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(54) CONCRETE FORM MADE OF THERMOPLASTIC RESIN.

(57) This invention provides a concrete form made of a thermoplastic resin which is obtained by thermally press molding a thermoplastic resin containing a predetermined amount of a glass fiber having a specific mean fiber length. A ceiling plate and ribs are integrally bonded as the same and one molding, the thickness t of the ceiling plate and the height h of the ribs satisfy the relations, $t = 2.5$ to 5 mm and $t + h = 25$ to 70 mm, and if desired, patterns may be formed on a panel surface.

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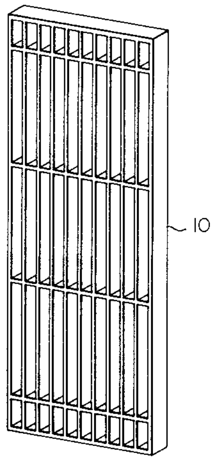
FIG. 1



TECHNICAL FIELD

The present invention relates to a concrete form made of a thermoplastic resin.

BACKGROUND ART

As concrete forms, wood products have been mainly used, but they have been disadvantageous, for example, in that they are heavy and moreover too damageable to be used for a long period of time. In addition, such concrete forms have been disadvantageous in that products produced by assembling a panel (e.g. plywood) and crosspieces in a working site are used as the concrete forms, resulting in a low working efficiency.

All of the panel surfaces of conventional concrete forms are smooth, and therefore when a natural stone such as marble or a surface-decorating material such as tiles is attached to a smooth surface obtained by concrete placing by the use of the conventional concrete forms and the surface of a concrete panel (these surfaces are hereinafter generically referred to as "concrete surface"), an adhesive, cement mortar or the like is usually applied on the concrete surface, followed by adhesion.

However, when the surface-decorating material is attached by such a method, the bond strength between a bonding layer and the concrete surface is not sufficient, so that in some cases, the surface-decorating material peels from the concrete surface together with the adhesive layer to cause an unexpected accident. Furthermore, when the peeling occurs at the high place of a multistory building or the like, repair has been very difficult and dangerous.

DISCLOSURE OF THE INVENTION

In view of such conditions, the present inventors investigated in order to remove the defects of conventional concrete forms made of wood and develop a practically effective concrete form made of a thermoplastic resin, and consequently found that a concrete form made of a thermoplastic resin by a hot-press molding method by using a thermoplastic resin containing a specific amount of glass fiber with a specific length, and employing a specific relationship between the thickness of a top plate and the height of ribs, is free from the above-mentioned defects and can be used very effectively as a concrete form, and that previous formation of concave patterns and convex patterns on the surface of the concrete form is very effective in improving the bond strength between a concrete surface formed by concrete placing and an adhesive layer by roughening the concrete surface, whereby the present invention has been accomplished.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 shows one example of the concrete form made of a thermoplastic resin of the present invention which is seen from the rib side.

Fig. 2 shows a part of a section of the concrete form shown in Fig. 1.

Fig. 3A to Fig. 3C show an outline of a process for producing the concrete form made of a thermoplastic resin of the present invention by injection press molding.

Fig. 4A to Fig. 4C show an outline of a process for producing the concrete form made of a thermoplastic resin of the present invention by cast press molding.

Fig. 5A to Fig. 5B show an outline of a process for producing the concrete form made of a thermoplastic resin of the present invention by a sheet stamping method.

Fig. 6 shows an impact tester used for an impact test.

Fig. 7 shows one example of a concrete form made of a thermoplastic resin having patterns on its panel surface.

Fig. 8 shows a section of the concrete form made of a thermoplastic resin which is shown in Fig. 7.

Fig. 9A to Fig. 9E show examples of various concave or convex patterns formed on the surface of a panel.

The symbols in the figures have the following meanings:

1 : glass-fiber-containing thermoplastic-resin melt,
2 : female mold,
3 : male mold,
4 : resin passageway,
5 : outside melt feeder,
6 : glass-fiber-containing thermoplastic-resin sheet,

7 : test piece,
8 : impactor,
9 : load,
10 : concrete form made of a thermoplastic resin,
11 : panel of a concrete form made of a thermoplastic resin,
12 : convex pattern,
13 : rib.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention is concretely explained below.

The present invention provides a concrete form made of a thermoplastic resin (hereinafter referred to merely as "concrete form" in some cases) which is produced by hot press molding of a thermoplastic resin containing 15 to 35% by weight of glass fiber with an average fiber length of 0.1 mm to 50 mm, and is characterized in that the top plate and ribs of the concrete form are integrally combined into one and the same molded product and that the thickness t of the top plate and the height h of the rib are as follows: t = 2.5 to 5 mm, t + h = 25 to 70 mm.

In the concrete form made of a thermoplastic resin of the present invention, the length of the glass fiber incorporated into the thermoplastic resin ranges from 0.1 to 50 mm, preferably from 1 to 15 mm. When glass fiber with a length below the above range is used, the concrete form cannot have a sufficient strength. When glass fiber with a length beyond the above range is used, there are, for example, the following problems: the packing of glass fiber into rib portions is not sufficient, so that a product containing the glass fiber in a uniformly dispersed state cannot be obtained; and crushing for disposal, and reuse are difficult. The diameter of the glass fiber is not critical and conventional glass fiber with a diameter of approximately 1 - 50 μm may be used.

