the polyurethane or similar insulating material of the panel expands, the fasteners remain in their pre-set position without the need for use external positioning frames.

**"Process for continuous manufacturing of insulating panels with latch fasteners"**

The invention relates to the manufacture of insulating panels used for the construction of cold-storage chambers, prefabricated structures and the like.

5           These panels have the usual composite "sandwich" structure where a layer of insulating material, usually expanded polyurethane, is arranged between two outer faces made of sheet metal, plastic, fibreglass or other material.

10           In order to construct the chambers or other cold-storage structures, the panels herein considered are assembled together by means of special latch fasteners; the latter essentially consist of hook latches operated by cam or eccentric mechanisms which are housed in cases incorporated in the polyurethane and positioned along the edges of the panels so as to co-operate with the associated fasteners of an adjacent panel.

15           The latch fasteners are well known since a long time and examples thereof may be found in US patents Nos. 3,784,240, 3,671,006 and 6,299,244.

20           At present the insulating panels referred to above are manufactured individually using a method according to which their components are first prepared on the plate of a press, using special frames to position the latch fasteners, and afterward the polyurethane is injected following the closing of the press, in order to allow it to expand.

          Such a method has the typical limitations of a discontinuous cycle, namely a productivity which cannot reach high levels because the panels are manufactured individually; it is therefore unsuitable for large scale industrial production.

25           The present invention aims to improve this state of the art.

          It has therefore the object of providing a method for the production of panels, having operating steps that can occur one after the other without interruption so as to be carried out industrially by means of a production line, along which the various components are fed and at the end of which finished  
30           panels are ready.

          It is indeed obvious that in this way it is possible to overcome the

limitations of the state of the art, where panels production is performed one by one.

The invention arises from the realisation of the Applicants that in order to achieve a continuous manufacturing process, the latch fasteners must be fixed  
5 onto the faces of the panels so that when the polyurethane expands, they remain in the correct position.

The object of the invention is therefore achieved by a method in which the faces of the panels are fed in a predefined direction and the latch fasteners (or the spacers thereof) are fixed onto them.

10 Depending on the type of panel to be made, the latch fasteners may be applied only along the longitudinal sides of the faces or also along the transverse sides thereof.

The characterising features of a process and of a plant for continuously manufacturing panels according to the invention above, are set out in the claims  
15 which will follow.

The aforesaid process and plant will appear more clearly from the description below, which relates to a preferred and non-limiting embodiment of the invention, shown in the accompanying drawings wherein:

- Fig. 1 is a plan view of a plant for the continuous manufacturing of  
20 panels in accordance with the present invention;

- Fig. 2 is a perspective and partially sectioned view of a latch fastener mounted on a support, during a step of the method carried out by the plant of Fig. 1;

- Figs. 3 and 4 show respective steps involving fixing of a spacer to a  
25 metal sheet during the method carried out by the plant of Fig. 1;

- Figs. 5 and 6 show a cross-sectional view of the latch fasteners with associated support sections during respective steps of the method carried out by the plant of Fig. 1;

- Fig. 7 shows a top plan view of the mounting phase assembly of latch  
30 fasteners on support sections, with a partially cut-away portion so as to show the hooks;

- Figs. 8 and 9 show a cross-sectional view of latch fasteners with associated support sections, during further steps of the process carried out the above plant.

5 With reference to the first of these figures, there it is shown in schematic form a plant for the continuous manufacturing of insulating panels for refrigerating rooms, which extends along a single line although for reasons of space on the sheet of Fig. 1 it has been divided into two sections joined by a broken line.

10 The aforementioned plant is intended in particular for the processing of panels having sheet-metal outer faces; for this purpose it includes a first reel 1 from which a metal strip used to form the upper face of the panels is unwound.

Thereafter the strip is processed in a manner known per se by a straightener 2 and coated with a plastic protective film (for example polythene) by an applicator 3, of the known type too; both straightening and coating of the strip  
15 are not necessary, however, and could in principle be eliminated from the production cycle.

Afterward, the strip reaches a cutting and bending station 4 where it is cut into rectangular sheets 5 of predefined length, whose corners are then trimmed, and which are folded along their front and edges 5a and 5b.

20 Likewise it has just been described, for forming the bottom face of the panels, in the plant of Fig. 1 there is provided a second reel 11 from which a respective metal strip is unwound, at a lower level than the first one.

The second strip, after passing through a straightener 12 and a polythene applicator 13 reaches a cutting-bending-punching station 14, where it is cut into  
25 rectangular sheets 15 whose corners are then trimmed, and which are folded along the front and longitudinal edges 15a and 15b.

The station 14 also performs punching of a series of holes 16 in the bottom strip advancing along the line, before it is cut into sheets; these holes are formed both along the edges of the strip and transversely thereto, and are intended for  
30 application of latch fasteners 17 in the successive stations 18, 19 and 20.

The first two of these stations apply the fasteners along the longitudinal

edges 15b of the sheets 15, while the third station places them along the transverse edges 15a.

Tubular spacers 21 with a widened base are fixed to the holes 16 present on the sheets 15, said spacers having the function of preventing the expanded  
5 material from obstructing access, from the outside, to the cam actuating the hooks.

The systems for fixing the spacers 21 may change depending on the dimensions of the panels, the thickness of their external faces, the spacers, the type of latch fastener and other factors.

In this example, the aforementioned fixing system is of the mechanical  
10 type, obtained by means of clinching of the metal sheet with a punch 22 after arranging the spacer 21 thereon, the latter being joined to a collar 23 formed around the hole 16 by the clinching operation: the interference between the joined surfaces keeps the spacer 21 fixed in position (Figs. 3 and 4).

