US 20070074484A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2007/0074484 A1

Yin (43) Pub. Date: Apr. 5, 2007

(54) LIGHT-TRANSMISSIBLE CONSTRUCTION MATERIAL AND MANUFACTURING METHOD FOR THE SAME

(76) Inventor: **Samuel Yin**, Taipei (TW)

Correspondence Address:
BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747 (US)

(21) Appl. No.: **11/445,276**

(22) Filed: **Jun. 2, 2006**

(30) **Foreign Application Priority Data**

Sep. 19, 2005 (TW)..... 094132248

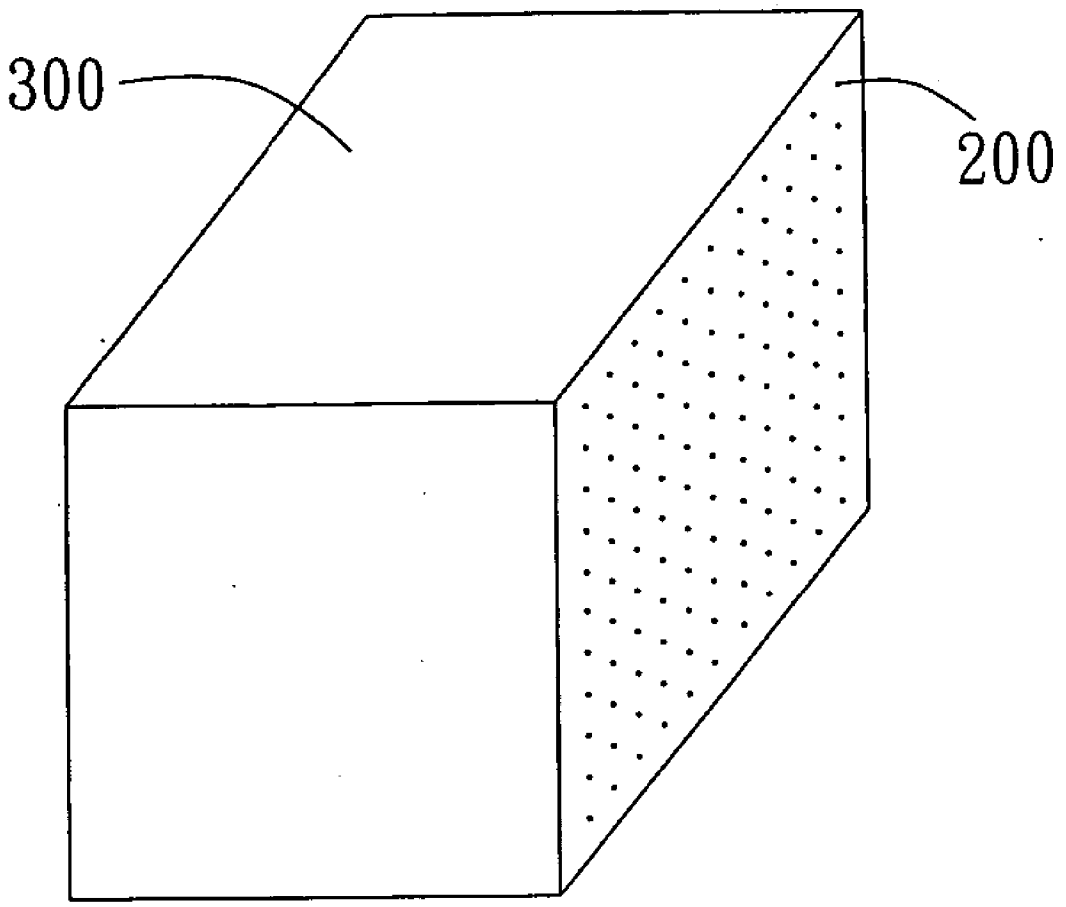
Publication Classification

(51) **Int. Cl.**
E04B 1/00 (2006.01)

(52) **U.S. Cl.** **52/750**

(57) **ABSTRACT**

A light-transmissible construction material and manufacturing method for the same. The light-transmissible construction material comprises at least a light-transmitting unit and a concrete unit. The light-transmitting unit has a light entrance end, a light exit end, and a lateral wall between both ends. The lateral wall of the light-transmitting unit is enclosed and surrounded with the concrete unit. The light entrance and exit end of the light-transmitting unit are exposed from two opposite surfaces of the concrete unit. A method for manufacturing the same light-transmissible construction material comprises: placing at least one light-transmitting unit between two side formworks; filling the concrete grout between above two side formworks; and drying the concrete grout to form the light-transmissible construction material.