Although such glass fiber may be one which have an untreated surface, glass fiber surface-treated with aminosilane, vinylsilane or the like is preferably used. The glass fiber may be used in the form of either a single fiber or a bunch of tens to hundreds of single fibers bundled with greige goods.

As to the amount of such glass fiber incorporated into the thermoplastic resin, the glass fiber content should be in the range of 15 to 35% by weight, preferably 20 to 30% by weight, from the viewpoint of the physical strength of the concrete form and problems in the production.

When the content is below the above range, the mechanical strength of a product is low. When the content is beyond the above range, the ease of nailing and perforability of a product are not sufficient at the time of use.

As the thermoplastic resin used in the present invention, there can be exemplified common thermoplastic resins such as polyethylenes, polypropylenes, poly(vinyl chloride)s, ABS resins, polyamides, polycarbonates, poly(ethylene terephthalate)s, etc., modified products thereof, polymer alloys, and mixtures of these resins. In particular, polypropylene type resins such as homopolymers and copolymers of propylene are preferable.

If necessary, various additives such as heat stabilizers and ultraviolet inhibitors, coloring agents, inorganic fillers, etc. may be blended with the above thermoplastic resins.

When such a third component is blended, the glass fiber content is defined as that based on the weight of only the thermoplastic resin exclusive of the third component.

As to the shape of the concrete form made of a thermoplastic resin of the present invention, the concrete form has a structure composed of a top plate and reinforcing ribs formed thereon integrally therewith so as to give one and the same molded product. If necessary, side plates may be formed around the top plate. In this case, some of the ribs are usually formed around the top plate as side plates. It is also possible to form, separately from the ribs, side plates with optional width and height (preferably a height equal to or smaller than that of the rib) which are different from those of the rib.

Here, the structure integrally formed by into one and the same molded product is a structure composed of a top plate and ribs, which are formed from the same material integrally at the same time, and it does not include a structure composed of a top plate and ribs, which are separately formed and then joined, for example, with an adhesive or by subsequent solvent welding.

In the present invention, the thickness t of the top plate ranges from 2.5 to 5 mm. When the thickness is smaller than 2.5 mm, the mechanical strength is low. When the thickness exceeds 5 mm, there is no particular advantage corresponding to the thickness, and such an unnecessary thickness is uneconomical and moreover offsets the advantage of weight reduction.

It is important that the sum of the height h of the rib and the thickness t of the top plate, i.e., t + h is 25 to 70 mm, preferably 59 to 66 mm, more preferably 61 to 65 mm. When the sum is below the above range, the height of the rib become insufficient, so that no sufficient reinforcing effect can be obtained. When the sum is beyond the above range, there is no particular advantage corresponding to the sum, and such a sum is uneconomical. Moreover such a sum is disadvantageous for transportation and on-site working because the thickness of the concrete form is increased. Particularly when t + h = 59 to 66 mm, preferably 61 to 65 mm in the concrete form of the present invention, this concrete form can be used together with a concrete form obtained by combining a panel such as plywood with crosspieces which is now widely used, and hence it is very advantageous for practical purposes.

The width w of the rib is usually 0.5 t to t at the joint between the rib and the top plate. The end of the rib usually has the same width as above, though for facilitating the withdrawal of a molded product in the production, it is preferable to taper the rib at an angle of 2° or less, preferably 1° or less, more preferably 0.5° or less between the end of the rib and the joint so as to thin the end of the rib slightly.

Such ribs may be formed either in the lengthwise direction or crosswise direction of the concrete form, and may be, of course, formed in both directions. Although the number of the ribs is not critical and is varied depending on various conditions such as the size of the concrete form and the thickness of the top plate, the ribs are formed usually at 20- to 300-mm intervals in the crosswise direction.

In the concrete form made of a thermoplastic resin of the present invention, there may be formed, besides the aforesaid ribs, auxiliary ribs lower than the aforesaid ribs, separator inserting holes, etc. if necessary.

The concrete form made of a thermoplastic resin of the present invention can be integrally produced as one and the same molded product by hot press molding of a thermoplastic resin containing the above-mentioned glass fiber.

As a method for molding a thermoplastic resin, there are various methods such as injection molding and a method of casting a molten resin into a mold, but in the case of the concrete form made of a thermoplastic resin of the present invention, molding by hot pressing is essential. When injection molding or the like is employed for the production of the concrete form made of a thermoplastic resin, breaking of the glass fiber during the production thereof is serious, resulting in the following troubles: incorporation of glass fiber with a desired length is difficult, packing of the resin into rib portions is not sufficient, or a warped or deformed product is obtained. Thus, only a product insufficient as a practical concrete form can be obtained.

The glass-fiber-containing thermoplastic resin used as a starting material in the hot press molding may be either a melt of a thermoplastic resin containing the glass fiber, or a material obtained by heating a previously prepared glass-fiber-containing thermoplastic-resin sheet such as a stampable sheet to a temperature higher than the melting temperature of the resin. For producing a product having high ribs, the former melt is preferably used.