As set out above, however, other systems may be used such as, for  
15 example, welding of the spacers (when they are made of metal), gluing thereof, folded seaming, etc.

Once the spacers 21 have been fixed to the sheet 15, the latch fasteners 17 are mounted on them; this occurs in two separate ways, depending on whether the devices are arranged along the front edges 15a or longitudinal edges 15b of the  
20 sheets 15.

As regards the first case, support sections 25 are prepared off the production line (cf. Figs. 5-9), which have seats 27 at a predefined distance from each other for pins 28; the latter are engaged by the hooks 29 of the fasteners 17, which are thus made solid with the sections 25 and may therefore be positioned  
25 along the front edges 15a of the metal sheets 15 (Fig. 5). Thereafter, in the station 20 the transverse supports 25 with the fasteners preassembled on them are lowered so as to cause engagement of a projection 30 present thereon, with the top end of the spacers 21 (Fig. 6).

In this connection it is important to point out that the transverse support  
30 sections 25 are symmetrical since the devices 17 are applied to them on both sides.

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It follows therefore that once the fasteners are associated with the respective spacers 21 as explained above, the metal sheets 15 are connected to each other forming a chain which advances along the line as if it were a single strip.

5           The configuration, during this step, of the system formed by the bottom sheets 15 connected by sections 25 and devices 17, is shown in Fig. 7; in this connection it should be just pointed out that the latch fasteners 17 are of the dual-purpose type, i.e. they are each provided in addition to the hook 29 of a pin (not shown in the drawings) with which the hook of another fastener may engage, so  
10       that they connect together.

          However, as an alternative to these dual-purpose fasteners, it is possible to use in the panels latch fasteners of the male type, i.e. provided only with the hook, and of the female type, i.e. provided only with the pin; in this case the support sections 25 will be provided with hooks instead of pins 28, but from a conceptual  
15       point of view there will be no substantial changes in the operating cycle, since these female devices will also be preassembled on the supports and fixed to the sheets 15 by means of the respective spacers.

          Application of the latch fasteners 17 along the longitudinal edges 15b of the sheets 15, is carried out in accordance with the same principles explained  
20       above, but in such a way that the means used to handle the fasteners is moved away from the latter after mounting thereof on the tubular spacers 21.

          Such means may be mechanical arms which grip the fasteners one at a time and then apply them onto a spacer, or hydraulic, electromechanical, pneumatic, suction-pad and other systems suitable to handle several fasteners at  
25       the same time and place them on the spacers; an example of this solution is shown in Fig. 2 where 31 denotes an application bar which contains a series of pins 32 similar to those already seen above.

          In the stations 18 and 19 the application bars 31, on which the devices 17 have been preassembled, are lowered on top of the spacers 31 fixed on the sheets  
30       15, causing them to engage with the projection 30 of the fasteners 17.

          Once this step has been completed the hooks 29 of the fasteners are rotated

using spanners 33 inserted from above into corresponding openings 34 present therein, thereby becoming disengaged from the pins 32 so that the application bar 31 may be moved away from the edge 15b of the bottom sheets 15 moving along the plant.

5           It just needs to be mentioned that the spanners 33 may be operated pneumatically, electromechanically, hydraulically or in similar ways, but also manually; it is further obvious that the hooks 29 might be rotated from underneath, by inserting the spanners 33 through the spacers 21.

10           Finally, also in this case the comments made above as regards the use of latch fasteners of the female type instead of the dual-purpose type shown in Fig. 2, are applicable; otherwise stated, in such a case hooks will be provided on the application bar 31 instead of the pins 32, allowing the mounting of female fasteners in a manner similar to that already described.

15           Once application of the latch fasteners 17 in the stations 18-20 has terminated as referred to above, the upper sheets 5 are associated with the chain of bottom sheets 15 advancing along the line by being placed between two consecutive support sections 25.

20           For this purpose the latter are provided with upper teeth 38 against which the front edges 5a of the upper sheets 5 come into contact, said edges being advantageously bent in a manner matching the profile of the teeth 38 thereby ensuring a seal preventing leakage of the polyurethane during the subsequent expansion thereof.

          For the same reason the bottom sheets 15 have front edges 15a which are bent so as to match the bottom teeth 39 present on the support section 25.

25           At the end of this step the chain of facing sheets 5 and 15 connected by the transverse sections 25 are in the condition shown in Fig. 8 and are made to pass into an oven 40, in order to be heated before application of the polyurethane.

30           In this connection it must be pointed out that for achieving a better retention of the expanded polyurethane mass, a seal 41 made of rubber or similar material is preferably applied between the teeth 38 and 39 of each transverse section 25.

The polyurethane is injected in a manner known per se by using a nozzle bar 45 inserted between the bottom and top sheets 5, 15 and extracted in a transverse direction with respect to them when, following their advancing movement, the support sections 25 meet the bar.

5           Afterward the chain of facing sheets 5 and 15 enters into a continuous press 50 where polymerization of the polyurethane occurs; this press comprises, two pairs of belts arranged along the sides of the sheet chain (namely at the top, at the bottom, and along the sides thereof), which restrain the increase in volume and the forces resulting from polymerization of the polyurethane.

10           At the exit from the press 50, an insulating layer 51 of polyurethane foam is therefore present between the sheets 5 and 15, as can be seen in Fig. 9; thereafter, a station 52 for extracting the support sections 25 removes the latter from the line, so that the panels may be considered completed.