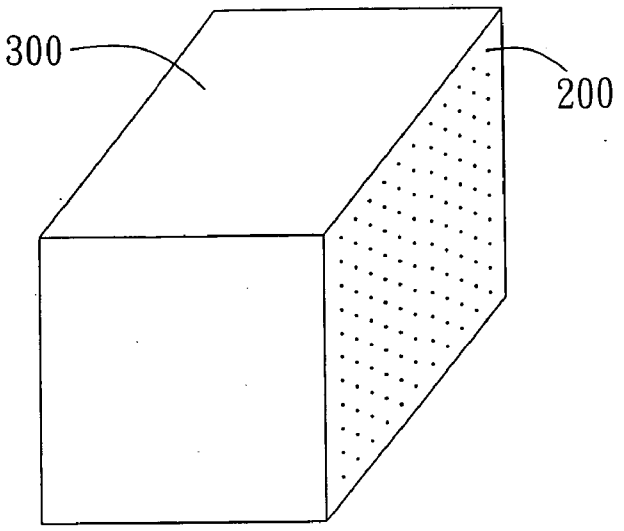


FIGURE. 1a

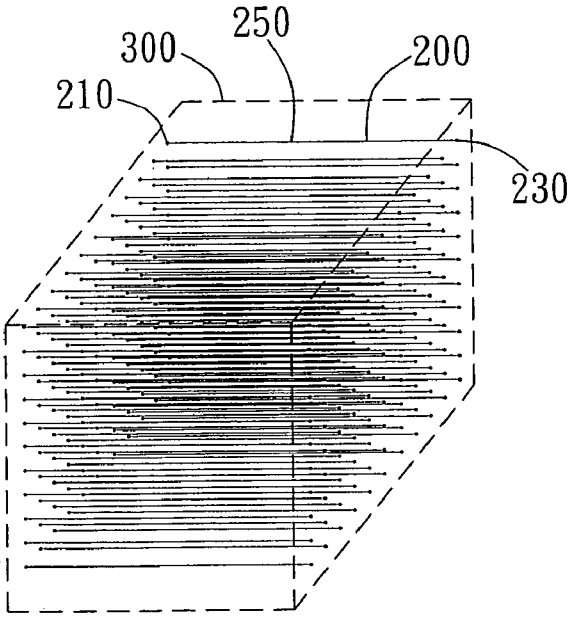


FIGURE. 1b

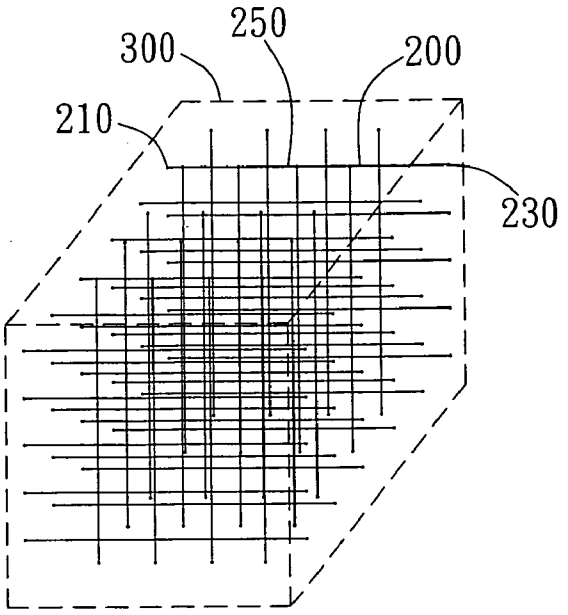


FIGURE. 1c

