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(71) Applicant: **KABUSHIKI KAISHA CENTRAL ENGINEERING**
Fukuchi Building 1-3-4 Uchiawaji-cho
Chuo-ku
Osaka(JP)

Applicant: **KABUSHIKI KAISHA DYFLEX**
2-4-16 Hirakawa-cho Chiyoda-ku
Tokyo(JP)

Applicant: **Kitano, Tokukazu**
10-4 Haruki Honmachi
Kishiwada-shi(JP)

(72) Inventor: **Iwata, Fujio c/o K.K. Central Engineering**
Fukuchi Building 1-3-4 Uchiawaji-cho
Chuo-ku
Osaka(JP)
Inventor: **Tashiro, Wataru**
535-4 Tsuruhara
Izumisano-shi(JP)
Inventor: **Yamaguchi, Takeshi**
5-1-89-102 Miigaoka
Neyagawa-shi(JP)
Inventor: **Arakawa, Junichi**
4-27-8 Kamiuma Setagaya-ku
Tokyo(JP)
Inventor: **Kitano, Tokukazu**
10-4 Haruki Honmachi
Kishiwada-shi(JP)

(74) Representative: **Fitzpatrick, Alan James et al**
Fitzpatricks 4 West Regent Street
Glasgow G2 1RS Scotland(GB)

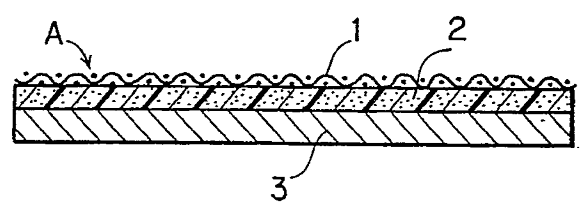
(54) A composite material for attachment to a concrete panel.

(57) A composite material for attachment to a concrete panel comprising a water/air-permeable sheet being adapted such that a woven or nonwoven fabric is smoothened at least on the surface thereof by heat treatment and having a water-permeability value of 0.5 to 50 l/m^2/min and an air permeability value of 0.1 to 20 ml/cm^2/sec, an adhesive layer applied to the back of the sheet, and a releasing sheet removably attached to the adhesive layer, wherein after the releasing sheet is removed, the water/air-permeable sheet is attached to the concrete placement side of the concrete panel via the adhesive layer.

When a concrete frame is made using the composite material of the present invention and concrete is placed into the frame, surplus water and air are quickly discharged from the placed concrete. The concrete body thus obtained is superior in strength and appearance free from cold joints and pinholes.

Furthermore, due to superior releasability, work efficiency can be increased significantly.

FIG.2



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A COMPOSITE MATERIAL FOR ATTACHMENT TO A CONCRETE PANEL

Background of the Invention

1. Field of the Invention

The present invention relates to a novel composite material for attachment to the inside surface of a concrete panel used at the time of concrete placement.

2. Prior Art

Concrete structures for construction and civil engineering work are made by framing wood or metal concrete panels, by pouring cement concrete into the frames comprising the panels and by allowing the cement concrete to cure and harden. Recently, higher buildings are being, built. To cope with this trend, promoting rationalization and improving work efficiency are requested. The water ratio is thus increased to improve the fluidity (to increase the slump) of the cement concrete so that the cement concrete can be poured by pumping and pipe feeding.

The use of the cement concrete with a high water ratio increases work efficiency, but surplus water and bubbles remain at the interface between the concrete and panels after the concrete is placed. This increases concrete contraction, causes cracks and reduces the strength of the concrete, generating numerous honeycombs, pinholes or cold joints.

Furthermore, numerous voids are formed in such a concrete structure, permitting water and air to pass therethrough. As a result, the concrete is neutralized and the reinforcing rods of the concrete get rusty, significantly reducing the strength of the concrete structure. Even if a water reducing agent or a fluidizing agent is added into raw concrete, air and water concentrate at the interface between the panel and concrete since the concrete is subjected to vibration and tamping from the outside of the panel during concrete placement. Therefore, the generation of pinholes and honeycombs cannot be prevented.

In the case of civil engineering work, raw concrete having a slump value of 8 cm or less is used. This concrete has less fluidity and is easy to entrain bubbles, generating pits and pinholes, and reduces the strength of the concrete at cold joints.

To solve these problems, a method for attaching various kinds of fabrics or water-permeable mats to the inside surface of a panel and for quickly discharging surplus water and bubbles contained in the placed concrete through the pores of the fabrics or mats was recently developed and has come to be used widely. When such a woven fabric or mat is attached to a panel, the ends of the fabric or mat are rolled around the ends of the panel and secured with stitches at necessary positions, or the entire surface of the fabric or mat is secured with stitches without rolling the ends of the fabric, or the entire surface is attached with adhesive.

The above-mentioned fabric or mat, however, is made of tangled fibers and yarns and thus includes numerous micropores. The cement paste of the placed concrete enters the micropores and cures and hardens. The anchor effect of the hardened cement paste hinders the panel from being released. As a result, the fabric or mat remains on the concrete structure side or is torn, or the surface of the concrete structure becomes rough.