15           The panels are then conveyed away by a rollerway 54 located at the end of the plant, towards a palletizing machine 55 and a wrapping machine 56.

From what has been described in the foregoing, it is possible to understand how the plant considered achieves the predefined object of the invention.

20           Indeed, this plant allows the series production on an industrial scale of panels which are currently manufactured in a discontinuous manner; this is made possible by the operating steps of the manufacturing process.

In particular it should be underlined the importance of the fact that, in the process of the invention, the latch fasteners are made solid with one of the faces of the panels, which in the example described above is the one corresponding to the bottom sheets 15.

25           This allows the subsequent application of the insulating material, in the same way as for normal insulating panels.

30           In other words it may be said that in the process according to the invention, the manufacture of panels with latch fasteners is brought back to a process similar to that used for normal insulating panels, owing to certain particular operating steps.

A first of these steps consists in associating the latch fasteners with one of

the faces of the panels, i.e. the bottom sheets 15; in the example described above this is obtained by fixing firstly the tubular spacers 21 onto the metal sheet and then mounting the fasteners 17 on top of them.

5 This solution facilitates the spacer fixing operation by means of mechanical machining of the metal sheet; however, it is also possible for the spacers to be formed in one piece with the fasteners or preassembled on them and then fixed to the surface of the panels, using one of the several systems mentioned above or others.

10 It should be noted that according to the present state of the art, the latch fasteners are kept in the required position by means of peripheral frames which have the shape of the perimeter of the panels and are also present during foaming; a system of this kind is, however, not compatible with the continuous manufacturing of panels, in particular those panels in which the latch fasteners are arranged only along the longitudinal edges, which will be explained more fully  
15 below.

Another important step of the process according to the invention which allows the continuous manufacturing of panels, is the connection in chain-like succession of the bottom sheets 5, which is achieved by means of the transverse support sections 25.

20 Indeed it can be easily understood that in this way the continuity of the strips, which were initially cut into sheets, is restored so as to allow feeding along the plant of a continuous semifinished product, which may undergo a foaming process like that used for the continuous production of ordinary insulating panels.

25 As mentioned above, the method according to the invention is also applicable to panels having latch fasteners on two sides only, and not on four sides, like for example the panels used for cold structures (buildings, warehouses, etc.) other than rooms.

30 In this type of panel the latch fasteners are present only along the longitudinal edges 15b and not along the transverse edges; consequently, in order to manufacture the panels, it is no longer necessary to cut the strips unwound from the reels 1 and 11 into sheets of predefined length and then connect them together

using the transverse sections 25 as explained above.

The manufacturing process implemented by the plant according to Fig. 1 is therefore simplified with respect to the preceding process, in that the strips unwound from the respective reels 1 and 11 are fed continuously and there is no longer the step of transverse cutting thereof carried out by the stations 4 and 14, but only the step of punching the holes 16; similarly, the station 20 (i.e. the station for insertion of the support sections 25) will be excluded from the cycle since the spacers and the latch fasteners are applied only along the longitudinal sides of the strips, at the stations 18 and 19.

The application of the polyurethane is also simplified because the nozzle bar 45 must no longer be moved away from the operating position, when the transverse support sections 25 pass by it.

As a specific element for this manufacturing process, the plant in Fig. 1 is provided with a transverse shear 53 which operates in place of the station 52 for removing the transverse sections 25, which are absent from the continuous semi-finished product advancing along the production line.

Obviously variations of the invention with respect to that described hitherto are possible.

For example it must be pointed out that although polyurethane is the most suitable insulating material for the process according to the invention, it would also be possible to use in place thereof other materials, including non-expanded materials such as rock or glass wool.

Significant modifications may also be made as regards the processing operations and the associated machinery used to perform them.

For instance the cutting, bending and punching operations may be carried out in a different order depending on the thicknesses of the sheets used, the metallic material used (steel, aluminium, copper, etc.), the shape of the profiles and other factors; profiling machines, punching machines, shears or other apparatus of known type will nevertheless be used.

It must be pointed out, however, that, in order to manufacture panels provided with latch fasteners on four sides and which are thus made using the

transverse support sections 25, the top sheets 5 could also be made of a non-metallic metal.

Indeed, since the latch fasteners are not applied onto these sheets and boring, clinching or other typical sheet-metal machining operations need not to be performed, the metal sheet may be replaced by plastics sheet or sheet of other than metal.

For this purpose sheets of suitable dimensions should therefore be provided in the plant, being placed on the support sections 25 in a manner similar to that described above, while the other operating steps of the process remain unchanged.

Finally it must be underlined that the process according to the invention has the advantage that it may be carried out using a multi-purpose plant, namely a plant suitable to produce also ordinary insulating panels or in any case panels without latch fasteners.

Indeed, as stated above the operating steps of the process allow to bring it back to a manufacturing process, similar to that for producing ordinary insulating panels.

