2017

PATENT ATTORNEYS

EXAMINATION

PAPER E

Patent Attorney Practice in New Zealand Including Interpretation and Criticism of Patent Specifications

Regulation 158(1)(e)

Duration: 4 hours (plus 10 minutes for reading)

Your client Bob writes as follows:

"Since about the early 2000's I have been installing interior linings in buildings. The linings often consist of plasterboard made of gypsum plaster sandwiched between a layer or layers of paper-like material and/or heat insulating material such as aluminum foil. The aluminum foil provides insulation and fire retardant properties. The plasterboard and foil product is marketed under the name Acme Cozidry Plaster Board. Acme also manufactures an insulating product called Acme Insulation Board which is a rigid board of insulating material that is usually mounted on the vertical studs of building framing, to help insulate the walls of the building. I have been installing Acme Cozidry Plaster Board for years, and in the last few years I have also been installing the Acme Insulation Board.

"In December 2014, I visited a building site and saw a different type of panel being installed by a company Install Inc. While I thought this might have possibilities, I found it difficult to install and after experimentation I produced a lining that worked very satisfactorily. I commenced installing it in 2015.

"The first layer of my lining is a heavyweight polythene sheet which is attached to the building wall and on this is sprayed a layer of foamed polyurethane which bonds to the polythene sheet. This layer is sprayed using a standard commercial foam gun and is applied to give a thickness of between 25 and 50mm.

"The next layer is an aluminum mesh which I purchase from the local hardware store. The aluminum mesh layer is placed on the foam layer – I usually hold it in place at the corner with one hand, but it could be taped in place using masking tape or similar. I then spray a thin coat of gypsum plaster over the aluminum mesh layer. This thin layer can sometimes be quite rough and uneven and is typically about 5mm thick. However, once installed, the builder can trowel on a finishing layer also of gypsum plaster which is smoothed to give the desired finish. I call this product 'Bob's Board'.

"I have been experimenting with alternatives to my Bob's Board product. The first alternative is to use a plastic mesh layer as this may be cheaper than the aluminum mesh

layer. I am also working on a second alternative using a moisture resistant barrier layer between the foam layer and the aluminum mesh layer. I have not yet installed any of these alternatives but I would like to launch these as part of a range of products at different price points.

"Bob's Board has been very successful and I have just purchased the additional materials to enable me to start making and installing the first and second alternatives I mention above.

"I was then disturbed to receive a letter from Leonie Inings who says she owns the attached patent NZ123456 which was filed with a complete specification in the first instance on 17 September 2014. The patent was sealed on 15 December 2015.

"*Ms Inings has complained that I have infringed her patent.*

"*Ms Inings has also said that she has franchised her system in different territories in New Zealand and that my Bob's Board product is the same as the franchised product. She has supplied me with a copy of the franchise documents and with a list of her franchisees. The drawings in the franchise documents are identical to the drawings in patent NZ123456, and certainly appear to look similar to the panels I saw Install Inc installing. I noticed that Install Inc is named as a franchisee."*

You conduct some background research on the Acme Cozidry Plaster Board and Acme Insulation Board. You find a 2013 installation guide on the website of a US DIY store. A print out of this guide is included as D1. A search of the New Zealand Patent Office records also reveals two earlier New Zealand patent specifications, D2 and D3, copies of which are attached. D2 and D3 were both filed with complete specifications in the first instance. D2 and D3 are not in force. D2 was published on 15 March 1999. D3 was published on 22 October 2003.

Your advice is required on the following:

1. Do the three versions of Bob's system infringe the claims of Patent NZ123456? You should provide reasons for your conclusions. [40 marks]

2. Regardless of whether you consider infringement occurs, are the claims of Patent NZ123456 valid? Again, reasoning should be provided. [35 marks]

3. What amendments (if any) could Ms Inings propose to her patent specification to strengthen her position? What requirements have to be met for an amendment to the claims to be allowed at this stage? [8 marks]

4. Advise on any further considerations/issues that may affect Bob's ability to commercialise his system. [8 marks]

5. Based on your conclusions to questions 1 to 4, what advice would you give Bob on the risks of commercialising his system and what options are available for him to improve his position. [9 marks]

PATENT NZ123456

PATENTS ACT 1953

COMPLETE SPECIFICATION

INTERIOR LINING FOR A BUILDING AND METHOD OF CONSTRUCTING THE LINING

I, Leonie Inings, a New Zealand citizen of Napier, New Zealand do hereby declare the invention for which I pray that a Patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

[01] The invention relates to a method of constructing an interior lining in a new or an existing building.

Background

[02] In New Zealand, houses often have their walls constructed of several layers including timber boards, insulation and fire retardant material and particle/composite boards.

[03] Unfortunately, these materials are often expensive, they require the use of adhesives, and are unsatisfactorily permeable to heat and noise. They are also prone to cracking.

Object of the Invention

[04] It is an object of this invention to provide an improved interior lining of a building which will go at least some way towards overcoming the aforementioned difficulties.

Statement of the Invention

[05] The invention comprises a method of coating a surface, comprising the steps of securing a layer of foam to the surface, securing a layer of metal to the layer of foam, applying a first layer of plaster to the layer of metal and applying a second layer of plaster to the first layer of plaster.

[06] The invention also comprises an interior lining whenever formed by using a method of securing a layer of foam to the surface, securing a layer of metal to the layer of foam, applying a first layer of plaster to the layer of metal and applying a second layer of plaster to the first layer of plaster.

[07] Preferably the foam is self-extinguishing but optionally contains a fire retardant.

[08] Preferably a layer of building paper is fixed between the surface and the

foam layer and preferably the building paper contains a fire retardant. Preferably the metal layer is a metallic mesh.

[09] Preferably there are two layers of plaster. The first layer is bonded to the metal layer and provides strength and stability while the second layer is preferably decorative.