The hot press molding is carried out, for example, as follows: as shown in Fig. 3A, Fig. 3B, Fig. 3C, Fig. 4A, Fig. 4B and Fig. 4C, there is used a combination of upper and lower molds, i.e., a female mold 3 and a male mold 4 which are designed to give a product of a predetermined shape; the molds are closed until the cavity between the two molds becomes a predetermined clearance, after or while feeding a glass-fiber-containing thermoplastic resin 1 heated to a temperature higher than the melting temperature of the resin by means of a plasticator (not shown) into the unclosed cavity between the molds; and after pressing and cooling, a product is taken out of the molds.

In this case, as a method for the feeding of a melt of the glass-fiber-containing thermoplastic resin, there may be employed either a method of feeding the melt into the cavity through a resin passageway 4 provided in the mold, as shown in Figs. 3A to 3C (this method is hereinafter referred to as "injection press molding") or a method of feeding the melt by the use of an outside feeder 5, as shown in Figs. 4A to 4C (this method is hereinafter referred to as "cast press molding").

When the glass-fiber-containing thermoplastic-resin sheet is used (this method is hereinafter referred to as "sheet stamping method"), the hot press molding is carried out by heating said sheet previously to a temperature higher than the melting temperature of the thermoplastic resin by means of an infrared heating oven or the like, placing the heated sheet between the above-mentioned female and male molds, and then closing the molds; or by placing, as shown in Fig. 5A and Fig. 5B, the glass-fiber-containing thermoplastic-resin sheet which may be in a heated state, between the female and male molds, heating the sheet by a heater provided in the molds until the resin is melted, and then closing the molds.

The concrete form made of a thermoplastic resin of the present invention is usually used as it is as a product. When a smooth concrete surface becomes an exterior as such, a surface material may, if necessary, be attached to the concrete form for further smoothening the surface. As the surface material, there are exemplified various thermoplastic-resin sheets and films.

The concrete form having such a surface material attached thereto can easily be obtained, for example, as follows: in the production of the above-mentioned concrete form, the surface material is previously placed between the female and male molds before feeding between them the melt of the glass-fiber-containing thermoplastic resin or the glass-fiber-containing thermoplastic-resin sheet heated to the melting temperature of the resin.

In bonding a suface-decorating material to a concrete surface in contrast with the above-mentioned smoothening, a concrete form having concave or convex patterns on its surface is effective.

When concrete placing is carried out using such a concrete form having concave or convex patterns, the patterns are transferred to a concrete surface, and the concrete surface is roughened by the transferred concave or convex patterns, so that the adhesion between the concrete surface and an adhesive or cement mortar is markedly improved.

Such concave or convex patterns are not particularly limited so long as they give concavities or convexities to a concrete surface when transferred to the concrete surface. There may be formed any of various columnar patterns; patterns composed of continuous concavities or convexities in the form of a blind, a lattice, waves or laid bricks; and a plurality of independent convexities of square, circular or crisscross shape.

The proportion of such patterns relative to the panel surface is usually 10% or more, preferably 30% or more, in terms of the projected area of the concavities or convexities.

Although the size of each pattern is optical, it should be such that a sufficient adhesive strength can be attained when an adhesive, cement mortar or the like is applied on the concrete surface. When the size is too large or too small, the difference between the concrete surface and a smooth surface becomes insufficient, resulting in an insufficiently improved adhesive effect.

It is generally preferable that the patterns are substantially uniformly located on the whole panel surface, though the patterns may be locally formed depending on purpose of use. For example, when a surface-decorating material is bonded to only a part of a concrete surface formed by concrete placing, the patterns may be locally formed.

When the height of the patterns (the depth of the patterns in the case where the patterns are concave) is too large, an adhesive layer for bonding a surface-decorating material becomes thick, resulting in not only need of the adhesive more than necessary and a deteriorated adhesive strength but also a difficult peeling operation of the concrete form after concrete placing. When the height is too small, distinction between the concrete surface and a smooth surface becomes difficult, so that the adhesive strength of a surface-decorating material is not sufficient. Therefore, the height is usually approximately 0.2 - 5 mm.

Needless to say, when the patterns are concave, their depth is smaller than the thickness of the panel.

The concrete form made of a thermoplastic resin of the present invention has many advantages in that it is very good in workability because it is light in weight, is easy to nail or saw, and does not require a crosspiece, and that it is excellent in recyclability. Furthermore, the concrete form of the present invention can be used not only singly but also in combination with conventional concrete forms, and hence is of very high utility value in practice.

When concrete placing is carried out using the concrete form having concave or convex patterns on its panel surface, patterns corresponding to the concavities or convexities are transferred to the resulting concrete surface to roughen this surface, so that cement mortar or the like for bonding a surface-decorating material such as marble or tiles is attached to the concrete surface strongly, whereby the surface-decorating material can be strongly bonded to the concrete surface.

[Examples]

The present invention is illustrated below in further detail with examples, but needless to say, the present invention is not limited by them.