Consequently, a plant could be designed where the steps common to both the process of the invention and to the process for production of ordinary panels (unrolling of the strips, straightening, lining with polythene, foaming, final cutting, etc.) are carried out by the same machines; for the different operating steps it would be possible to provide means for rapid change-over of the machines or ensuring that the machines which do not need to be used are excluded from the working cycle

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### CLAIMS

1. Process for continuous manufacturing of insulating panels, wherein the panels comprise two opposite faces, a layer (51) of insulating material therebetween and a plurality of latch fasteners (17) arranged along at least one of their sides for connection with other the panels,
- 5 characterized in that it comprises the steps of:
- forming a plurality of holes (16) along the edges of a first advancing metal strip;
  - fixing spacers (21) to be associated with respective latch fasteners, on
  - 10 said holes;
  - providing a second advancing strip opposite and above the first strip;
  - applying the insulating material between the strips, thereby forming a continuous semifinished product;
  - achieving the panels of desired length from the semifinished product thus
  - 15 formed.
2. Process according to Claim 1, further comprising the steps of:
- forming a plurality of holes (16) in a transverse direction on the first strip;
  - cutting the first strip into sheets (15) of predefined length in the vicinity
  - 20 of said transverse holes;
  - providing support sections (25) on which a plurality of latch fasteners (17) projecting from opposite sides thereof, are mounted;
  - fixing the spacers (21) of the fasteners mounted on the support sections (25) to the transverse holes, thereby connecting the sheets (15) cut from the first
  - 25 strip;
  - cutting the second strip into sheets (5) of predefined length and placing them on the transverse support sections (25), opposite and above the sheets (15) cut from the first strip.
3. Process according to Claim 2, wherein the final step of obtaining
- 30 the panels of desired length is carried out by removing the support sections (25) and disengaging the latch fasteners (25) mounted thereon.

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4. Process according to Claim 3, wherein the sheets (5) cut from the upper strip are placed on upper teeth (38) formed on the transverse support sections (25).

5. Process according to Claim 4, wherein the front edges (15a, 5a) of the lower sheets (15) and the upper sheets (5) are bent so as to match respectively the profile of lower teeth (39) and upper teeth (38) formed on the transverse support sections (25).

6. Process according to any of the preceding claims, wherein the spacers (21) consist of tubular elements separate from the latch fasteners (17), the latter being provided with means (30) for removably coupling with the spacers, and in that said fasteners are coupled to the spacers after these are fixed on the holes (16).

7. Process according to Claim 6, wherein the spacers (21) are fixed by means of clinching of the metallic material of the first strip, folded seaming or other equivalent mechanical system.

8. Process according to Claim 7, wherein the means for coupling the latch fasteners (17) to the spacers (21) comprise a projection (30) present on said fasteners.

9. Process according to any one of the preceding claims, wherein the material of the insulating layer (51) of the panels is an expanded polymer material.

10. Transverse support section for carrying out the method according to Claims 2 to 9, comprising means (27, 28) for engagement with latch fasteners (17) of male or female type, which allows removably fixing of the fasteners on both sides of the section.