Detailed Description

[010] A preferred form of the invention is illustrated in the accompanying drawing. It is described by way of example only and is not intended to limit the scope of the invention as defined by the claims. As shown in the drawing, the building material 1 can be fixed on the external cladding such as timber cladding 3 or internal lining of existing dwellings or to the framing of new buildings. A layer of building paper 6 is preferably first secured to the timber 3 by suitable means such as staples, nails or the like.

[011] A layer of foam 9 is secured either directly to the timber layer, or through the building paper to the timber layer by suitable means such as nails, staples or the like. The foam used is preferably self-extinguishing and is chosen for its insulation properties. It may also contain a fire retardant. The thickness of the foam layer 9 is preferably at least about 30 mm, more preferably at least about 40 mm thick.

[012] A layer of metal 12 is secured to the timber by suitable means such as nails or the like. The metal layer 12 preferably has a mesh-like structure with a thickness of at least about 5 mm, but preferably at least about 7 mm.

[013] While the coating material of the present invention can have a single layer of plaster, the preferred form of coating has two layers of plaster. The first plaster layer 15, or base coat, is applied to the metal layer and provides strength, stability and insulation. The thickness of the first plaster layer 15 is preferably at least about 5 mm, more preferably at least about 7 mm but can be about 20 mm. It can optionally contain a fire retardant.

[014] The second layer of plaster 18 serves more of a decorative function by providing an attractive exterior finish. For example it can be patterned or coloured to suit, e.g., to resemble a traditional cob cottage. The thickness of the second layer of plaster 18 is preferably at least about 5 mm and more preferably

from about 8 to 15 mm depending on what finish is chosen. For example, the thickness of the second layer of plaster 18 can be up to about 15 mm where a pebble-dash or textured gunned finish is required.

[015] The coating can be produced by successively adding each layer or it can exist as a preformed composite panel. The coating of the present invention has other advantages over known building materials as it is substantially sound proof, it provides effective insulation so there is no need to provide additional insulation material, and cracking as a result of building movement is minimized. The preferred form of coating is also cost effective and requires little maintenance. Furthermore, the properties of the coating can be varied to suit by carefully choosing the material of each layer and the thickness of each of the layers.

[016] The foregoing describes the invention including a preferred form thereof. Alterations and modifications as will be obvious to those skilled in the art are intended to be incorporated within the scope of the invention as defined in the following claims.

WHAT I CLAIM IS:

1. A method of coating a surface, comprising the steps of, in any order, securing a layer of foam to the surface, securing a layer of metal to the layer of foam, applying a first layer of plaster to the layer of metal and applying a second layer of plaster to the first layer of plaster.

2. The method of claim 1, wherein the metal layer has a mesh-like structure.

3. The method of claim 1, wherein the thickness of the first layer of plaster is at least substantially 5 mm.

4. The method of claim 1, wherein the thickness of the first layer of plaster is from substantially 7 mm to substantially 20 mm and the thickness of the second layer of plaster is from substantially 8 mm to substantially 15 mm.

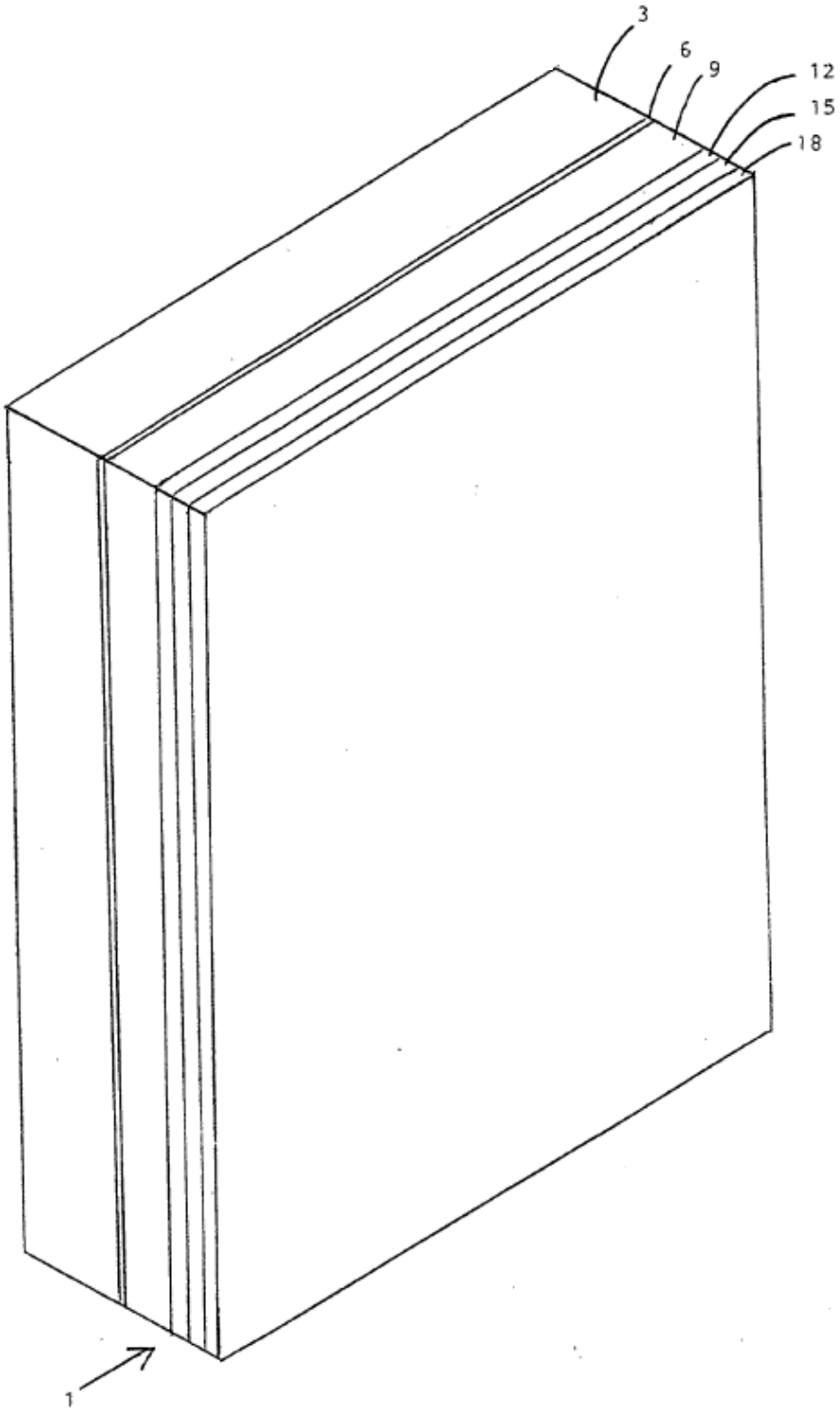
5. The method of any one of the preceding claims, wherein the second layer of plaster is patterned and/or coloured.