Furthermore, since a roll of the fabric is cut to a proper length, the yarns of the fabric are frayed at the cut-off ends of the fabric and tangle to the placed concrete, reducing the releasability of the panel and impairing the appearance of the concrete. Moreover, since the fabric has peculiar drapability, they are apt to wrinkle and slack when they are secured to the panel with stitches. If raw concrete is placed, such wrinkled and slack portions are buried in the concrete, making it very difficult to release the panel from the concrete and greatly impairing the appearance of the concrete. When separation holes are drilled in wood panels, wood chips enter the clearances between the panel and the fabric. To solve these problems, adhesive application to the entire surface of the panel is desirable. This method, however, is very difficult to carry out on site. In addition, the adhesive applied to the entire surface of the panel prevents water and air from being discharged. Furthermore, when the ends of the fabric are rolled around the ends of the panel, the thickness of the rolled portions is added to the width of the panel. If numerous panels are connected in the case of a large scale construction, the total dimensional error of the connected panels is not negligible.

These days, the shortened life of concrete due to damage from acid rain and salt constitutes a social problem. To solve this and the above-mentioned problems, the development of a useful composite material for attachment to a concrete panel, which allows surplus water and air to be discharged from placed concrete, has been earnestly requested.

Summary of the Invention

In view of the circumstances described above, the present invention provides a novel composite material for attachment to a concrete panel, which can be attached to a concrete panel extremely easily and securely and offers superior releasability and water/air permeability after concrete placement.

Brief Description of the Drawings

Fig. 1 is a perspective view of a first embodiment of the present invention; Fig. 2 is an enlarged sectional view taken on line II-II in Fig. 1; Fig. 3 is a view similar to Fig. 2 illustrating a second embodiment of the present invention; Figs. 4 (a) and 4 (b) are a fragmentarily enlarged perspective view and a sectional view of a monofilament fabric used for the composite material of the present invention; Figs. 5 (a) and 4 (b) are a fragmentarily enlarged perspective view and a sectional view of a composite monofilament fabric used for the composite material of the present invention; Figs. 6 (a), 6 (b) and 6 (c) shows various application forms of adhesive application layers; and Fig. 7 is a vertical sectional front view of a panel frame, illustrating a concrete placement method using the composite material of the present invention.

Detailed Description of the Invention

The present invention provides a composite material A for attachment to a concrete panel. The material comprises a water/air-permeable sheet 1 being adapted such that a woven or nonwoven fabric made of synthetic resin is smoothened at least on the surface thereof by heating treatment and having a water permeability value of 0.5 to 50 l/m^2/min and an air permeability value of 0.1 to 20 ml/cm^2/sec, an adhesive layer 2 attached to the back surface of the sheet 1, and a releasing sheet 3 removably attached to the adhesive layer 2, wherein after the releasing sheet 3 is removed, the water/air-permeable sheet 1 is attached to the concrete placement side of the concrete panel using the adhesive layer 2.

The water/air-permeable sheet 1 must have a water permeability value of 0.5 to 50 l/m^2/min and an air permeability value of 0.1 to 20 ml/cm^2/sec. If the water permeability value is less than 0.5 l/m^2/min and the air permeability value is less than 0.1 ml/cm^2/sec, water and air are not discharged sufficiently after concrete placement. If the water permeability value is more than 50 l/m^2/min and the air permeability value is more than 20 ml/cm^2/sec, micropores which pass through the inside from the surface increase in size and quantity. This allows cement paste of placed concrete to enter the micropores and deteriorates the releasability of the panel.

The embodiments described in (i) to (iv) are desirable as the water/air-permeable sheet 1.

(i) A plurality of webs made of synthetic resin fibers of 0.5 to 20 deniers are laminated and needle punched 200 times/cm^2 or more to form a sheet fabric. At least the surface of the sheet is heated to fuse at 80 to 180°C to form film surface layers 12 including a plurality of micropores. (Refer to Fig. 3.)

(ii) This embodiment is a fabric woven using synthetic resin monofilaments 13, wherein the monofilaments 13 are pressed flat and fused to join to each other at the intersections by pressing and heating treatment. [Refer to Figs. 4 (a) and 4 (b).]

(iii) This embodiment is a fabric woven using composite monofilaments 14 comprising synthetic resin core members 14a (having a high melting point) and synthetic resin sheath members 14b (having a low melting point) covering the core members 14a, wherein the sheath members 14b of the composite monofilaments 14 are pressed and fused to join to each other at the intersections of the monofilaments 14 by pressing and heating treatment. [Refer to Figs. 5 (a) and 5 (b).]

(iv) This embodiment is a fabric woven using synthetic resin multifilaments, most constructive filaments of which are fused to join to each other and the multifilaments are fused to join to each other at the intersections by pressing and heating treatment. (This embodiment is not shown.)

The water/air-permeable sheet 1 of embodiment (i) comprises a basic layer 11 formed in a sheet by numerous synthetic resin fibers being closely entangled with each other, and a smooth surface layer 12 formed by the synthetic resin fibers being fused to join to each other as shown in Fig. 3. The surface layer 12 is formed by heating and fusing the surface of the basic layer 11. It is desirable to form the surface layer 12 on both sides of the basic layer 11, but the surface layer 12 formed only on one side of the basic layer 11 is included in the present invention. When the surface layer 12 is formed on one side, a releasing sheet 3 is attached to the non-heated surface using an adhesive layer 2.