Evaluation in performance tests and on-site working test was made by the following methods.

Static strength:

Evaluated by constructing a concrete form and measuring the degree of deformation of the concrete form caused by practical concrete placing.

Concrete forms with a height of 1800 mm and a width of 600 mm were arranged so that their panel surfaces might face each other at a distance of 500 mm. Outside bars (cross bars) were attached to the concrete forms at distances of 150 mm, 650 mm, 1150 mm and 1650 mm from the upper ends of the concrete forms to fix the concrete forms. Concrete was placed in the resulting assembly to a height of 1800 mm, and the degree of displacement of the concrete forms by the placing was measured at positions 450 mm, 900 mm and 1350 mm above the bottom. At any of these positions, a degree of displacement of 6 mm or less was expressed by ○, that of not more than 10 mm and more than 6 mm by △, and that of more than 10 mm by ×.

Impact strength:

Evaluated by means of the impact tester shown in Fig. 6.

An impactor 8 having a semicircular tip with a diameter of 1/2 inch was placed on a 50 mm x 50 mm test piece 7 cut out of a concrete form produced by molding, and a load 9 was dropped onto the impactor from above. The minimum drop distance (height for fracture) (cm) at which the test piece was destroyed was measured, and a fracture energy calculated by the following equation was referred to as impact strength:

Fracture energy

Fracture energy (kg•cm) = load (kg) x height for fracture (cm)

A fracture energy of 200 kg•cm or more was expressed by ○, that of less than 200 kg•cm and not less than 150 kg•cm by △, and that of less than 150 kg•cm by ×.

Ease of nailing:

A 9-cm nail was driven into a concrete form and the ease of nailing was visually evaluated on the basis of the penetrability to the nail, fine splits formed on the reverse side after the penetration of the nail, and cracks formed around the nail.

Ease of sawing:

A concrete form was cut with a chip saw and scattering of glass fiber and adhesion of resin to the teeth of the saw were visually observed.

Recyclability:

A concrete form repeatedly used 10 times was ground and the ground product and the same glass-fiber-containing thermoplastic resin as used for producing the concrete form were pellet-blended in amounts of 30% by weight and 70% by weight, respectively. The resulting blend was remolded into a concrete form in the same manner as for the aforesaid concrete form. The concrete form thus obtained was subjected to the above-mentioned performance tests. When the same results as those obtained before the recycling were obtained, the concrete form was rated as (marked by) ○.

Example 1

Polypropylene pellets containing 25% by weight of glass fiber with an average fiber length of 6 mm was fed to a plasticator and heated at 240 °C to be melted. The melt 1 was fed between a female mold and a male mold at a cavity clearance of about 10 cm through a resin passageway 4 provided in the female mold 2. The molds were closed until the cavity clearance between the flats of the female and male molds became 3.5 mm, and then pressing and cooling were conducted to obtain a concrete form made of thermoplastic resin with a length of 1800 mm and width of 600 mm which is shown in Fig. 1:

thickness of top plate: height of rib: width of joint between rib and top plate: angle of taper of rib: thickness of form: number of ribs:	3.5 mm, 58.5 mm, 3.5 mm, 0.5°, 61.5 mm, 11 ribs in all at regular intervals in the lengthwise direction (inclusive of both side plates) and 6 ribs in all in the crosswise direction (both side plates and ribs formed at distances of 150 mm and 650 mm from each end in the lengthwise direction).

Table 1 shows the results of the performance tests and on-site working tests on the concrete form obtained.

Examples 2 to 6 and Comparative Examples 1 to 2

Various concrete forms made of a thermoplastic resin were obtained in the same manner as in Example 1 except for varying the average fiber length of glass fiber, the glass fiber content, and the thickness of top plate and the height of rib of a product.

Table 1 shows the results of the performance tests and on-site working tests on the concrete forms obtained.

Example 7

A stampable sheet composed of 25% by weight of glass fiber with an average fiber length of 12 mm and a polypropylene as matrix resin (K-Pla sheet, mfd. by K-Pla Sheet Co., Ltd.) was preheated to 220°C and placed between a female mold and a male mold, after which the molds were closed, followed by pressing and cooling. Thus, there was obtained a concrete form made of thermoplastic resin with a length of 1800 mm and width of 600 mm which is shown in Fig. 1:

thickness of top plate: height of rib: width of joint between rib and top plate: angle of taper of rib: thickness of form: number of ribs:	5 mm, 22 mm, 3.5 mm, 0.5°, 27 mm, 11 ribs in all at regular intervals in the lengthwise direction (inclusive of both side plates) and 6 ribs in all in the crosswise direction (both side plates and ribs formed at distances of 150 mm and 650 mm from each end in the lengthwise direction).

Table 1 shows the results of the performance tests and on-site working tests on the concrete form obtained.

Comparative Example 3

A concrete form made of a thermoplastic resin with a length of 1800 mm and width of 600 mm was obtained in the same manner as in Example 7, except that there was used a stampable sheet composed of 25% by weight of glass fiber with an average fiber length of 70 mm or more and a polypropylene as matrix resin, and that the thickness of top plate and the height of rib were 4 mm and 8 mm, respectively, (the thickness of the concrete form: 12 mm). Table 1 shows the results of the performance tests and on-site working tests on the concrete form obtained.