6. The method of any one of the preceding claims, further comprising the step of placing a layer of building paper between the foam layer and the surface.

7. The method of any one of the preceding claims comprising a first step of securing a layer of foam to the surface, a second step of securing a layer of metal to the layer of foam, and a third step of applying a first layer of plaster to the layer of metal.

8. A coated surface when coated by the method of any one of the preceding claims.

9. A coated surface substantially as herein described with reference to the accompanying drawing.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D1 – Acme Plaster Board Installation Guide

Materials:

- Trowel
- Acme Insulation Board (Rigid foam board – 10mm thick)
- Acme Cozidry Plaster Board (10mm gypsum plaster layer sandwiched between a layer of paper on one side and a layer of 1mm aluminum foil on the other side)
- Acme plaster ready-mix
- Acme plasterboard adhesive
- Plasterboard screws
- Trowel
- Sand paper

Initial Checks:

Wall linings can form structural bracing within a building – please check with a builder or engineer before installation.

Ensure any old wall linings/panels are removed correctly. If you suspect the wall lining/panel contains Asbestos or any other hazardous materials, please contact a professional.

Installation Steps:

1. Prepare the wall – remove old screws, nails, plasterboard adhesive and ensure the framing is smooth, flat and straight using a spirit level. Check the framing is dry.
2. Measure the area of wall you wish to line.
3. Measure and cut corresponding amounts of the Acme Insulation Board and the Acme Cozidry Plaster Board to size. Ensure you have corresponding amounts of both types of board before further installation.
4. Apply plasterboard adhesive to the wall framing.
5. Place the pre-cut Acme Insulation Board against the wall framing and insert a screw into the wall framing at each corner.
6. Apply plasterboard adhesive to the Acme Insulation Board.

7. Place the precut Acme Cozidry Plaster Board against the Acme Insulation Board and insert a screw into each corner.

8. Apply a layer of the Acme plaster ready-mix to the Acme Cozidry Plaster Board using the trowel.

9. Once dry, sand down the exterior surface and apply further Acme plaster ready-mix to any required areas to ensure a smooth, straight and flat surface finish.

10. Lightly sand again prior to applying primer.

Tips:

Apply the boards horizontally so that any joints are below line of sight

Use as few screws as possible

Only apply further Acme plaster ready-mix in selected areas to minimise waste

D2 – NZ666666

PATENTS ACT, 1953

COMPLETE SPECIFICATION

"A METHOD OF BUILDING CONSTRUCTION AND MANUFACTURE"

I, James Marmeduke Smith of Tauranga, New Zealand, a British subject and New Zealand citizen, do hereby declare this invention to be described in the following statement: -

[01] The invention relates to building construction and manufacture and more particularly to a method of constructing a thin layer or units of latex or synthetic latex modified fibre reinforced concrete or gypsum, however it is envisaged that fibre reinforced concrete and gypsum can be improved by modifying their properties with other additives.

[02] Concrete and gypsum are well established building materials and their use with a restricted number of fibre types as reinforcement has also been established; however most such known methods of manufacture and construction of fibre reinforced concrete and fibre reinforced gypsum suffer from various disadvantages causing a restriction of use, a restriction of fibre types and some of these disadvantages are set out below.

[03] The unmodified cement or concrete matrix has a relatively poor bond to the fibre reinforcement and its high elastic modulus does not make it very compatible with fibres of a relatively low elastic modulus, that is, the tensile strength of the unmodified brittle concrete matrix is unlikely to be increased by the incorporation of polymer fibres which have a relatively low elastic modulus.

[04] Another disadvantage of fibre reinforced concrete when manufactured as a thin sheet or constructed as a thin layer is the problem of retaining the moisture content during the relatively long curing stage to develop full strength.

[05] Another disadvantage of the concrete matrix is the low tensile strength to compressive strength ratio.

[06] Fibre reinforced concrete consists of a matrix with a relatively low tensile failure strain which results in the disadvantage of a heavily cracked matrix by the time the fibres develop a significant stress.

[07] The gypsum matrix also has a relatively poor bond to the fibre reinforcement and the disadvantage of a long fibre length and the wet gypsum slurry setting quickly makes the mixing of fibre reinforced gypsum followed by troweling difficult.

[08] Another disadvantage of fibre reinforced gypsum is the temporary loss of strength caused by wetting and its poor resistance to water and water vapour permeability.

[09] Another disadvantage of unmodified fibre reinforced concrete and gypsum is the relatively poor bond to a sprayed rigid polyurethane foam or polystyrene foam former when sprayed or hand troweled to vertical or overhead surfaces. The bonding of a layer of unmodified fibre reinforced concrete to a previous layer of itself is also relatively poor.

[010] Accordingly an object of the present invention is to overcome at least in part the disadvantages stated above and provide an improved method of relatively inexpensively manufacturing and forming modified fibre reinforced concrete or gypsum to form a constructional unit, sandwich panel or shell in a variety of structural shapes and usable for a variety of different purposes.

[011] It is an object of the present invention to provide a simple and economical method of constructing or manufacturing a very thin fibre reinforced concrete sheet, shell, layer or layers usable for a variety of different purposes.