The synthetic resin fibers of the nonwoven fabric comprise one or several kinds of synthetic fiber filament materials selected from among nylon, polyester, acrylic, polypropylene, acetate, etc. The thickness of the synthetic resin fiber is determined to 0.5 to 20 deniers. If the thickness is less than 0.5 deniers, the voids inside the fabric becomes too small, reducing water/air permeability. If the thickness is more than 20 deniers, the voids becomes too large and cement paste is apt to easily enter the voids. The number of needle punching treatments is determined to 200 times/cm^2 or more. If the number is less than 200, the density of the nonwoven fabric decreases and the surface of the fabric becomes rough. The heating temperature is determined to 80 to 180°C. If the temperature is less than 80°C, fusing is insufficient and fibers are apt to become easily fluffy. If the temperature is more than 180°C, excessive fusing occurs and it is difficult to form water/air permeable pores.

The water/air-permeable sheet 1 of embodiment (ii) comprises a plain, twill or satin fabric of monofilaments of 80 to 400 deniers, made of polyester, acrylic, nylon, polyethylene, polypropylene, saran, teflon, etc. The fabric is then subjected to pressing and heating treatment to press flat and fuse the monofilaments 13 as shown in Figs. 4 (a) and 4 (b).

The pressing and heating treatment is conducted for about five minutes at 90 to 250°C (a temperature below the melting point of the monofilament) using heat calender rolls.

The core member 14a (of synthetic resin having a high melting point) of the composite monofilament 14 used for the water/air-permeable sheet 1 of embodiment (iii) is mainly composed of polypropylene resin. The sheath member 14b (synthetic resin having a low melting point) is made of a polyolefin-based resin (mainly polyethylene resin). The core member 14a is covered with the sheath member 14b. Heating treatment is conducted using heat calender rolls in the same way as described above at a temperature (110 to 120°C) close to the melting point of the sheath member 14b. By this heating treatment, the sheath members 14b are fused to join to each other at the intersections of the composite filaments 14 as shown in Figs. 5 (a) and 5 (b).

The water/air-permeable sheet 1 of embodiment (iv) is obtained by heating a fabric woven using multifilaments comprising a plurality of twisted synthetic resin fibers. By the heating treatment, most constructive filaments are fused to join to each other and the multifilaments are fused to join to each other at the intersections thereof.

The above-mentioned water/air-permeable sheets 1 are common in that at least one side of the woven or nonwoven fabric is heated and smoothened. The water/air permeability values must remain in the above-mentioned specific ranges.

Acrylic-based adhesive or rubber-based adhesive (natural rubber, reclaimed rubber, chloroprene, polyisoprene, styrene butadiene, polyisobutylene, etc.) is desirably used for the adhesive layer 2. Instead of being formed on the entire back surface of the water/air-permeable sheet 1, the adhesive layer 2 is formed in vertical stripes, circular spots or oval spots as shown in Figs. 6 (a), 6 (b) or 6 (c) respectively. The adhesive non-application portions 22 located between adhesive application portions 21 should be continuous at least in the vertical direction of the water/air-permeable sheet 1. If the adhesive layer is formed on the entire surface, the layer prevents the water and air included in placed concrete from moving, reducing the water/air permeability. Using the adhesive application layers shown in the figures, water and air can pass through the water/air-permeable sheet 1 and can be smoothly discharged from the adhesive non-application portions 22. It is needless to say that the forms of the adhesive application portions and the adhesive non-application portions are not limited to those shown in the figures but other forms can also be used. Kraft paper, pulp paper or various sheets to which a releasing agent has been applied can be used as the releasing sheet 3 which is attached to the water/air-permeable sheet 1 using the adhesive layer 2.

After the releasing sheet 3 is removed, the composite material A of the present invention is attached to the inner surface of the concrete panel P using the adhesive layer 2. Since the water/air-permeable sheet 1 has the adhesive layer 2 on its back surface, it is not necessary to roll and secure the top, bottom, right and left ends of the sheet on the panel. The sheet can be attached to even a large panel made by joining a plurality of 900 x 1800 mm panels without joint marks.

In addition, the drapability of the sheet is canceled by the form holding function of the adhesive layer 2. Uniform attachment is ensured simply by gently stroking the surface by hand. No wrinkle or slack is caused. When the water/air-permeable sheets 1 are attached to the inner surfaces of the concrete panel P and raw concrete C is placed into the frame F formed by the panels P (as shown in Fig. 7), the water and bubbles included in the placed concrete C pass through the micropores disposed in the areal direction of the water/air-permeable sheets 1 and are quickly discharged from the apertures 4 disposed at the lower section of the frame F to the outside of the frame F. Since the water/air-permeable sheet 1 is made of woven or nonwoven fabric which has specific water/air permeability values as described above, cement paste is filtered effectively. Water and bubbles quickly pass through the micropores of the sheet 1 and move in the areal direction. They are then discharged.

After a while, the concrete body C cures and hardens and the surface becomes dense. Contraction or crack generation due to drying of surplus water do not occur. Rust generation on reinforcing rods due to permeation of carbon dioxide is prevented. In addition, pinholes and voids due to residual bubbles are not caused. The concrete structure is as a whole extremely sturdy (20 to 50% higher in compression strength than a conventional concrete body). If the surface is lower in density and higher in contraction rate than the inside of the concrete body, cracks are apt to occur. Since the concrete body C obtained by the present invention is dense as a whole, crack generation is reduced significantly. The cold joints due to bleeding of cement paste at the time of concrete placement are reduced significantly and almost undetectable visually. Since the surplus water and air are discharged quickly after concrete placement as described above, the surplus water and air flow spontaneously from the inside of the concrete body C and are delivered smoothly. This prevents dryout phenomenon of cement.