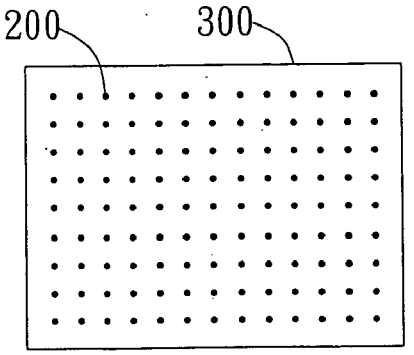


FIGURE. 2

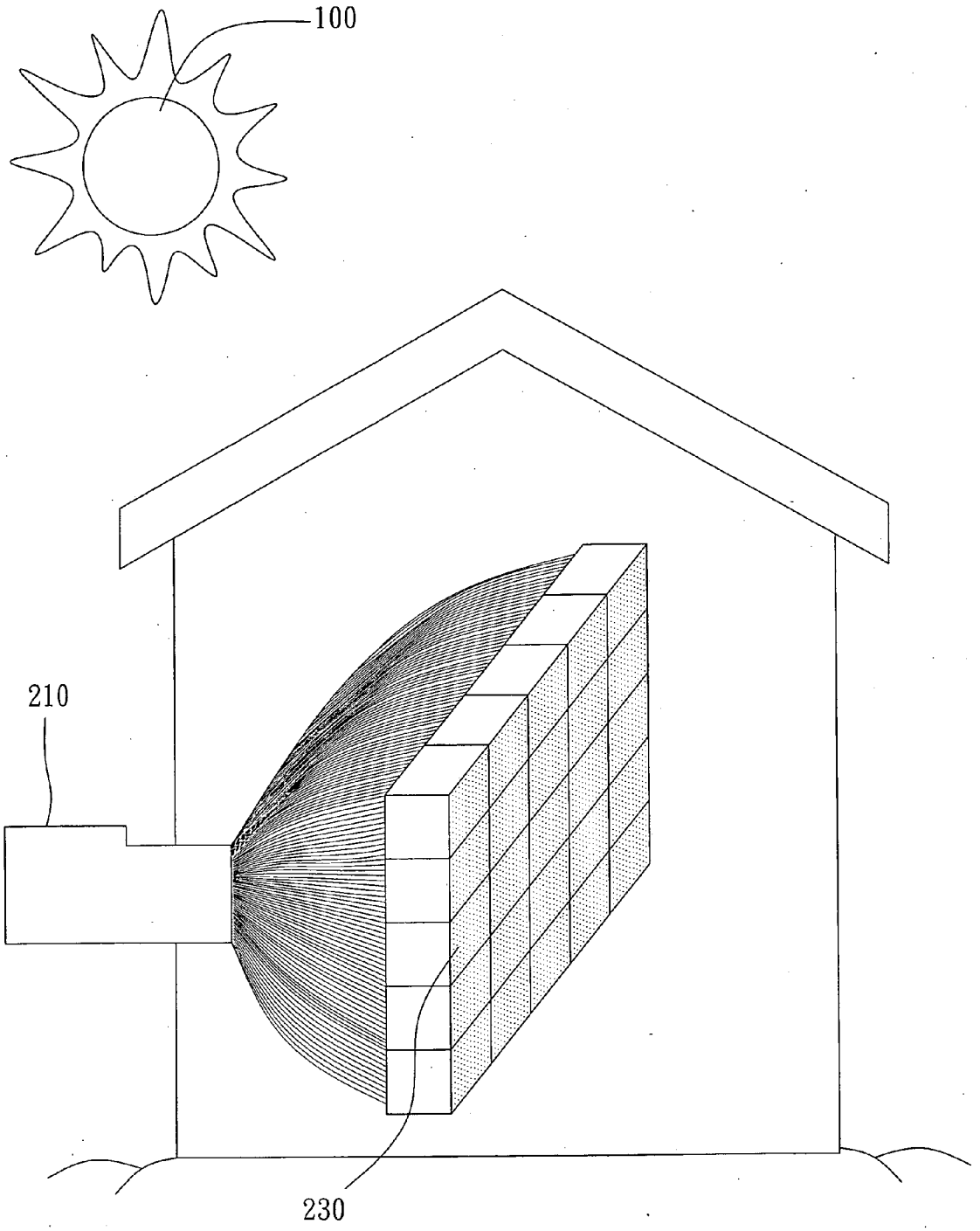


FIGURE. 3

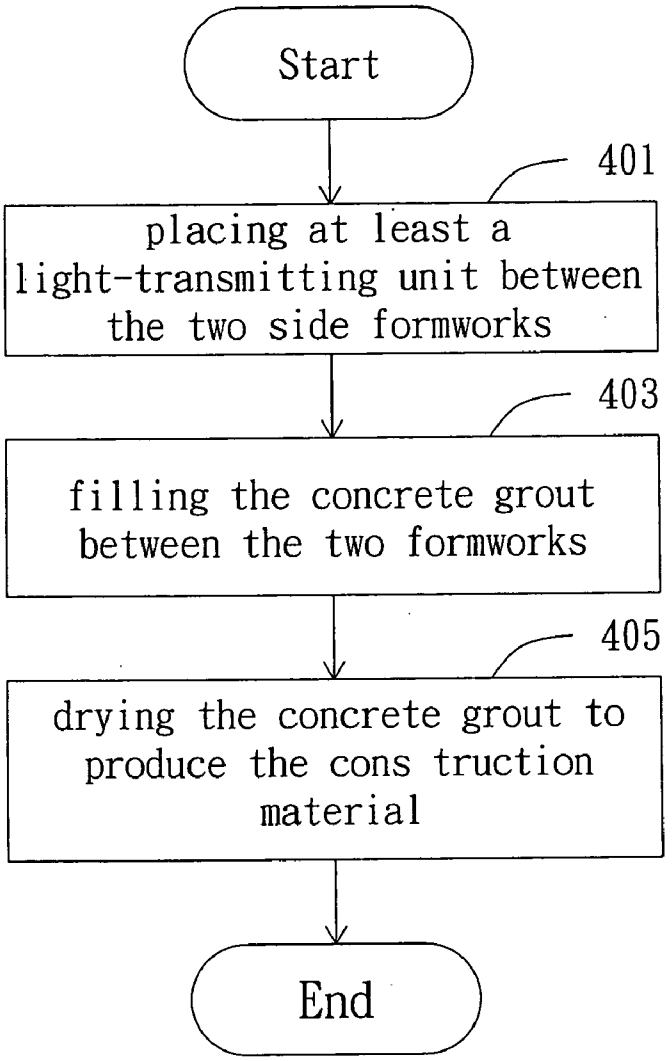

Start
401
placing at least a light-transmitting unit between the two side formworks
403
filling the concrete grout between the two formworks
405
drying the concrete grout to produce the cons truction material
End