Example 8

A stampable sheet composed of 25% by weight of glass fiber with an average fiber length of 12 mm and an average fiber diameter of 10 μ and a polypropylene as matrix resin (K-Pla Sheet, mfd. by K-Pla Sheet Co., Ltd.) was preheated in a heating oven until the surface temperature of the sheet became 220°C.

The heated sheet was placed between a female mold and a male mold which had mold faces capable of giving, in molding, a shape having columnar convexities with a diameter of 10 mm and a height of 3 mm on the panel surface at 20-mm intervals in each of the lengthwise and crosswise directions, and having, on the reverse side, ribs with a height of 20.5 mm and a thickness of 4 mm which were located at 40-mm intervals in the lengthwise direction and were continuous in the crosswise direction. Then, the molds were closed, followed by pressing (100 kg/cm^2) and cooling, whereby there was obtained a concrete form made of thermoplastic resin with a length of 1,800 mm, a width of 600 mm and a panel thickness of 4.5 mm having convexities on the panel surface and ribs on the reverse side of the panel which is shown in Fig. 7.

Two of the concrete forms were placed so that their surfaces having convexities might face each other at a distance of 50 mm, and concrete was placed in the space between the concrete forms and then cured for 1 week to form a concrete panel of 50 mm in thickness.

The surfaces of the obtained concrete panel had columnar and concave patterns corresponding to the columnar convexities on the surfaces of the concrete forms used.

Cement mortar was applied on the concrete panel to adjust its thickness from the flat of the panel to about 5 mm, and tiles were attached to the cement mortar.

In the above application of the cement mortar, there was no mortar running observed in the application of cement mortar on a smooth concrete panel surface, and the adhesion of the tiles was strong.

Example 9

The same concrete form made of thermoplastic resin as obtained in Example 8, i.e., a concrete form made of thermoplastic resin with a length of 1,800 mm, a width of 600 mm and a panel thickness of 4.5 mm having convexities on the panel surface and ribs on the reverse side of the panel, was obtained by the use of the same press molding machine consisting of a female mold and a male mold as used in Example 8, by feeding a necessary amount of a resin melt of a polypropylene resin composition containing 30% by weight of glass fiber with an average fiber length of 1 mm and an average fiber diameter of 10 μ through a molten-resin passageway provided in the female mold, with the molds unclosed, and then closing the molds, followed by pressing (190 kg/cm^2) and cooling.

Using the concrete forms thus obtained, a concrete panel was produced in the same manner as in Example 8, and the adhesion of tiles on the surface of the panel was tested to obtain the same results as obtained in Example 8.

Table 1

	Example				
	1	2	3	4	5
Thermoplastic resin	PP	PP	PP	PP	PP
Average fiber length (mm)	6	0.5	30	6	6
Glass fiber content (wt%)	25	33	20	25	25
t (mm)	3.5	3.5	3.5	2.5	4.5
t + h (mm)	61.5	61.5	61.5	62	62
Molding method (Note 1)	IP	IP	IP	IP	IP
Moldability	○	○	○~△	○~△	○
Static strength	○	○	○	○	○
Impact strength	○	△	○	○	○
Ease of nailing or sawing	○	○~△	○	○	○
Weight (no crosspiece) (kg)	8.8	9.2	8.3	7.7	9.8
Need of crosspiece	No	No	No	No	No
Recyclability	○	○	△	○	○

- Cont'd -

Table 1 (Cont'd)

	Example		Comparative example		
	6	7	1	2	3
Thermoplastic resin	PP	PP	PP	PP	PP
Average fiber length (mm)	12	6	>70	6	>70
Glass fiber content (wt%)	25	25	25	40	25
t (mm)	5	3.5	3.5	3.5	4
t + h (mm)	27	45	61.5	61.5	12
Molding method (Note 1)	IP	SS	IP	IP	SS
Moldability	○~△	○	×	△	○
Static strength	△	○	○	○	○
Impact strength	○	○	○	○	×
Ease of nailing or sawing	○	○	△	×	○
Weight (no crosspiece) (kg)	6.7	8.7	8.7	9.3	5.8
Need of crosspiece	No	No	No	No	Yes
Recyclability	○	○	×	○	×

Note 1: IP denotes injection press molding, and SS denotes a sheet stamping method.

INDUSTRIAL APPLICABILITY

By the present invention, there is provided a concrete form which is light in weight, is easy to nail or saw and does not require a crosspiece, namely, which is very good in workability. Said form can be used together with conventional concrete forms, depending on a use site and use conditions, and is of great utility also in this regard.

Claims

1. A concrete form made of a thermoplastic resin by hot press molding of a thermoplastic resin containing 15 to 35% by weight of glass fiber with an average fiber length of 0.1 mm to 50 mm, characterized in that its top plate and ribs are integrally combined into one and the same molded product, and that the thickness t of the top plate and the height h of the rib are as follows: $t = 2.5$ to 5 mm, $t + h = 25$ to 70 mm.