[012] It is a further object of the present invention to provide a method of improving the resistance of fibre reinforced concrete to vapour permeability and avoid condensation within a sandwich panel construction.

[013] It is a further object of the present invention to provide a method of using

inexpensive fibres to act as a more effective reinforcement.

[014] Further objects and advantages of the present invention will become apparent from the following description which is given by way of example only. According to the present invention there is provided a simple and economical method of constructing a thin layer of modified fibre reinforced concrete both sides of a light weight core material to form a strong sandwich panel suitable for a variety of different purposes.

[015] According to the present invention there is provided a method of constructing a very thin layer of modified fibre reinforced concrete as a stiffening and strengthening layer to a flexible former and if required for further strength an extra layer or layers of modified fibre reinforced concrete may be applied to form a structural building unit shell.

[016] The cement may be modified by a liquid that can be diluted with water or mixed with the wet cement matrix such as latex or synthetic latex which rubberises the brittle concrete matrix. Other additives may include water soluble epoxy, water soluble adhesives such as P.V.A. or polymer dispersions.

[017] The modified cement matrix may be reinforced with a variety of fibres or combination of fibres such as wire fibres, asbestos fibres, alkali resistant glass fibres, polypropylene fibres, hemp fibres, vegetable fibres or polymer fibres.

[018] The most widely used fibre reinforced concrete is asbestos cement produced under carefully controlled factory conditions. Because of health problems with asbestos fibre, alkali resistant glass fibres are gaining wider use but their long term resistance to alkali attack of the glass fibre is uncertain and hence their long term use as a structural material is limited.

[019] In accordance with the present invention the problems associated with asbestos fibres and alkali resistant fibres can be avoided by overcoming problems associated with other fibres such as polypropylene fibres by modifying the cement or concrete matrix with latex. Latex modified cement and concrete has a lower elastic modulus and a higher bonding property than the unmodified matrix and hence improve the mechanical compatibility with polypropylene fibres that have a lower elastic modulus and poorer bonding surface than asbestos or glass fibres. Latex modified polypropylene reinforced concrete (L.M.P.R.C.) is a very impact resistant material with a chemically inert fibre reinforcement in the highly alkaline environment of hydrating cements, and may be applied as a thin layer or layers to protect and sandwich polystyrene or polyurethane foam to form a watertight structural shell or sandwich construction.

[020] Alternatively, other fibres may be used with latex modified concrete and the improved bonding properties reduce the tendency of the fibres to pull out the matrix and therefore improve the properties of glass fibre reinforced concrete or steel fibre reinforced concrete.

[021] The improved bonding properties of latex modified fibre reinforced concrete enable a shorter fibre length to be used as reinforcement without a reduction in tensile strength and hence improves the workability of fibre reinforced concrete.

[022] Other aspects of the present invention which should be considered in all its novel aspects will become apparent from the following descriptions which are given by way of example only.

[023] The present invention is preferably utilised for constructing a wide variety of different shapes for a number of different purposes, however, it is particularly suitable for sandwiching a light weight core material of any shape with a thin layer or layers of modified fibre reinforced concrete.

Alternatively, latex modified fibre reinforced concrete may be used as a thin protective layer over a foamed plastic insulation material such as sprayed rigid polyurethane foam.

[024] Examples of cross sections through building shells or panels in accordance with the present invention are shown in the accompanying drawings in which:

Figure 1 is a cross section through a part of a single or double curvature shaped building shell using rigid polyurethane foam as a former.

Figure 2 is a cross section through a part of a building shell using polystyrene as a Former.

Figure 3 is a cross section through a precast panel.

[025] The building shell shown in Figure 1 is formed on an elastic synthetic rubber sheet 1 which is inflated or inflated and propped to any shape. A layer or layers of polyurethane foam 2 are spray applied to the inside followed by a layer or layers of latex modified fibre reinforced concrete 3 which may be sprayed or trowelled to the vertical, overhead and concave wall and roof surface or floor surface. The sprayed rigid polyurethane foam 2 is a plastic insulation material with a rough textured surface and acts as a relatively flexible former for the latex modified fibre reinforced concrete 3 which has improved bonding, flexibility and curing properties and may be trowelled to give a reasonably smooth surface.

[026] To the surface of latex modified fibre reinforced concrete 3 may be applied a layer of latex modified fibre reinforced gypsum or a very thin layer of latex modified gypsum 4 may be spray or trowel applied to hide the fibre texture.

[027] The insulated fibre reinforced concrete building shell may remain with the elastic synthetic rubber sheet 1 exposed or the rubber may be covered with

latex modified fibre reinforced concrete 5 or the rubber sheet 1 may be peeled off and the exposed rigid polyurethane foam protected and sandwiched by a layer of latex modified fibre reinforced concrete 5 which may be finished immediately afterwards by bonding an exposed aggregate 6. In the embodiment shown in Figure 2 a polystyrene former 7 of any shape may be established and sandwiched by an external layer of latex modified fibre reinforced concrete 8 and an internal layer of latex modified fibre reinforced concrete or gypsum 9 to simply and economically establish an insulated building sandwich panel, unit or shell for a number of different purposes.

[028] In the embodiment shown in Figure 3 an exposed aggregate 10, tiles or any finish may be bonded and strengthened with a layer of latex modified fibre reinforced concrete 11, followed by a light weight core of polystyrene beads bonded with latex modified cement or concrete 12, which is sandwiched by a layer of latex modified fibre reinforced concrete 13 to construct a precast panel suitable for a variety of different purposes such as decorative light weight concrete fence panels or building wall and roof panels.

[029] In use the present invention provides a method of improving the properties of fibre reinforced concrete and gypsum by modifying with latex, synthetic latex, or other suitable additives, the cement or gypsum matrix. The improved properties of modified fibre reinforced concrete enables a wider use and more effective reinforcement by a number of fibre types.

[030] Thus by this invention there is provided a method of improving the compatibility between the cement matrix and fibre reinforcement enabling more effective reinforcement with a wider range of fibre types. Particular forms of the invention have been described by way of example and it is envisaged that modifications to and variations of the invention may take place without departing from the scope thereof.