The movement of water and air inside the concrete body C is not stopped. Therefore, extremely beautiful concrete surface is obtained after the panels are removed.

In addition, since at least the surface of the sheet 1 is made smooth by fusing, the surface is free from minute unevenness and fluff due to fibers.

Furthermore, since the micropores are closed to the extent that the specified water/air permeability values are maintained, the actual contact area to the placed concrete is small, preventing the entry of fine fibers into the concrete and also preventing cement paste from entering the sheet 1. Therefore, the releasability of the sheet 1 is extremely superior after the concrete cures and hardens. The concrete surface obtained after releasing the sheet 1 has a glossy appearance and can be used as a finished surface without requiring finish work.

Furthermore, the color of the surface concrete layer is the same as that (deep gray) of the inner concrete layer. No chalking is noticed. Accordingly, the entire structure is uniform in quality. This feature is obtained since the internal surplus water and air are discharged at a proper speed from the sheet 1 when the concrete body C cures and hardens. The phenomenon of maldistribution and hardening of alkali (effolorescence phenomenon) does not occur on the surface of the concrete body C.

When the nonwoven sheet of embodiment (i) is used as the water/air-permeable sheet 1, fibers are not frayed at their ends since the fibers are densely entangled because the synthetic resin fiber webs are formed into a sheet by needle punching treatment, and the adhesive layer 2 is attached to the back surface of the sheet 1.

Furthermore, since the surface is formed into a film including numerous micropores by heating and fusing treatment, entry of cement paste is prevented while the specified water/air permeability values are maintained. The releasability of the panels is extremely superior after the concrete cures and hardens.

When the water/air-permeable sheet 1 of embodiment (ii) is used, the monofilaments 13 are pressed flat and fused at the intersections. The clearance between the monofilaments 13 is scarce, preventing entry of cement paste and further improving the releasability of the sheet from the concrete after the concrete cures and hardens.

When the water/air-permeable sheet 1 of embodiment (iii) is used, the composite monofilaments 14 are fused to join to each other. The clearance between the composite monofilaments are eliminated at the intersections. Entry of cement paste is further prevented, ensuring superior releasability. In addition, the fusing of the composite monofilaments 14 improves the form holding characteristic of the sheet.

Furthermore, at a low temperature where the resin of the sheath members 14b can melt, only the sheath members 14b are melted in a short period to cause fusing at the intersections. Excessive heating is thus prevented and the mesh area is not filled with melted resin, ensuring the specified water/air permeability values.

When the water/air-permeable sheet 1 of embodiment (iv) is used, multifilament yarns are fused to join to each other and most filaments are also fused to join to each other, preventing fluffing of fibers.

Like the above-mentioned embodiments, this embodiment is superior in releasability. When the composite material A of the present invention is attached to the concrete panel P, it is also possible to hold the panel on the sheet 1 side using metal battens (not shown). In this case, the concave/convex patterns formed by the battens generate after the frame panels are released. Combined with the superior releasability of the water/air-permeable sheet 1 from the concrete body C, the patterns provide beautiful appearances different from conventional ones.

Embodiments

The present invention is detailed below referring to the embodiments.

(Embodiment 1)

Polypropylene fiber web (15 cm thick) comprising 100% two-denier fibers was placed on the top and bottom surfaces of a base fabric, 250 g of web for each surface. This lamination was needle punched 600 times/cm^2 to form a 1.2 cm thick nonwoven fabric having a sheet form. After needle punching, the base fabric had not its original shape. Both sides of the nonwoven fabric were heated and fused using heat calender rolls at 160 to 170°C to obtain a water/air-permeable sheet 1 having surface films 12 including a plurality of micropores on both sides. The water and air permeability values of the sheet 1 were 5 l/m^2/min and 0.8 to 1 ml/cm^2/sec respectively. On one side of the water/air-permeable sheet 1, solvent-type chloroprene adhesive was applied in vertical stripes to form an adhesive layer 2. Kraft paper (releasing sheet) 3 with a releasing agent applied was attached to the adhesive layer 2 to obtain the composite material A shown in Fig. 3.

After the releasing sheet 3 was removed from the composite material A, the water/air-permeable sheet 1 was attached to one side of a plywood panel P (90 x 180 cm) for general frame use using the adhesive layer 2. Uniform attachment was ensured to the entire surface of the panel P simply by gently stroking the surface by hand. No wrinkle or slack was caused. A plurality of the panels P were formed into a frame F having an open width of 15 cm with the water/air-permeable sheets 1 attached inside the frame F. At the lower sections of the frame F, apertures 4 measuring 5 to 10 mm in diameter were provided.