- 1/6 -

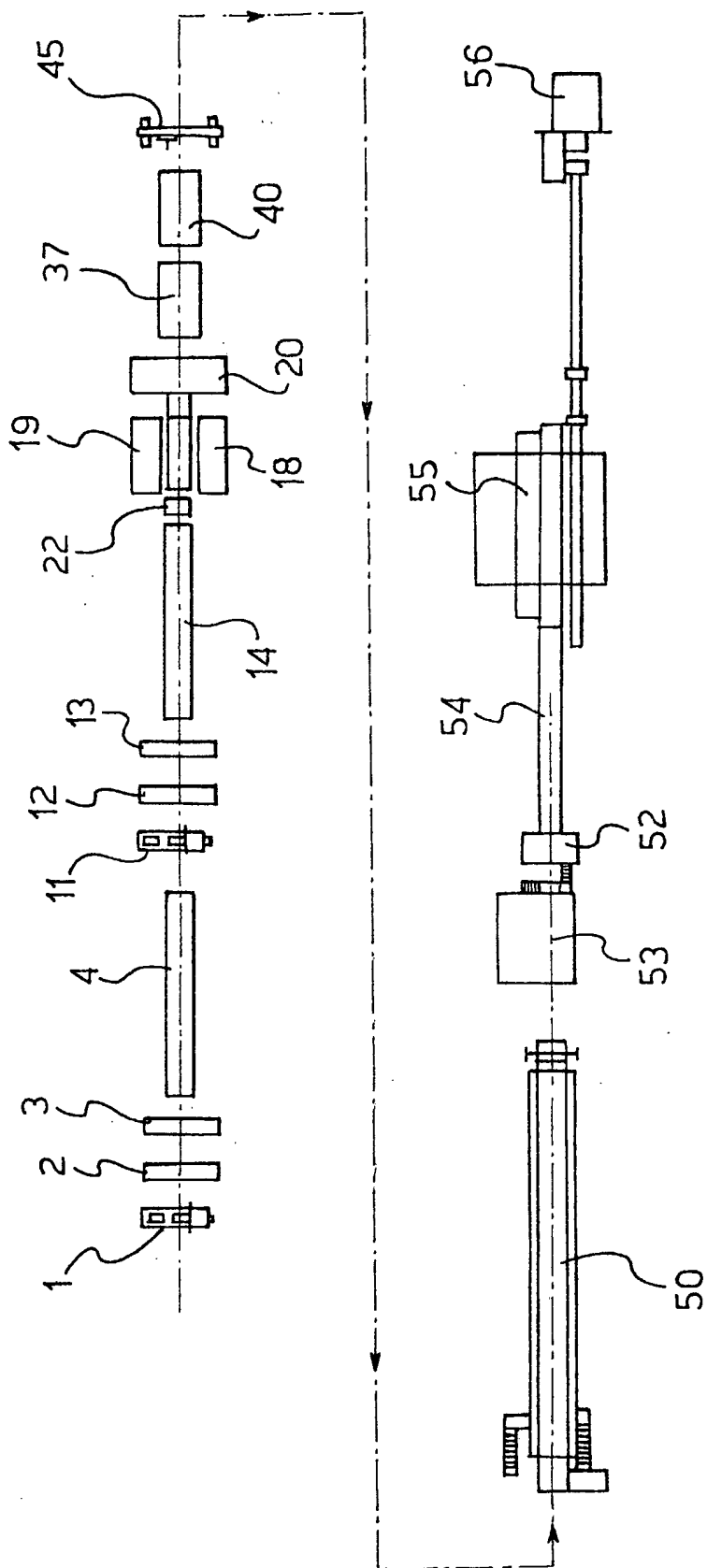


FIG. 1

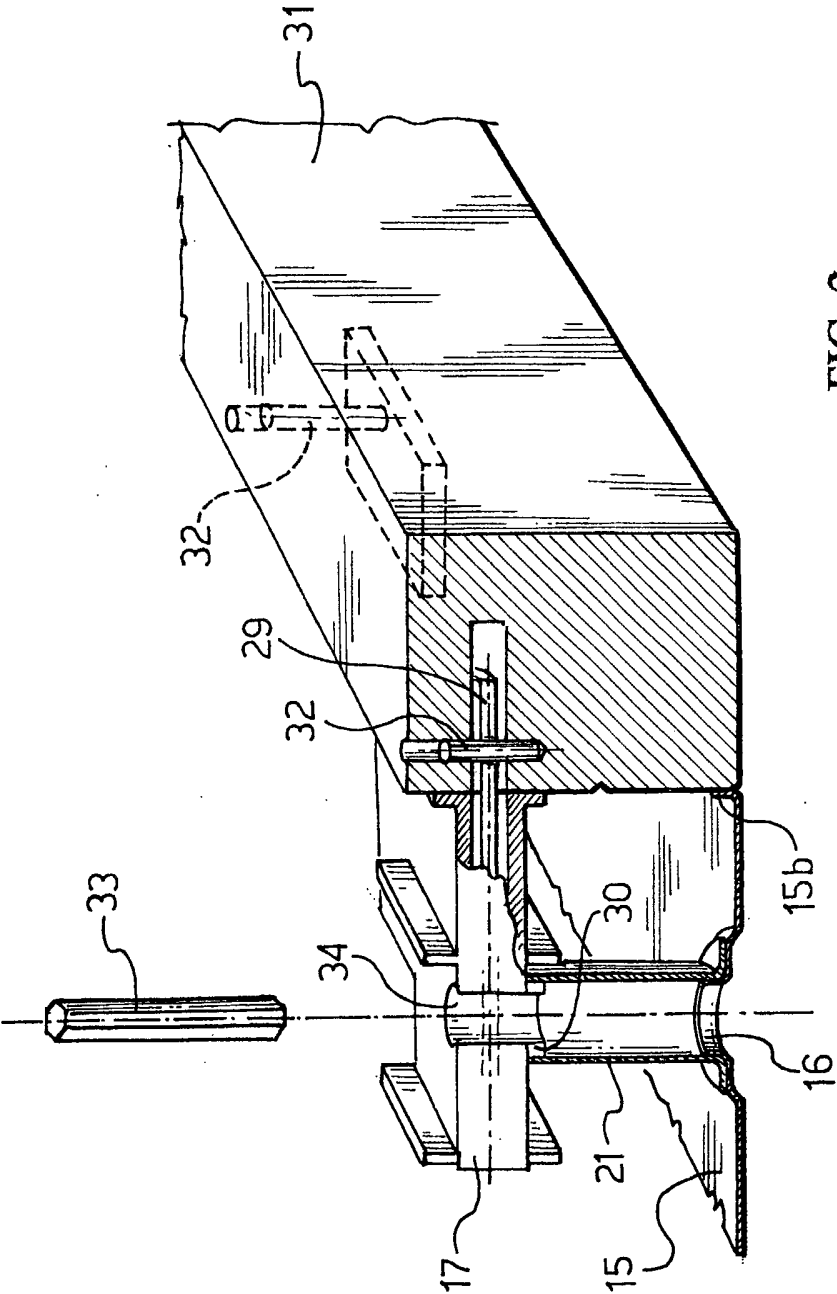


FIG. 2

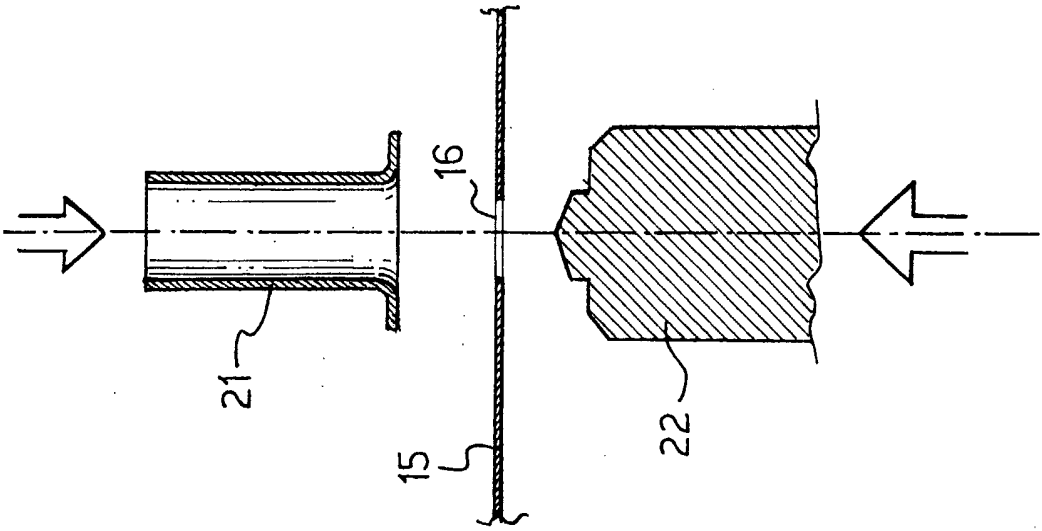


FIG. 3

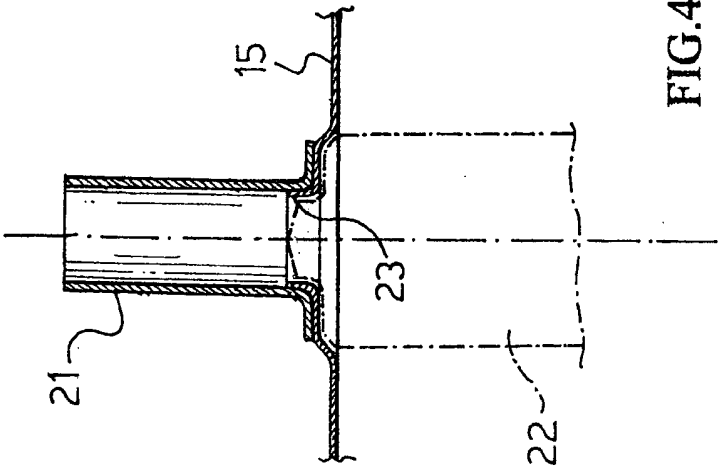


FIG. 4

- 4/6 -

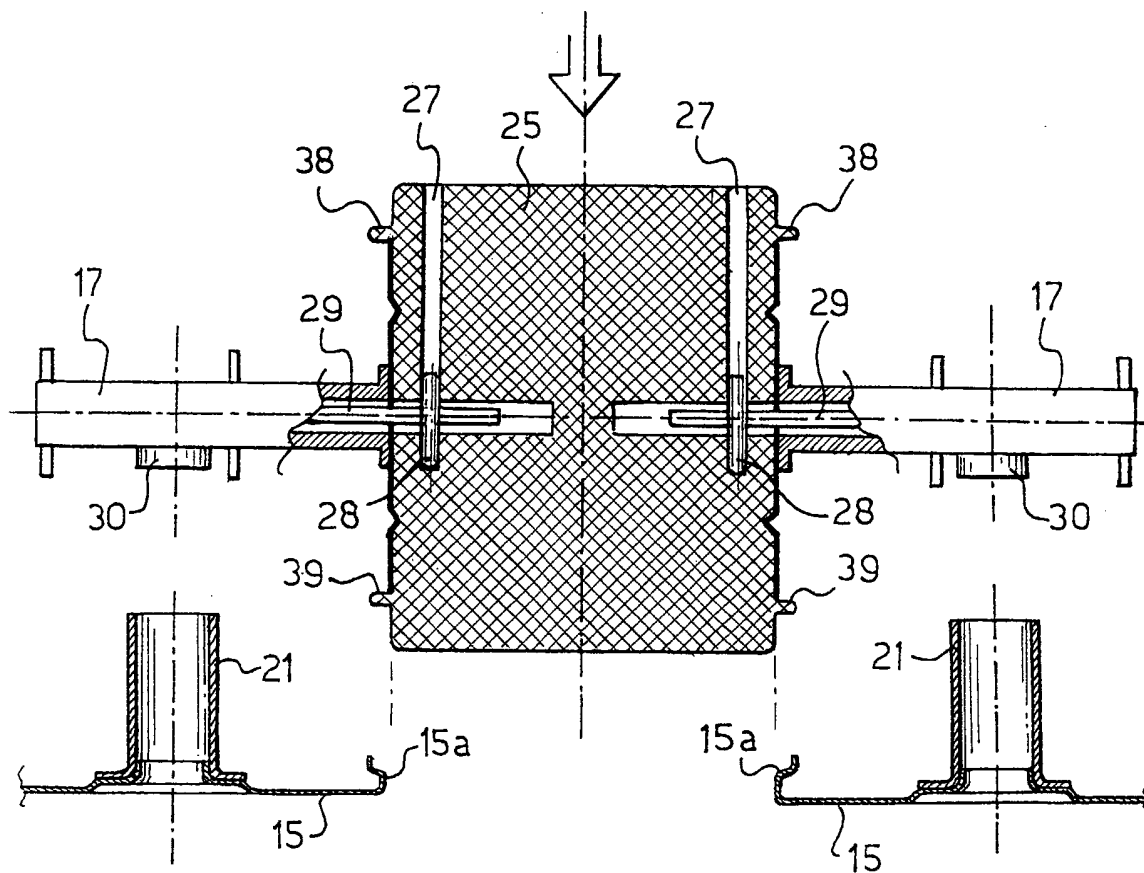


FIG. 5

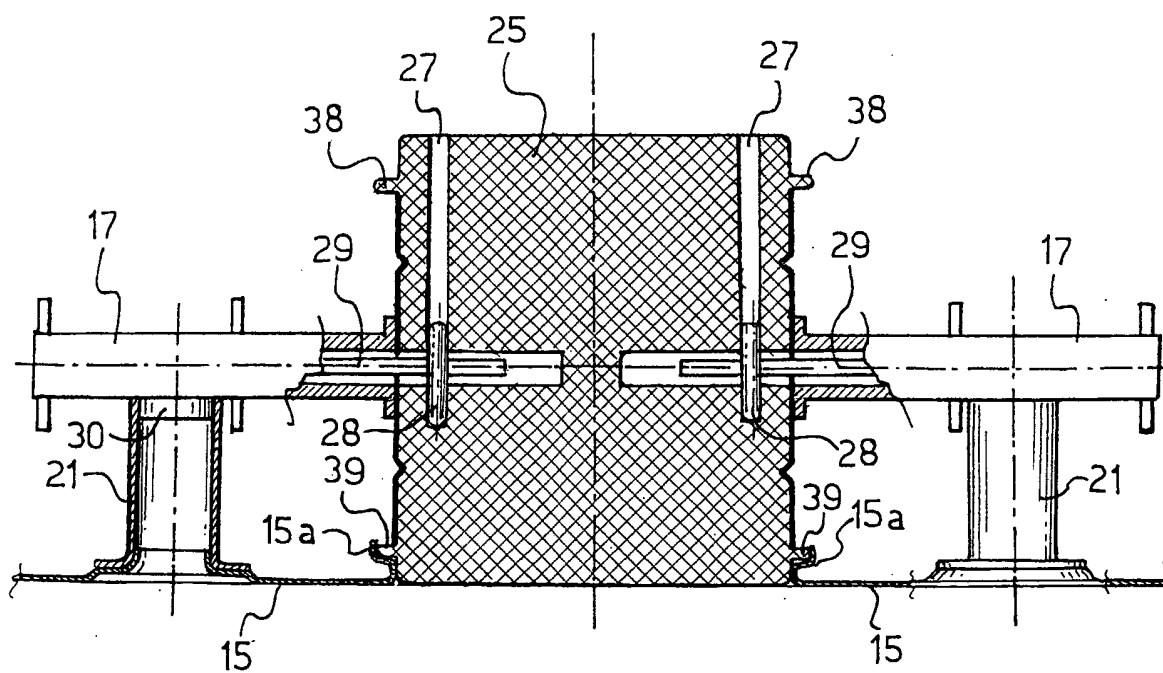


FIG. 6

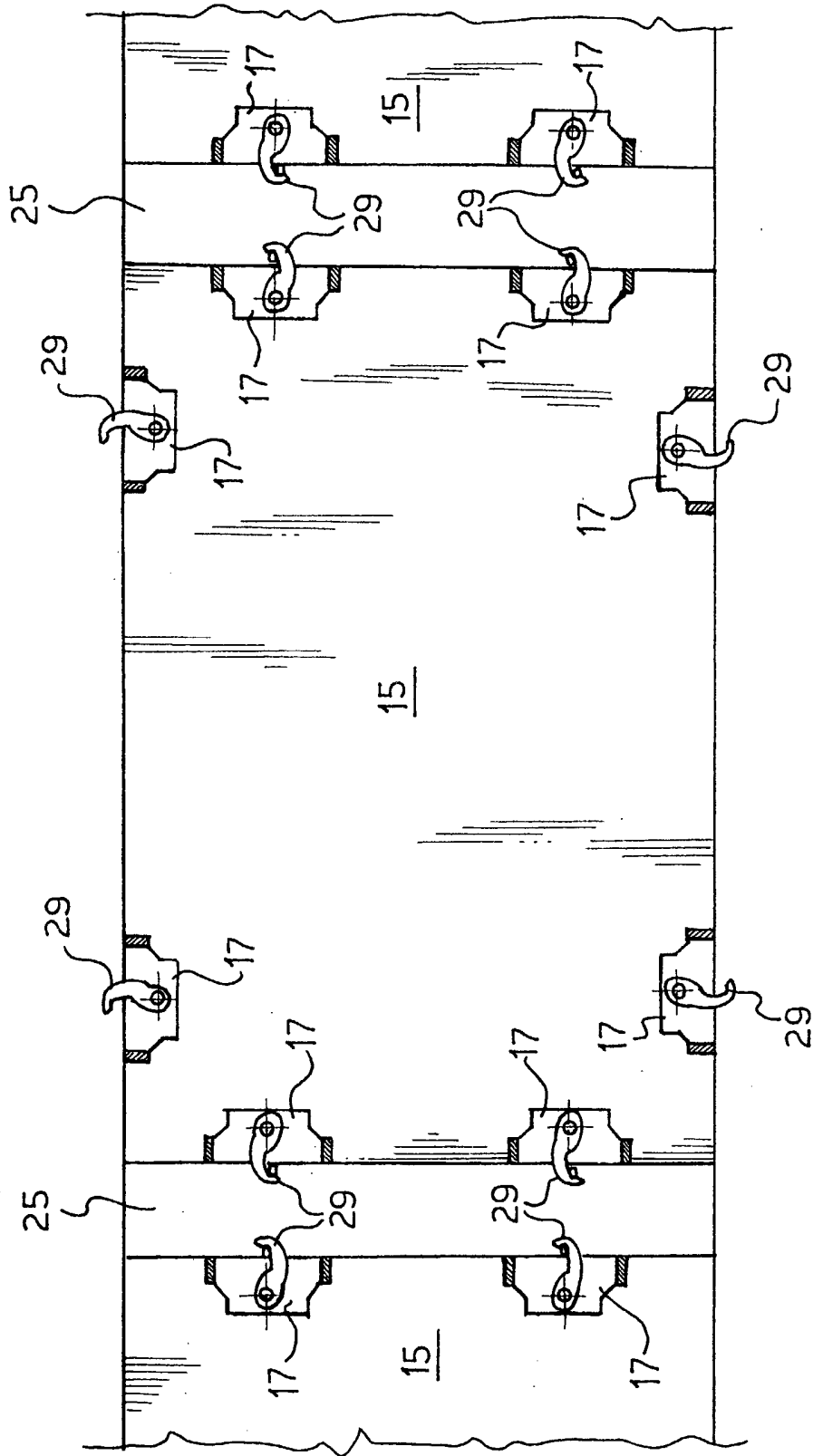
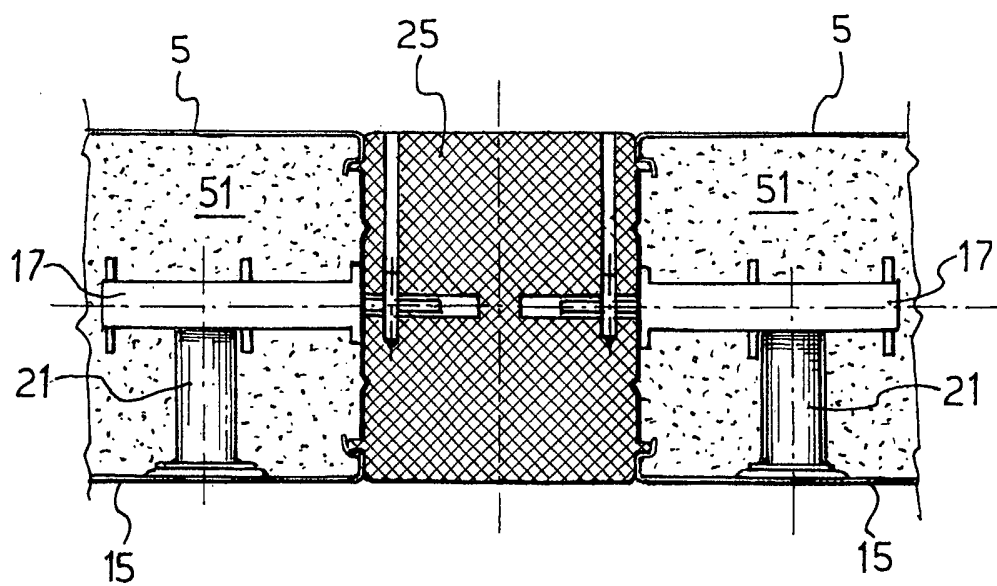
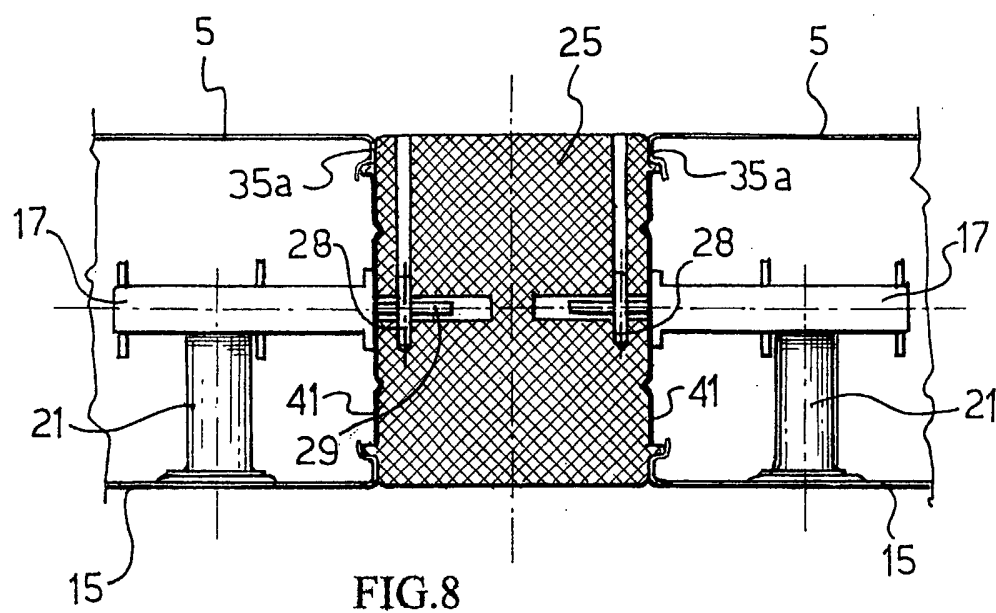


FIG. 7



# INTERNATIONAL SEARCH REPORT

In **International Application No**  
**PCT/IT 02/00479**

**A. CLASSIFICATION OF SUBJECT MATTER**  
**IPC 7 E04B1/61**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

**IPC 7 E04B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**EPO-Internal, WPI Data**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                            | Relevant to claim No. |
|------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A          | US 3 671 006 A (BERKOWITZ IRVING L)<br>20 June 1972 (1972-06-20)<br>cited in the application<br>the whole document<br>---     | 1                     |
| A          | US 3 341 233 A (VANTINE CUSHMAN KENNETH)<br>12 September 1967 (1967-09-12)<br>column 5, line 10 - line 39; figures 5,7<br>--- | 1                     |
| A          | GB 2 179 719 A (TAKIGEN MFG CO)<br>11 March 1987 (1987-03-11)<br>page 1, line 116 - line 119; figure 5<br>-----               | 1                     |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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**25 March 2003**

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**01/04/2003**

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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|-------------------------------------------|---|---------------------|-------------------------------|--------------------------|
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| US 3341233                                | A | 12-09-1967          | NONE                          |                          |
| GB 2179719                                | A | 11-03-1987          | CN 86106305 A , B             | 18-03-1987               |