What I claim is:

1. A method of manufacturing a building shell, the method comprising the steps of:

providing an elastic synthetic rubber sheet which is inflated to any shape;

spraying a layer or layers of polyurethane foam to the rubber sheet;

spraying or trowelling a layer or layers of latex modified fibre reinforced concrete to the foam;

spraying or trowelling a layer of latex modified fibre reinforced gypsum or a very thin layer of latex modified gypsum to hide the fibre texture.

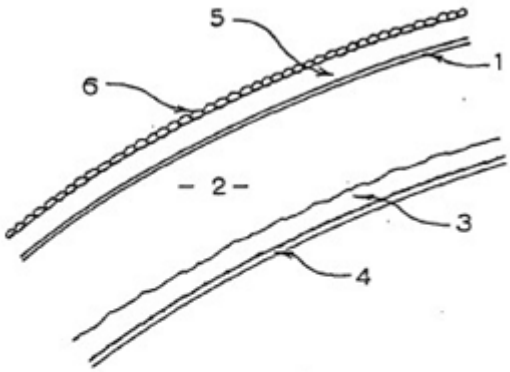

FIG. 1

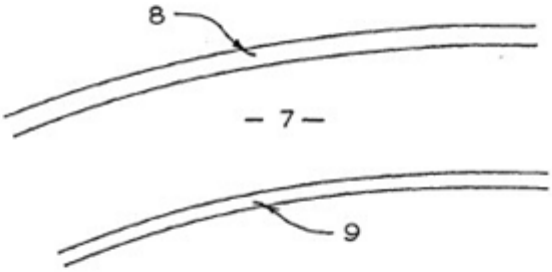

FIG. 2

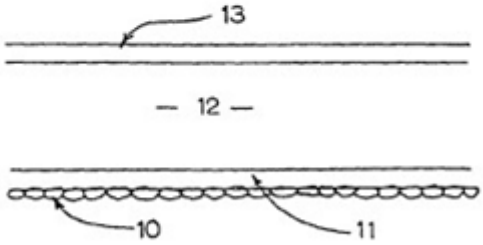

FIG. 3

D3 – NZ777777

PATENTS ACT 1953

COMPLETE SPECIFICATION

"A METHOD OF BUILDING CONSTRUCTION AND MANUFACTURE"

I, James Marmeduke Smith of Tauranga,, New Zealand, a British subject and New Zealand citizen, hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

[01] The invention relates to building construction and manufacture and more particularly to a method of changing the properties of a basic building material to overcome disadvantages causing a restriction of use. The term basic building material as used in this specification includes references to all settable materials for example, cement mixtures and gypsum mixtures. The basic building material as herein defined is modified with both a film forming water soluble dispersed polymer which sets to a water impervious film at room temperature and a fibre reinforcement to form a modified building material in which a change in the properties of the basic building material has occurred, however it is envisaged that further additives can be included and that numerous additives can be premixed to achieve quality control and ease of mixing the total ingredients to produce the modified building material.

[02] Cement and gypsum mixtures are well established basic building materials and their use with a restricted number of fibre types as reinforcement has also been well established; however most such known methods of manufacture and construction of fibre reinforced concrete and fibre reinforced gypsum suffer from various disadvantages causing a restriction of use, a restriction of fibre types and some of these disadvantages are set out below.

[03] The unmodified cement or concrete matrix has a relatively poor bond to the fibre reinforcement and its high elastic modulus does not make it very compatible with many fibre types.

[04] Another disadvantage of the concrete matrix is the low tensile strength to compressive strength ratio. Fibre reinforced concrete consists of a matrix with a relatively low tensile failure strain which results in the disadvantage of a heavily cracked matrix by the time the fibres develop a significant stress.

[05] Another disadvantage of thin layers of fibre reinforced concrete when used to sandwich a foam plastic insulation foam is the high stresses caused by differential temperature and moisture conditions between the internal and external

sandwiching layers caused by a relatively high cement to sand ratio and the brittle nature of the unmodified concrete matrix.

[06] Another disadvantage of unmodified fibre reinforced concrete and gypsum is the relatively poor bond to a foam plastic insulation material such as polystyrene and polyurethane and especially the dense skin of sprayed polyurethane foam. The bonding of a layer of fibre reinforced concrete to a previous hardened layer of fibre reinforced concrete is relatively poor.

[07] Accordingly an object of the present invention is to overcome at least in part the disadvantages stated above and provide an improved method of manufacture and construction using a modified building material to form a constructional unit, sandwich panel or shell in a variety of structural shapes and usable for a variety of different purposes.

[08] It is an object of the present invention to provide a simple and economical layer of a modified cementitious building material to form a sheet, panel, shell, layer or layers of any desired shape usable for a variety of different purposes.

[09] It is a further object of the present invention to provide a simple and economical method of reducing the curing problems associated with a thin sheet or thin layer of a modified cementitious building material.

[010] Further objects and advantages of the present invention will become apparent from the following description which is given by way of example only.

[011] According to the present invention there is provided a simple and economical method of constructing a very thin layer or layers of modified building material both sides of a light weight core material to form a lightweight sandwich panel of any desired shape suitable for a variety of different purposes.

[012] According to the present invention there is provided a method of constructing a

very thin layer of modified building material as a stiffening and strengthening layer to a flexible former and if required for further strength an extra layer or layers of modified building material may be applied to form a building unit or shell.

[013] According to the present invention there is provided a method of increasing the flexibility of modified building material particularly while it is setting when placed over a relatively flexible former.

[014] According to the present invention there is provided a method of improving the resistance of modified building material to vapour permeability.

[015] According to the present invention there is provided a method of improving the impact resistance of the modified building material layer which protects a lightweight insulation material.

[016] According to the present invention there is provided a method of improving the workability and application of the modified building material mix particularly under site conditions.