When raw concrete having a slump value of 18 cm was placed into the frame F using a general concrete placement method, transparent alkaline water began to be discharged from the apertures 4 immediately after concrete placement. After five days, the frame F was released. Releasing was done extremely easily without leaving the water/air-permeable sheets 1 on the concrete body C. The surface of the concrete body C was dense and glossy. Pinholes and honeycombs were very few and cold joints were completely sealed. A test piece was made from the concrete body C and the compression strength of the test piece was measured using a general measurement method. The strength was 304 kg/cm^2. This value is about 32% higher than the nominal strength of 230 kg/cm^2.

A long sheet of the composite material of this embodiment, which has been rolled, is brought to a construction site and cut to proper dimensions before use. Therefore, the embodiment is superior in transportability and handling.

(Embodiment 2)

Two-hundred-denier polypropylene monofilaments were plain woven (0.32 mm thick, 145 pieces/inch x 46 pieces/inch) and subjected to pressing and heating treatment at 160 to 165°C using heat calender rolls to obtain the water/air-permeable sheets 1 of this embodiment. The water and air permeability values of the sheet 1 were 15 l/m^2/min and 5 ml/cm^2/sec respectively.

On the back surface of the water/air-permeable sheet 1, solvent-type chloroprene adhesive was applied in vertical stripes to form an adhesive layer 2. Kraft paper (releasing sheet) 3 with a releasing agent applied was attached to the adhesive layer 2 to obtain the composite material A shown in Figs. 1 and 2.

After the releasing sheet 3 was removed from the composite material A, the water/air-permeable sheet 1 was attached to one side of a plywood panel P (90 x 180 cm) for general frame use using the adhesive layer 2. Like the embodiment 1, uniform attachment was ensured to the entire surface of the panel P simply by gently stroking the surface by hand. No wrinkle or slack was caused. Two panels P with the water/air-permeable sheets 1 attached and two panels P without the water/air-permeable sheet 1 were formed into a square column frame F with a cross-sectional area of 90 x 90 cm and a height of 1800 cm. In this case, the two panels with the water/air-permeable sheets 1 were provided adjacent to each other with the water/air-permeable sheets 1 attached inside the panels. The two panels without the water/air-permeable sheet 1 were also provided adjacent to each other. At the lower sections of the frame F, water discharge apertures 4 were provided.

When raw concrete having a slump value of 18 cm (water ratio 38%) was placed into the frame F, almost transparent water began to be discharged from the apertures 4 of the panels P with the water/air-permeable sheet 1 attached immediately after concrete placement. In the case of the panels P without the water/air-permeable sheet 1, however, cement color water began to be discharged from the apertures 4 of the panels P a few minutes after concrete placement. After 72 hours of curing, the frame F was released.

The panels P with the water/air-permeable sheets 1 can be released extremely easily. The surfaces of the water/air-permeable sheets 1 were almost free from cement. It was thus possible to reuse the panels. The surface of the concrete body C was deep gray and extremely glossy and almost free from pinholes and honeycombs. On the other hand, it took time and labor when releasing the panels P without the water/air-permeable sheet 1. Much cement was attached to the panels P. Chalking was noticed on the surface of the concrete body C and numerous pinholes and honeycombs were found.

Resiliency was measured at nine positions on the surfaces of the concrete body C using Schmidt hammer testing method (25 points at each position). The surface strength of the concrete body C was calculated according to the formula of F (surface strength) = 7.3•Ro (resiliency) + 100 established by the Architecture Society of Japan. The average surface strength value on the sides to which the panels with the water/air-permeable sheets 1 of the composite material of the present invention were attached was 421 kgf/cm^2. On the other hand, the average surface strength value on the sides to which the panels without the water/air-permeable sheet 1 were attached was 368 kgf/cm^2. This means that the former is 14% higher than the latter in the surface strength.

(Embodiment 3)

Two-hundred-denier monofilaments comprising polypropylene core members covered with sheath members made of polyolefin resin were plain woven (0.38 mm thick, 145 pieces/inch x 20 pieces/inch) and subjected to pressing and heating treatment at 130°C using heat calender rolls to obtain the water/air-permeable sheet 1 of this embodiment. The water and air permeability values of the sheet 1 were 10 $l/m^2/min$ and 5 $ml/cm^2/sec$ respectively.

On the back surface of the water/air-permeable sheet 1, solvent-type chloroprene adhesive was applied in vertical stripes to form an adhesive layer 2. Kraft paper (releasing sheet) 3 with a releasing agent applied was attached to the adhesive layer 2 to obtain the composite material A shown in Figs. 1 and 2.

In the same way as for the embodiment 2, a frame F was formed using panels with the water/air-permeable sheets 1 made of the above-mentioned composite material A. Concrete was placed into the frame F. After the concrete cured and hardened, the releasability of the frame F and the appearance of the surface of the concrete body C were checked. The releasability and appearance were almost the same as those obtained in the case of the embodiment 2. The resiliency of the surfaces of the concrete body C was measured according to the above-mentioned method. The result was also the same as that obtained in the case of the embodiment 2.

(Embodiment 4)

Polyester multifilaments were plain woven (weight 410 g/m^2) and subjected to pressing and heating treatment at 150°C to obtain the water/air-permeable sheet 1 of this embodiment. The water and air permeability values of the sheet 1 were 18 $l/m^2/min$ and 10 $ml/cm^2/sec$ respectively.