FIGURE. 4

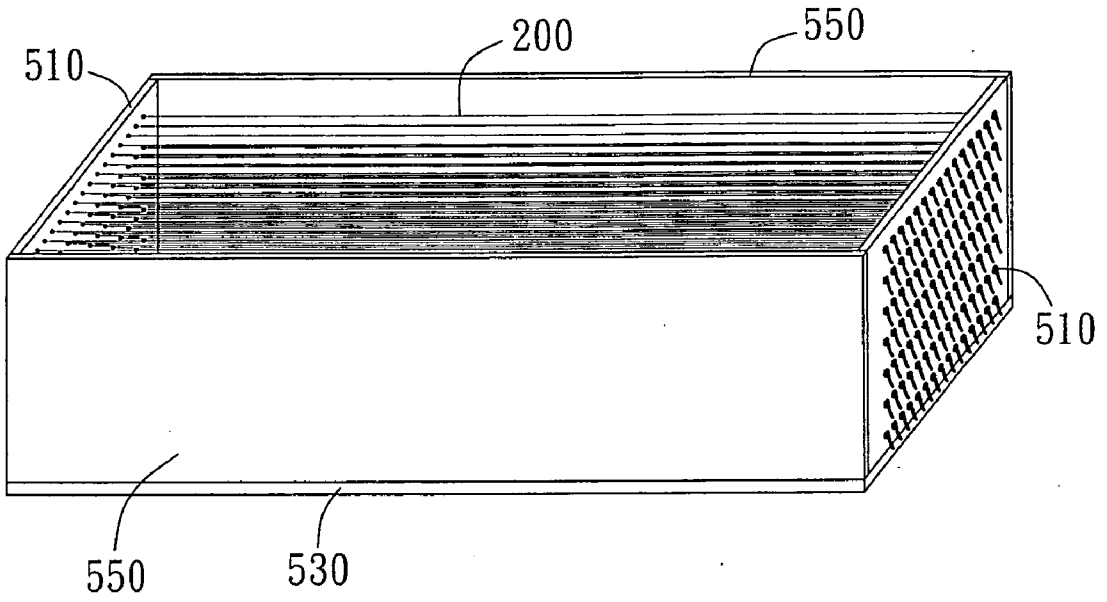


FIGURE. 5

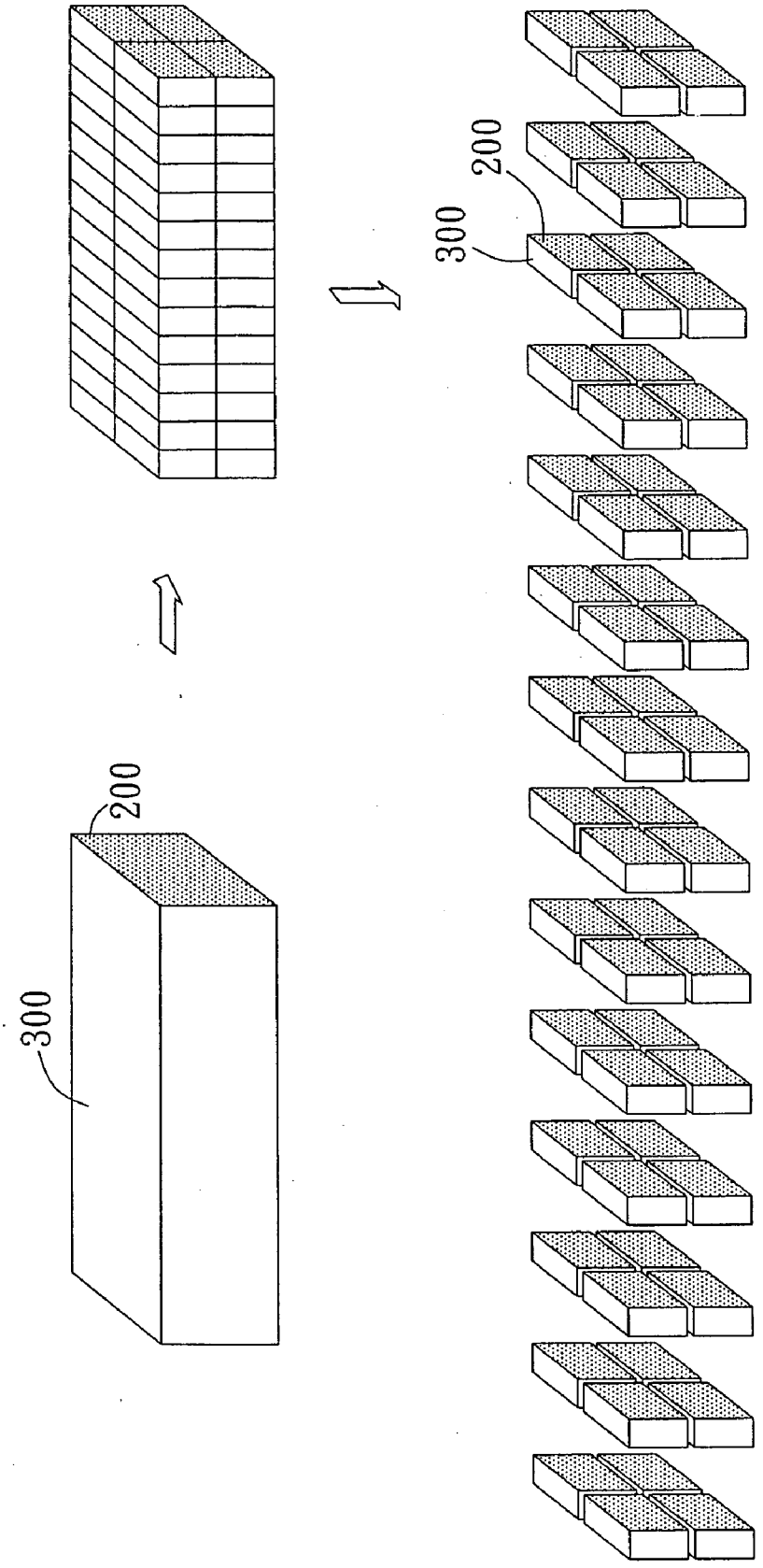


FIGURE. 6

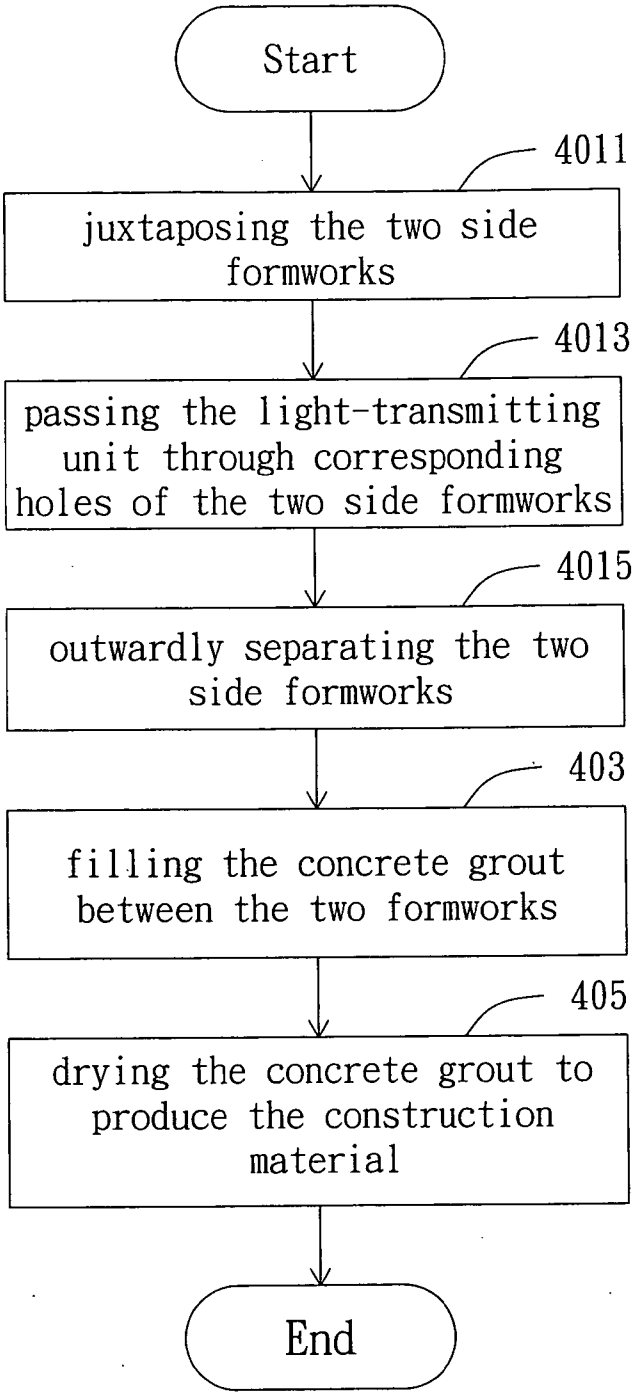

Start
4011
juxtaposing the two side formworks
4013
passing the light-transmitting unit through corresponding holes of the two side formworks
4015
outwardly separating the two side formworks
403
filling the concrete grout between the two formworks
405
drying the concrete grout to produce the construction material
End