[017] According to the present invention there is provided a method of reducing or eliminating the sand content without causing differential shrinkage stress cracks. According to the present invention there is provided a method of constructing a panel or building shell of sandwich construction which has improved resistance to cracking due to differential temperature conditions. According to the present invention there is provided a method of spraying, troweling or extruding a very thin layer or layers of modified building material to vertical, topside or underside surfaces.

[018] According to the present invention there is provided a method of applying a very thin layer of modified building material by spraying or troweling to vertical and overhead surfaces of a relatively flexible former of foamed plastic insulation.

[019] The building material may be modified by a liquid that can be diluted with water or mixed with the wet cement matrix such as latex or synthetic latex which lowers the elastic modulus of the brittle concrete matrix. Other additives may include water soluble epoxy, water soluble adhesives such as P.V.A., polymer dispersions, expansion additives, water reducing additives and additives to improve workability.

[020] The modified building material matrix may be reinforced with a variety of fibres or combination of fibres such as wire fibres, alkali resistant glass fibres, polypropylene fibres, hemp fibres, vegetable fibres or polymer fibres.

[021] Other aspects of the present invention which should be considered in all its novel aspects will become apparent from the following descriptions which are given by way of example only.

[022] The present invention is preferably utilised for constructing a wide variety of different lightweight shell and panel shapes for a number of different purposes, however, it is particularly suitable for sandwiching a light weight core material of any shape with a thin layer or layers of modified fibre reinforced concrete may be used as a thin protective layer over a foamed plastic insulation material such as sprayed rigid polyurethane foam.

[023] Examples of cross sections through building shells or panels in accordance with the present invention are shown in the accompanying drawings in which:

Figure 1 is a cross section through part of a flat lightweight building panel.

Figure 2 is a cross section through part of a flat lightweight extruded or troweled building unit.

Figure 3 is a cross section through part of a single or double curvature lightweight building panel or shell.

Figure 4 is an example of a lightweight double curvature dome shaped

building shell.

Figure 5 is a cross section through part of a lightweight double curvature building shell with flaring protruding shapes.

Figure 6 is an example of a building shell formed in accordance with the present invention showing a pattern of embedded reinforcing wires around each flaring protruding shape incorporating an opening in the dome shaped building shell.

Figure 7 is an alternative example of a double curvature building shell formed in accordance with the present invention showing a pattern of embedded reinforcing wires around each flaring protruding shape.

Figure 8 is another alternative example of a building shell in accordance with the present invention.

[024] The present invention is preferably utilised for constructing a lightweight sandwich construction usable as an insulated outer building shell which can be used for a number of different purposes. The outer building shell can utilise the stiffness of sandwich construction and/or double curvature shape and can be in situ or a combination of in situ and precast construction, however it is to be appreciated that a variety of different lightweight structural shapes can be formed and are to be constructed as included in the present invention.

[025] Initially, after the shape of the building panel or shell has been decided upon a lightweight relatively flexible former material, for example, polystyrene or polyurethane foam is formed and controlled so that it can support a very thin layer of modified building material. The modified building material mixture consists of numerous ingredients and to achieve quality control and ease of mixing particularly on site some ingredients are premixed for example a selected mix weight of dry silica sand can be bagged and to this sand can be added the required amount of fibre reinforcement.

[026] The modified building material has been applied as a very thin layer or layers 1 to 9mm thick and has been particularly used as two 3mm thick layers or one 6mm

layer both sides of a relatively flexible former consisting of polystyrene or rigid polyurethane foam. However a thin layer of 9 mm and greater is also envisaged particularly if adequate control has been established and other lightweight relatively flexible formers such as thin elastic sheet, galvanised steel sheeting, cloth, netting or reinforcement mesh can be used.

[027] The modified building material mixture consists of numerous ingredients and each solids percentage by weight of the total solids can vary considerably to achieve the desired properties. For example the film forming water dispersed polymer which sets to a water impervious film at room temperature is usually in a water solution with the solids and water content in approximately equal proportions in its concentrated liquid form so that the dispersed polymer solids can be between 1 and 20% by weight of the total solids. Similarly the fibre weight can be varied considerably with the fibre weight between 0.2 and 10% by weight of total solids. Very small percentages of other ingredients can be added to the cementitious mixture such as a plasticiser and/or other ingredients to improve the performance of the modified building material.

[028] The modified building material can include the following:

i. Cement between 10% and 70% by weight.
ii. Water between 5% and 35% by weight; and
iii. Filler, for example, sand, expanded polystyrene, perlite and the like between 20 to 80% by weight.

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[029] A very thin layer of modified building material can be troweled onto the internal surface of a relatively flexible building shell former of any desired shape constructed of sprayed rigid polyurethane foam to stiffen and strengthen the lightweight former. Similarly a very thin layer of modified building material can be applied to more simple shapes and used to cover polystyrene foam to form numerous lightweight building panel shapes. These building shells and panels can be combined and further layers of modified building material can be applied to

form a variety of building shell shapes of lightweight sandwich construction. If required selected areas of a double curvature building shell can be reinforced with small diameter galvanized high tensile wires which are tensioned over the building shell and around openings in the shell and fixed to the shell foundation. These wires are embedded and covered by modified building material to form a wire reinforced building shell that if required can be further finished and protected by a light coloured water based paint containing a film forming water soluble dispersed polymer which sets to a water impervious film at room temperature.

[030] An example of a flat lightweight building panel of sandwich construction is shown in Figure 1 of the accompanying drawings and includes polystyrene as a lightweight core material 1 which is sandwiched by modified building material 2. This lightweight panel construction can be precast, or the core material can be cut and fitted on site for example between prefabricated internal partitions and the double curvature building shall and a thin layer of modified building material 2 troweled to both sides of the polystyrene core 1 to form a lightweight sandwich panel.

[031] An example of a lightweight frame cross section is shown in Figure 2 and includes a thin layer of modified building material 3 extruded or troweled over a lightweight polystyrene core 4.