On the back surface of the water/air-permeable sheet 1, adhesive made by diluting acrylic ester and ethyl acetate with solvent was applied in vertical stripes to form an adhesive layer 2. Kraft paper (releasing sheet) 3 with a releasing agent applied was attached to the adhesive layer 2 to obtain the composite material A shown in Figs. 1 and 2.

In the same way as for the embodiment 2, a frame F was formed using panels with the water/air-permeable sheets 1 made of the above-mentioned composite material A. Concrete was placed into the frame F. After the concrete cured and hardened, the releasability of the frame F and the appearance of the surface of the concrete body C were checked. The releasability and appearance were almost the same as those obtained in the case of the embodiment 2. The resiliency of the surfaces of the concrete body C was measured according to the above-mentioned method. The result was also the same as that obtained in the case of the embodiment 2. In the case of the embodiments 2 to 4, like the embodiment 1, a long sheet of the composite material, which has been rolled, is brought to a construction site and cut to proper dimensions before use.

Therefore, the embodiments are superior in transportability and handling. The water/air-permeable sheets 1 of the embodiments 2 and 3 produce superior results in all cases of flat, twill and satin fabrics.

The fabrics, however, differ in their characteristics. The flat fabric is high in cement paste collecting (filtering) performance but is apt to cause clogging. The twill fabric is medium in cement paste collecting and unclogging performance. The satin fabric is low in cement paste collecting performance but high in releasability. Therefore, it is desirable to selectively use them depending on the application.

Claims

1. A composite material for attachment to a concrete panel comprising;
a water/air-permeable sheet being adapted such that a woven or nonwoven fabric made of synthetic resin is smoothened at least on the surface thereof by heat treatment and having a water permeability value of 0.5 to 50 $l/m^2/min$ and an air permeability value of 0.1 to 20 $ml/cm^2/sec$,
an adhesive layer applied to the back surface of said sheet, and
a releasing sheet removably attached to said adhesive layer,
wherein after said releasing sheet is removed, said water/air-permeable sheet is attached to the concrete placement side of the concrete panel via said adhesive layer.

2. A composite material according to claim 1, wherein said water/air-permeable sheet is made by firstly laminating a plurality of webs of synthetic resin fibers of 0.5 to 20 deniers, by secondly needle punching said webs 200 times/cm^2 or more to obtain a nonwoven fabric of a sheet form and by

finally fusing said nonwoven fabric at 80 to 180°C to form film layers with numerous micropores at least on the surface of said fabric.

3. A composite material according to claim 1, wherein said water/air-permeable sheet is a fabric woven with synthetic resin monofilaments pressed flat and fused to join to each other at the intersections thereof by pressing and heating treatment.

4. A composite material according to claim 1, wherein said water/air-permeable sheet is a woven fabric of composite monofilaments comprising synthetic resin core members having a high melting point and synthetic resin sheath members having a low melting point and covering said sheath, and said fabric is pressed and heated so that said composite monofilaments join to each other at the intersections thereof via mutual fusion of said sheath members.

5. A composite material according to claim 1, wherein said water/air-permeable sheet is a fabric woven with synthetic resin multifilaments, most constructive filaments of which are fused to join to each other and said multifilaments are fused to join to each other at the intersections thereof by pressing and heating treatment.

6. A composite material according to claim 1, 2, 3, 4 or 5, wherein said adhesive layer is formed on the back surface of the water/air-permeable sheet in vertical stripes, circular spots or oval spots and adhesive non-application portions are continuous at least in the vertical direction of said water/air-permeable sheet.