FIGURE. 7

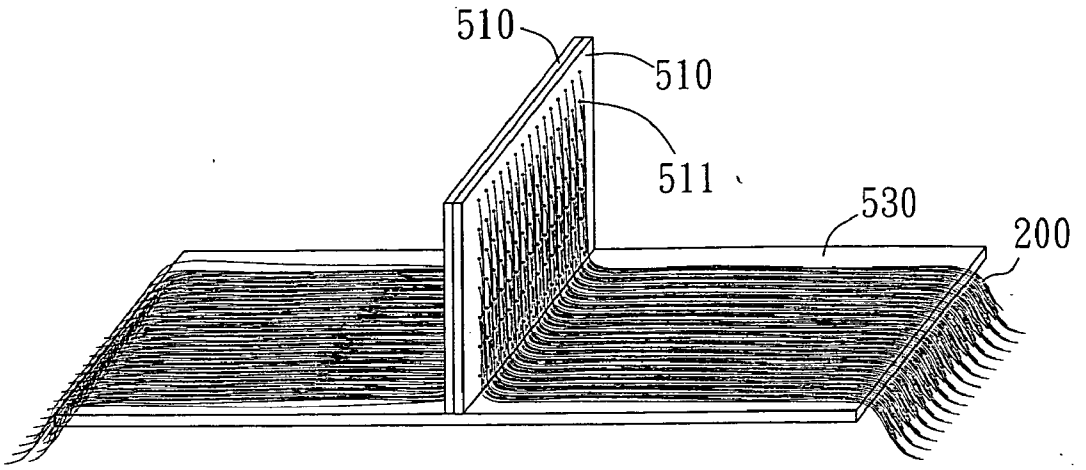


FIGURE. 7a

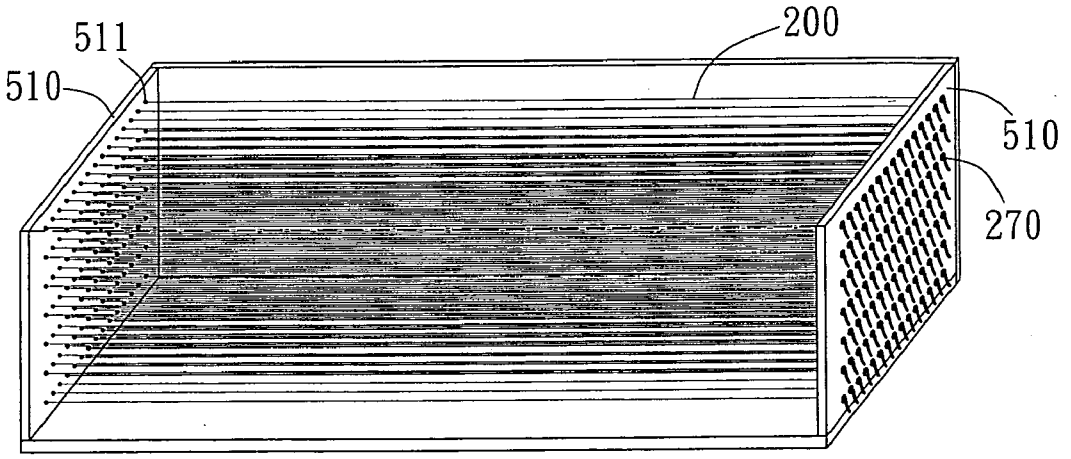


FIGURE. 7b

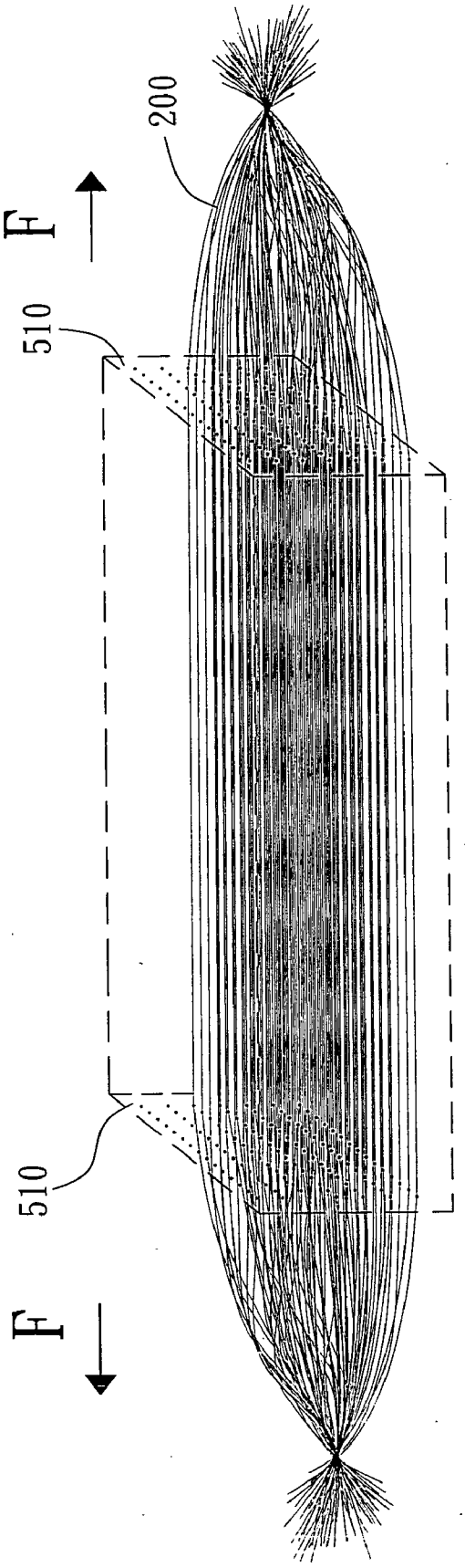


FIGURE. 7c