[032] Other lightweight polystyrene or polyurethane former shapes can be formed such as the single curvature shapes or double curvature dome shapes, for example, as shown in Figure 3 a curved lightweight core material 5 can be sandwiched with a modified building material 6 to form a lightweight single curvature shape or double curvature dome shape of lightweight sandwich construction. The dome building shell 7 as shown in Figure 4 shows small diameter high tensile galvanised wires 8 placed around arched shaped shell openings 9. These wires 8 are tensioned and fixed to the shell foundation 10 to reduce tension stress or to compression stress the building shell particularly

around tops of openings which should be arched shape to minimise stress in the shell. These arched shaped openings are weather protected by protruding construction of any shape (not shown) that can include a window or door.

[033] The building shell shown in Figure 5 consists of an insulation core of rigid polyurethane foam 11 which was formed by spraying the foam material in thin layers onto an inflated and propped sheet material (not shown) which is peeled off when the foam has sufficiently hardened to establish a polyurethane foam former of any desired double curvature shape which can embed opening frames 12 and be trimmed and shaped as required.

[034] The polyurethane former 11 is relatively flexible and it is inflated and the opening frames 12 can be propped by temporary screw adjustable props 13 acting in compression to tension the foam 11 to maintain the required shape while a very thin layer of high bonding, self-curing, modified building material 14 is applied to the internal surface. When the modified building material has hardened the temporary supporting air pressure can be reduced or removed and the screw adjustable props 13 adjusted to act in tension so that the hardened modified building material 14 is placed in compression to avoid the risk of tension cracking.

[035] To further stiffen and strengthen the building shell a second very thin layer of modified building material is applied to the internal surface to establish the required internal thickness of modified building material 14.

[036] To sandwich and protect the polyurethane foam 11 an outer layer of modified building material 15 incorporating white silica sand and white cement is applied and when hardened a pattern of high tensile galvanised wires 16 are tensioned over the external double curvature surface to compression stress the previous modified building material layers particularly around protruding shaped openings 17 as shown in Figures 6, 7 and 8. The galvanised wires are then covered with a layer of modified building material 15 incorporating white silica sand and white cement and the complete external surface is finished to give sufficient modified

building material 15 cover protection to the small diameter high tensile galvanised wires 16 and give the required surface finish.

[037] The surface can be further protected by a very light colored (preferably white) solution containing a film forming water soluble dispersed polymer which sets to a water impervious film at room temperature such as a white acrylic paint.

[038] In use the present invention provides for an inexpensive and simple building construction and manufacture which can be constructed in situ wherever required or partly premixed to simplify mixing on site or precast if required. The shape of the building shell construction is preferably of double curvature and sandwich construction to allow very thin layers of modified building material to be used and achieve a sufficiently stiff lightweight construction, however it is envisaged that other shapes particularly for building panels and units can be flat or of single curvature to construct or manufacture a lightweight building panel or unit.

[039] Thus by this invention there is provided a method of constructing lightweight buildings by using very thin layers of modified building material which is inexpensive and which enables a building to be built in situ or precast with a minimum of formwork, materials and labour.

[040] Particular forms of the invention have been described by way of example and it is envisaged that modifications to and variations of the invention can take place without departing from the scope of the appended claims.

What I claim is:

1. A method of building construction and manufacture, the method comprising the steps of:

establishing and controlling a lightweight per surface area relatively flexible permanent former for a building shell, panel or unit, which can support a thin layer of a settable modified building material;

modifying a cementitious building material as herein defined by adding thereto both an aqueous solution or emulsion of film forming polymer material which sets to a water impervious film at room temperature and a fibrous reinforcing material, and mixing the materials to form a modified building material;

applying the modified building material in a thin layer or layers by trowel, spray or extrusion, to at least one surface of the former and allowing the layer or layers to harden which establishes the building shell, panel or unit.

2. A method of building construction and manufacture as claimed in claim 1 which additionally includes the step of:

adding further additives to improve properties of the modified building material.

3. A method of building construction and manufacture as claimed in claim 1 or claim 2 which additionally includes the step of:

applying a thin layer of modified building material to both internal and external surfaces of the permanent former which further layers can be finished smooth, textured or with exposed aggregate.

4. A method of building construction and manufacture as claimed in claim 3 comprising:

sandwiching the former which is formed from a foam plastics insulation foam between thin layers of the modified building material to reduce the differential temperatures and moisture stresses in the sandwiching layers.

5. A method of building construction and manufacture as claimed in any one of the

preceding claims which additionally includes the steps of:

applying a further thin layer of the modified building material, over a previously hardened thin layer of modified building material and

controlling the former to avoid damage to the previously hardened layer of modified building material while the further layer is applied.

6. A method of building construction and manufacture as claimed in any one of the preceding claims which includes the steps of:

establishing the former from a lightweight insulation foam, with good tension properties, into a double curvature shell; controlling the foam shell by temporary internal air pressure and/or by temporary props or screw adjustable props acting in compression to prop prefabricated shapes, window frames or door frames so that the shape of foam shell is maintained during the application of a first internal thin layer of modified building material; and

after hardening of the first layer of the modified building material removing the temporary props or adjusting the screw adjustable props to act in tension; and/or

removing or reducing the internal air pressure so that the hardened modified building material is compression stressed to reduce the risk of subsequent tension stress damage, subsequently applying a further external layer or layers to either protect and/or sandwich the foam shell with the modified building material.

7. A method of building construction and manufacture as claimed in claim 6 wherein the lightweight former is a rigid polyurethane foam formed by spraying layers onto an inflated and/or propped elastic sheet material such as butyl rubber or nylon sheeting and trimming any surplus set foam from the former before applying the modified building material.

8. A method of building construction and manufacture as claimed in any one of the preceding claims wherein the modified building material can have embedded therein or bonded thereto galvanised steel additional reinforcement or the suitable additional reinforcement such as nylon fishing net, nylon cloth or other suitable cloth.

9. A method of building construction and manufacture as claimed in any one of the preceding claims wherein the aqueous solution or emulsion of the film forming polymer material includes any one of a latex, synthetic latex, acrylic material, P.V.A., water soluble epoxy material, or other polymer dispersions.