FIG. 1

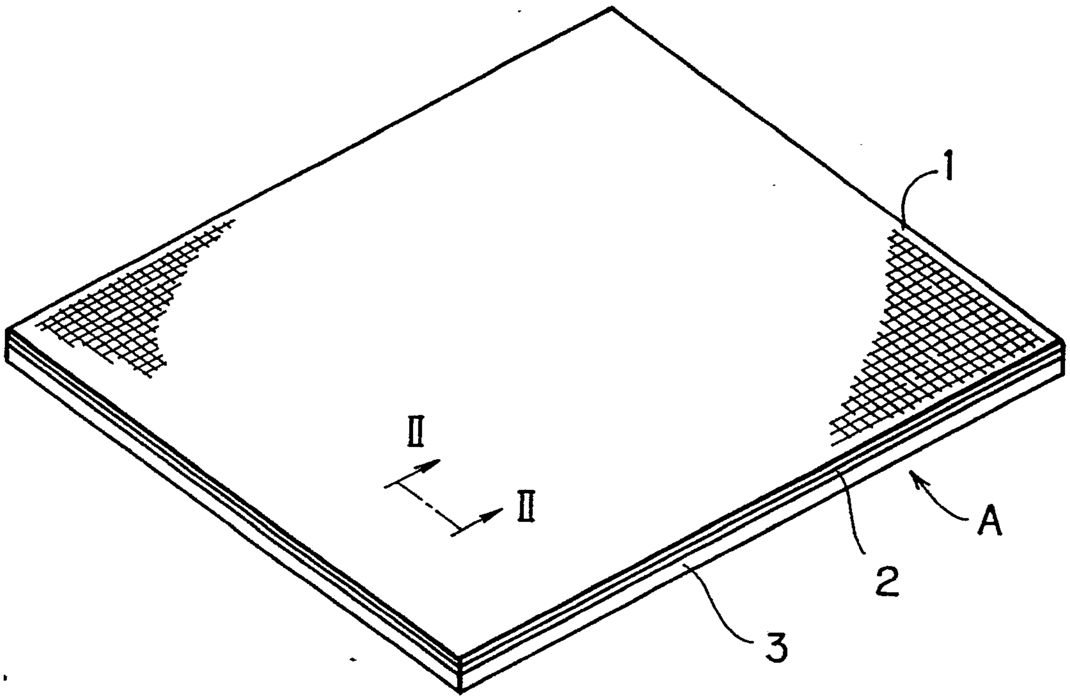


FIG. 2

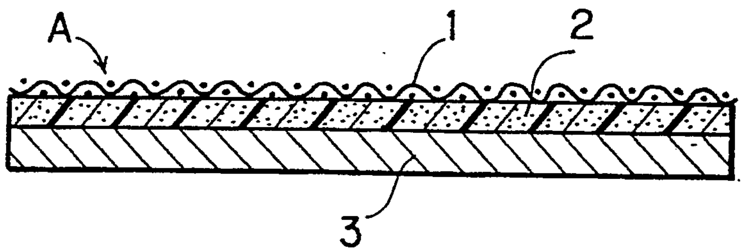


FIG. 3

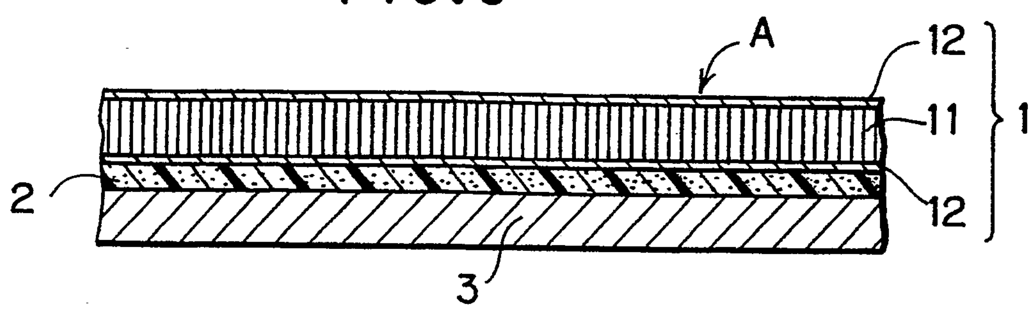
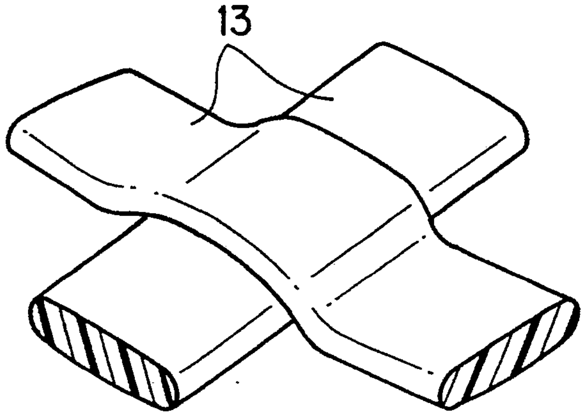


FIG.4

(a)



(b)

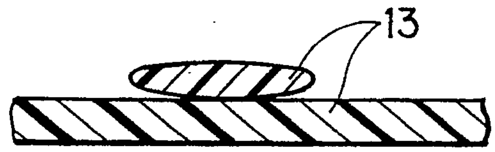
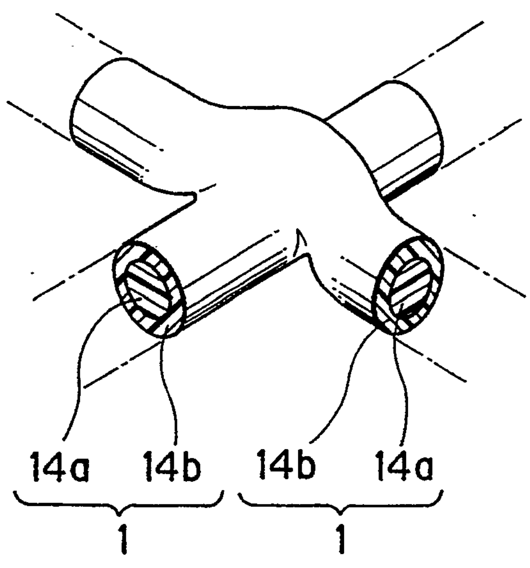


FIG.5

(a)