2. A concrete form made of a thermoplastic resin according to Claim 1, wherein $t + h$ is 61 to 65 mm.

3. A concrete form made of a thermoplastic resin, characterized by having concave or convex patterns on its panel surface.

4. A concrete form made of a thermoplastic resin according to Claim 1, characterized by having concave or convex patterns on its panel surface.

5. A concrete form made of a thermoplastic resin according to Claim 3 or 4, characterized in that the percentage of projected area of the concavities or convexities is 10% or more based on the area of the panel surface.

FIG. 1

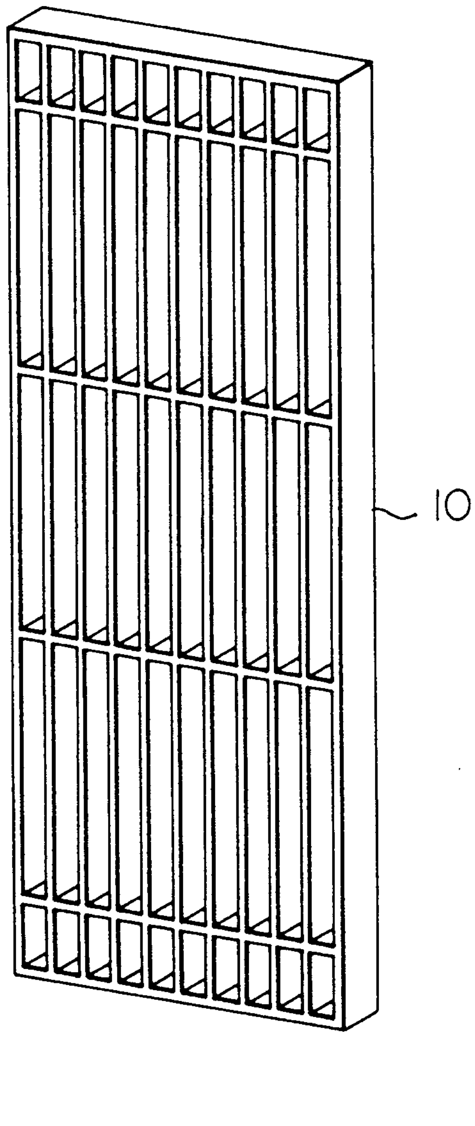


FIG. 2

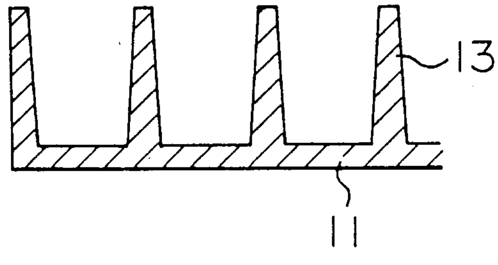


FIG. 3

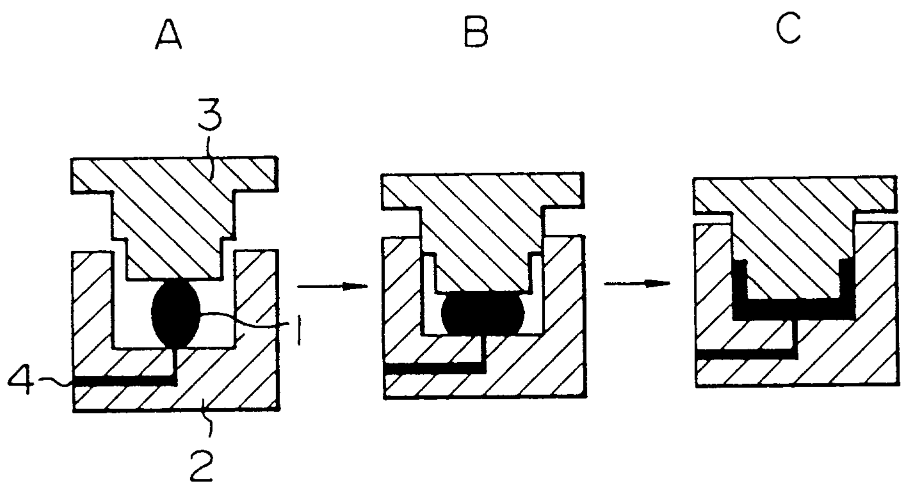


FIG. 4