10. A method of building construction and manufacture as claimed in claim 9 wherein the aqueous solution or emulsion of the film forming polymer material includes a latex or synthetic latex, the cementitious building material is formed from a sand or fine aggregate and cement mixture and the fibrous reinforcing is any one of an alkali resistant glass fibre, a polypropylene fibre or a nylon fibre.

11. A method of building construction and manufacture substantially as herein described with reference to the accompanying drawings.

12. A method of building as herein described incorporating the shell construction as shown in any one of Figure 4, Figure 6, Figure 7 or Figure 8 of the accompanying drawings.

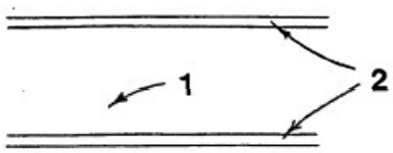

FIG. 1

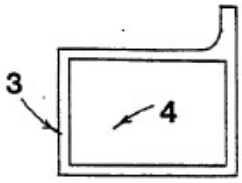

FIG. 2

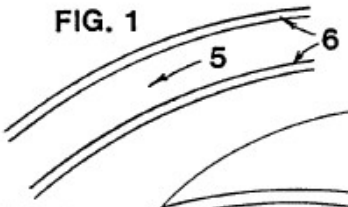

FIG. 3

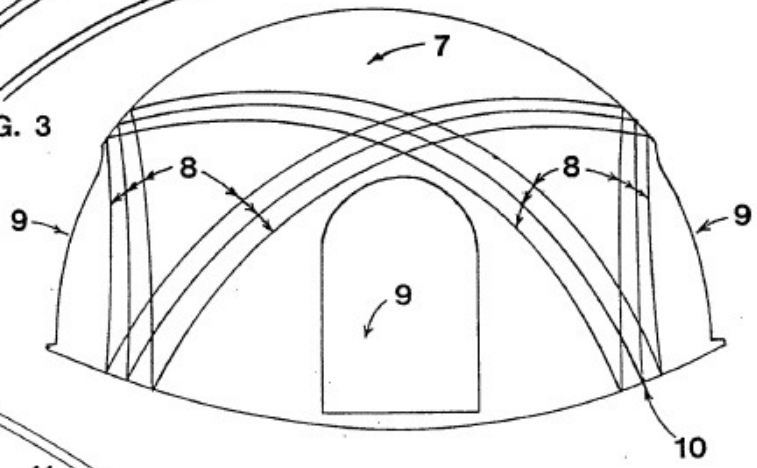

FIG. 4

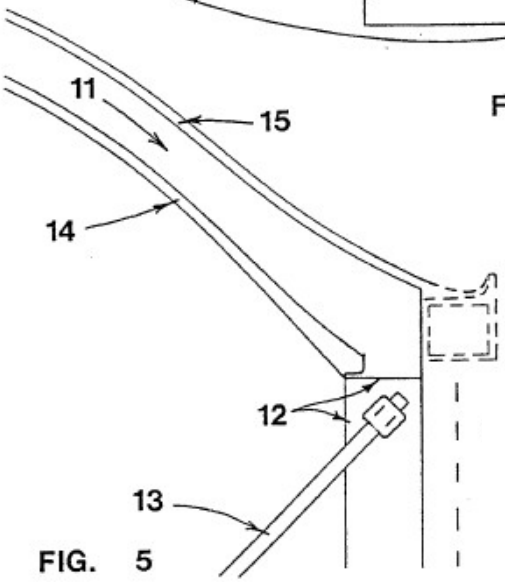

FIG. 5

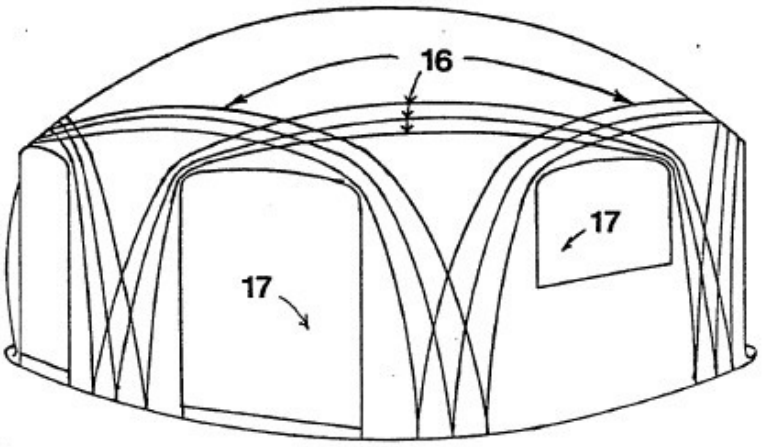

FIG. 6

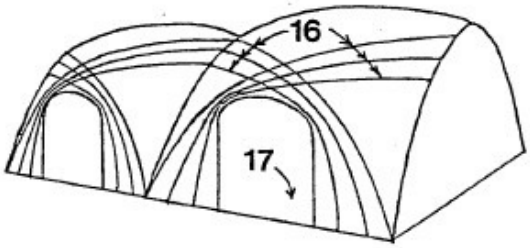

FIG. 7

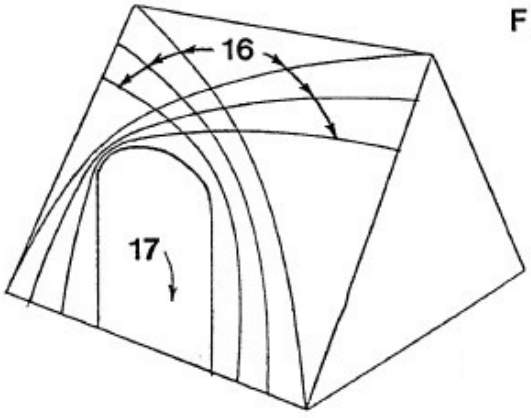

FIG. 8