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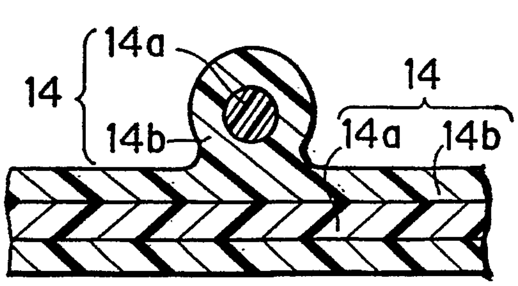
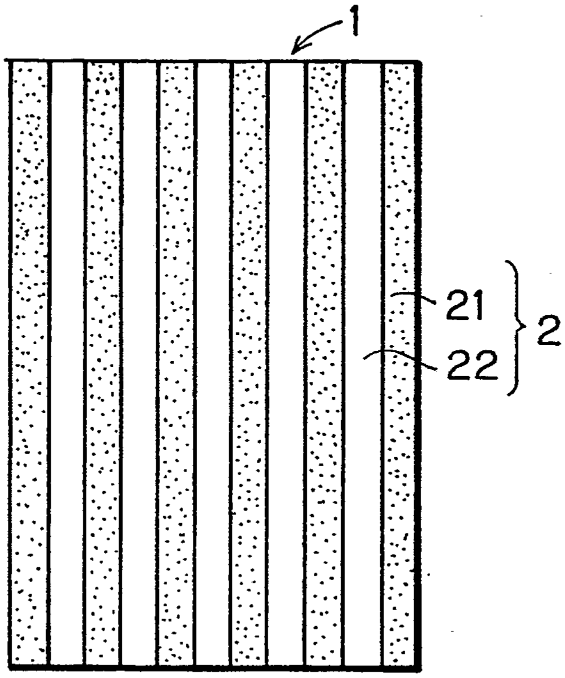


FIG. 6

(a)



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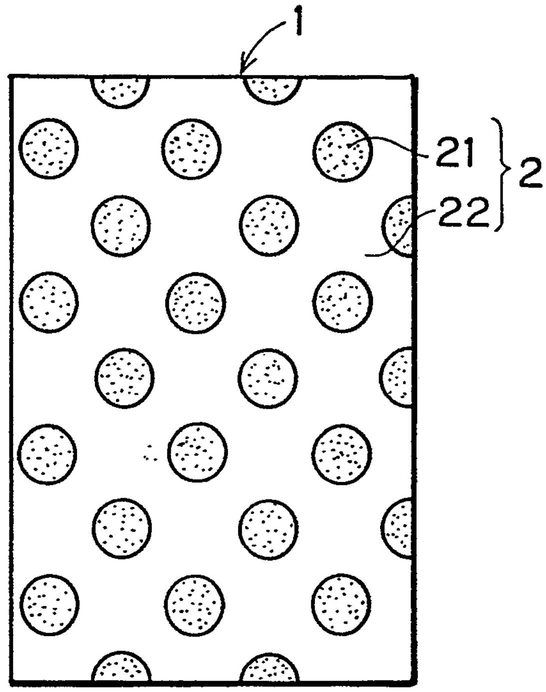


FIG. 6

(c)

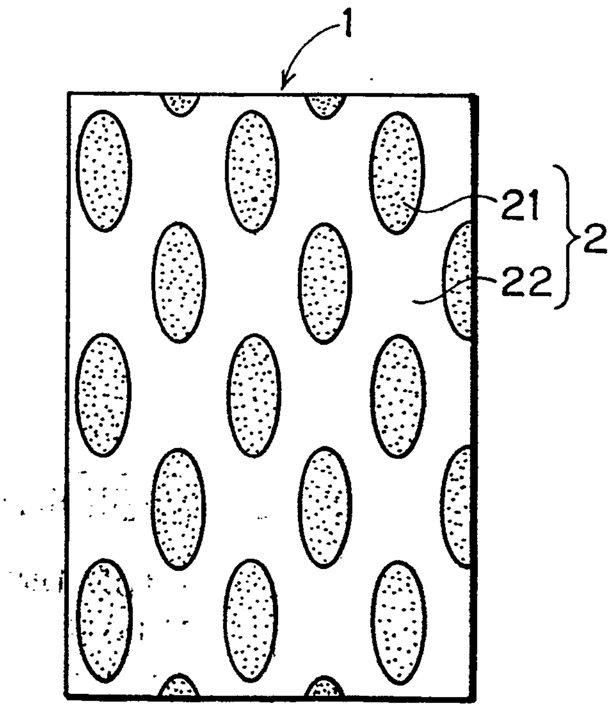
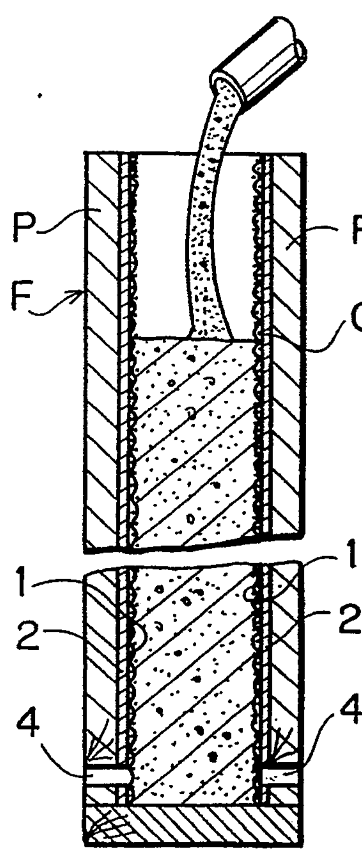


FIG. 7



Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung

EP 89 31 2545

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int. Cl.5)
A	EP-A-0 315 323 (KUMAGAIGUMI K.K.) ---		E 04 G 9/10
A	GB-A-2 175 635 (KUMAGAIGUMI K.K.) ---		
A	US-A-2 310 400 (CRANE) -----		
			RECHERCHIERTE SACHGEBIETE (Int. Cl.5)
			E 04 G

Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	09-07-1990	VIJVERMAN W.C.

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