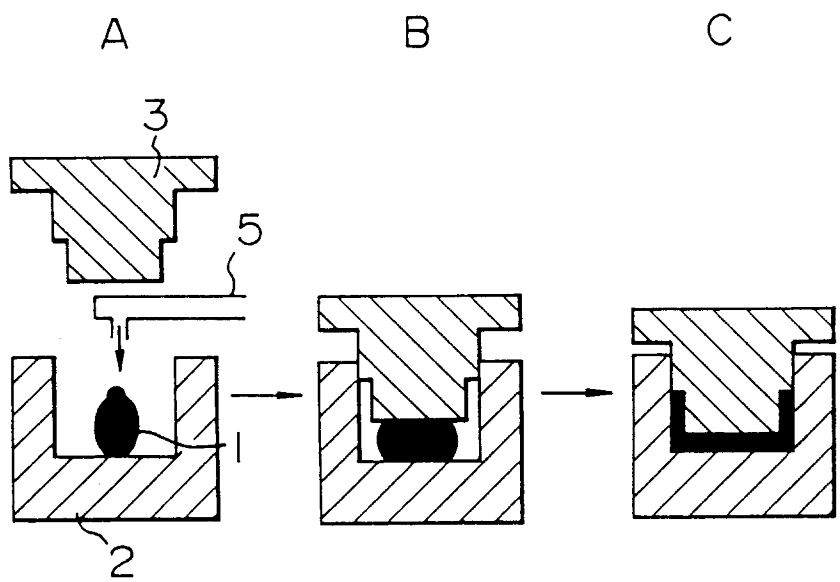


FIG. 5

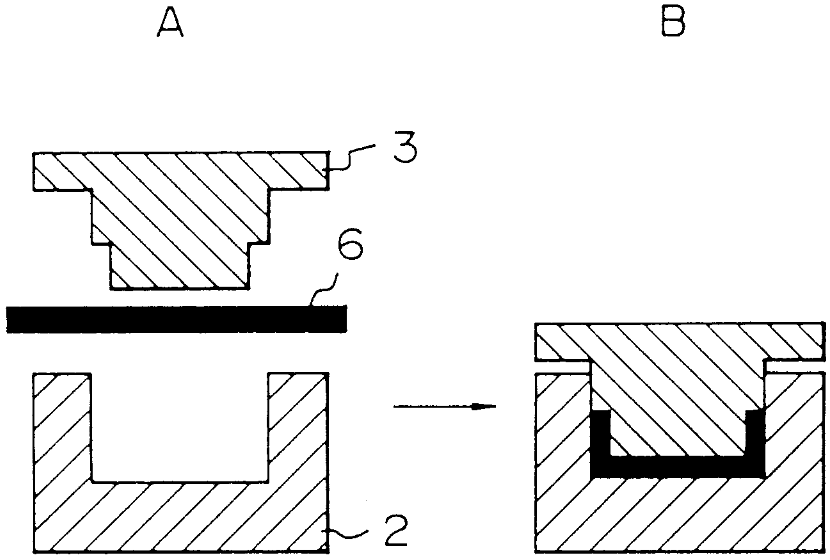


FIG. 6

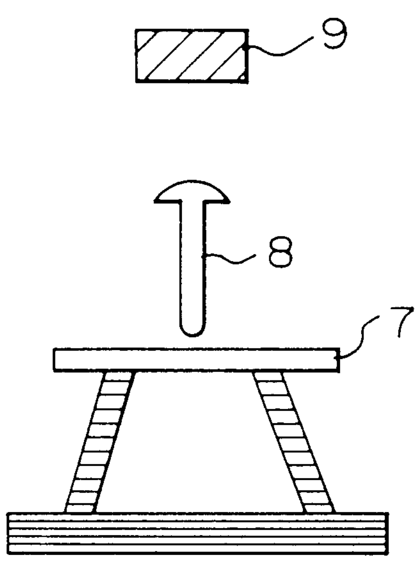


FIG. 7

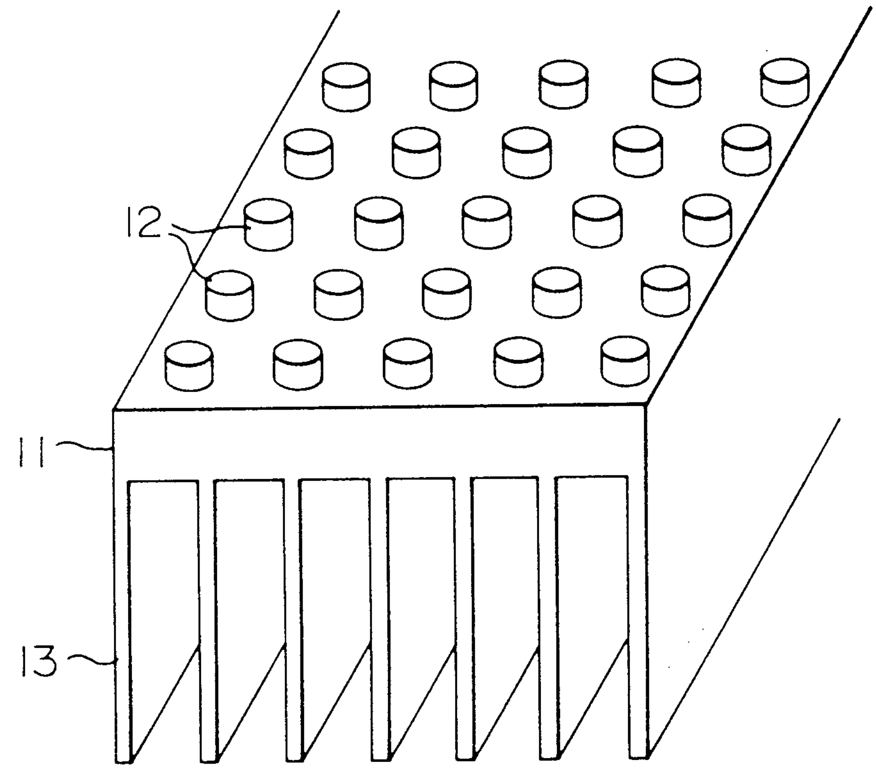


FIG. 8

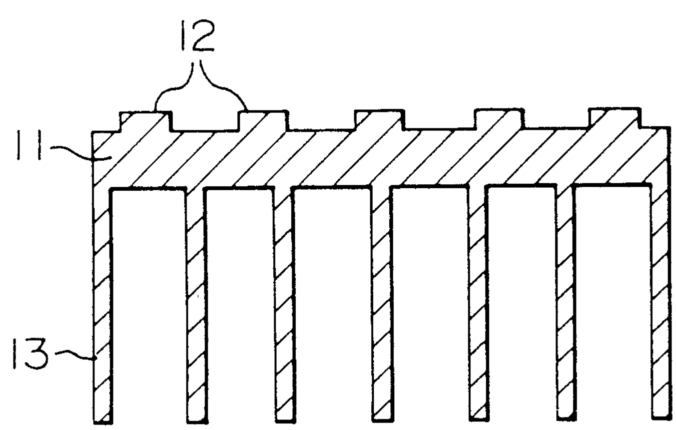
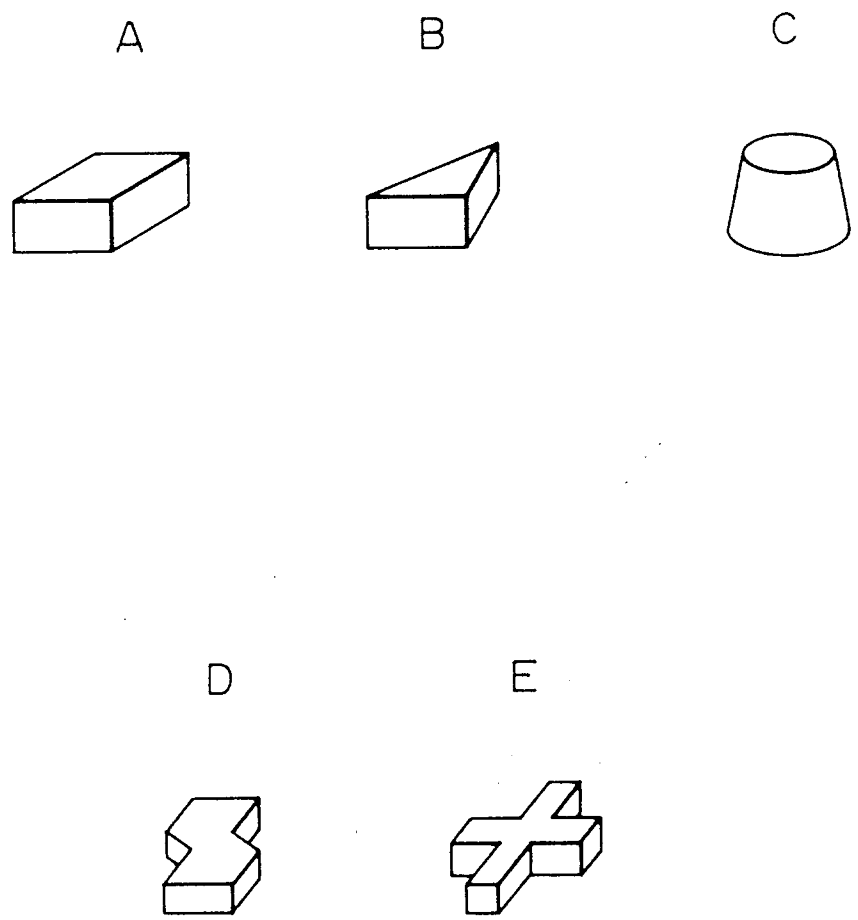


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No. PCT/JP93/01474

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl^5 E04G9/05, E04G9/10

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)

Int. Cl^5 E04G9/05, E04G9/10

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 practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, A, 2-8459 (Idemitsu NSG K.K. and another), January 11, 1990 (11. 01. 90), Line 11, upper right part, page 2, line 13, upper right part to line 19, lower right part, page 3 (Family: none)	1
Y	JP, A, 2-8459 (Idemitsu NSG K.K. and another), January 11, 1990 (11. 01. 90), Line 11, upper right part, page 2 to line 19, lower right part, page 3 (Family: none)	2, 4
Y	JP, U, 61- 176348 (Takenaka Komuten Co., Ltd. and another), November 4, 1986 (04. 11. 86), Claim (Family: none)	1, 3, 4, 5
A	JP, U, 59-148840 (Yoshimichi Nozawa),	1, 2, 4

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
December 20, 1993 (20. 12. 93)	January 11, 1994 (11. 01. 94)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP93/01474

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	October 4, 1984 (04. 10. 84), Claim (Family: none)	
A	JP, A, 55-55768 (Kamechio Tokuyama), April 23, 1980 (23. 04. 80), Claim (Family: none)	3, 4, 5