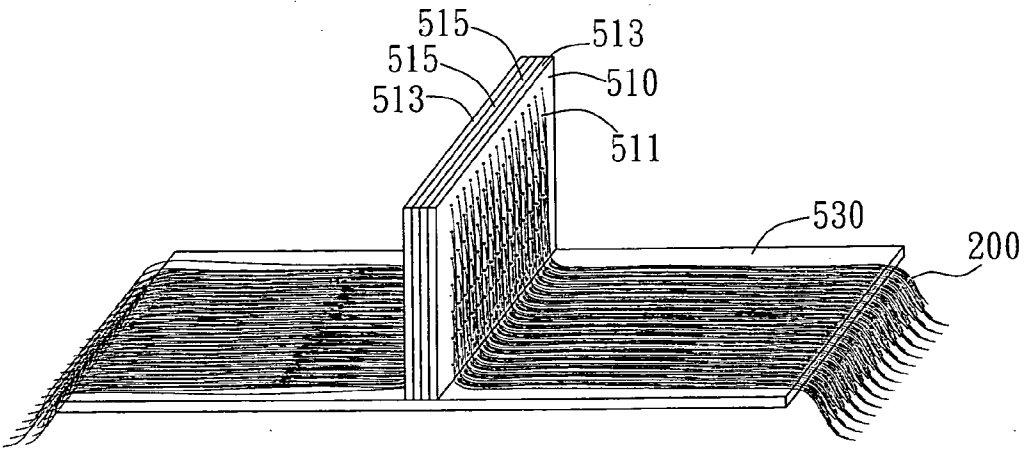


FIGURE. 8a

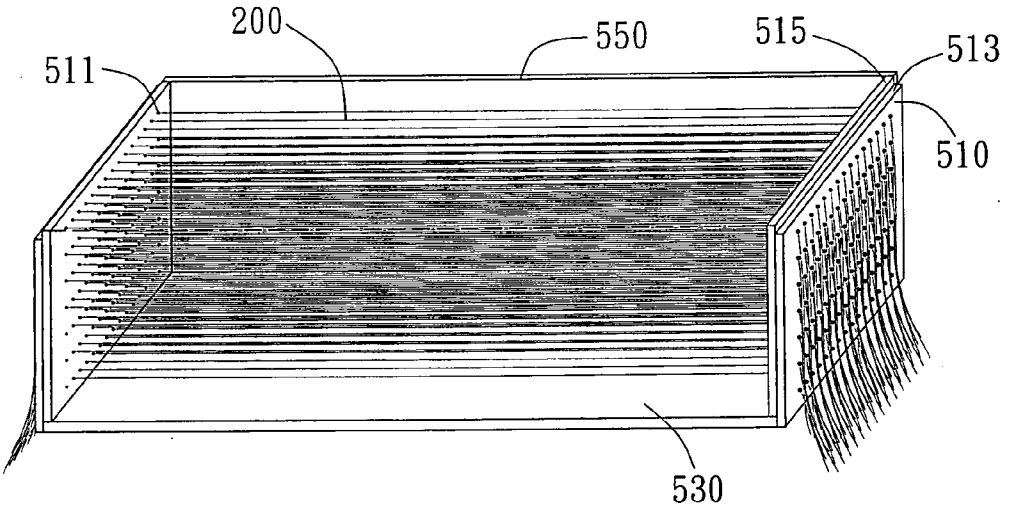


FIGURE. 8b

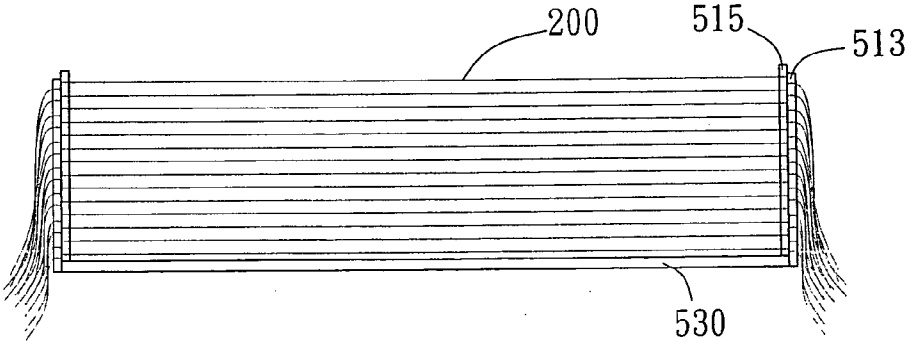


FIGURE. 8c

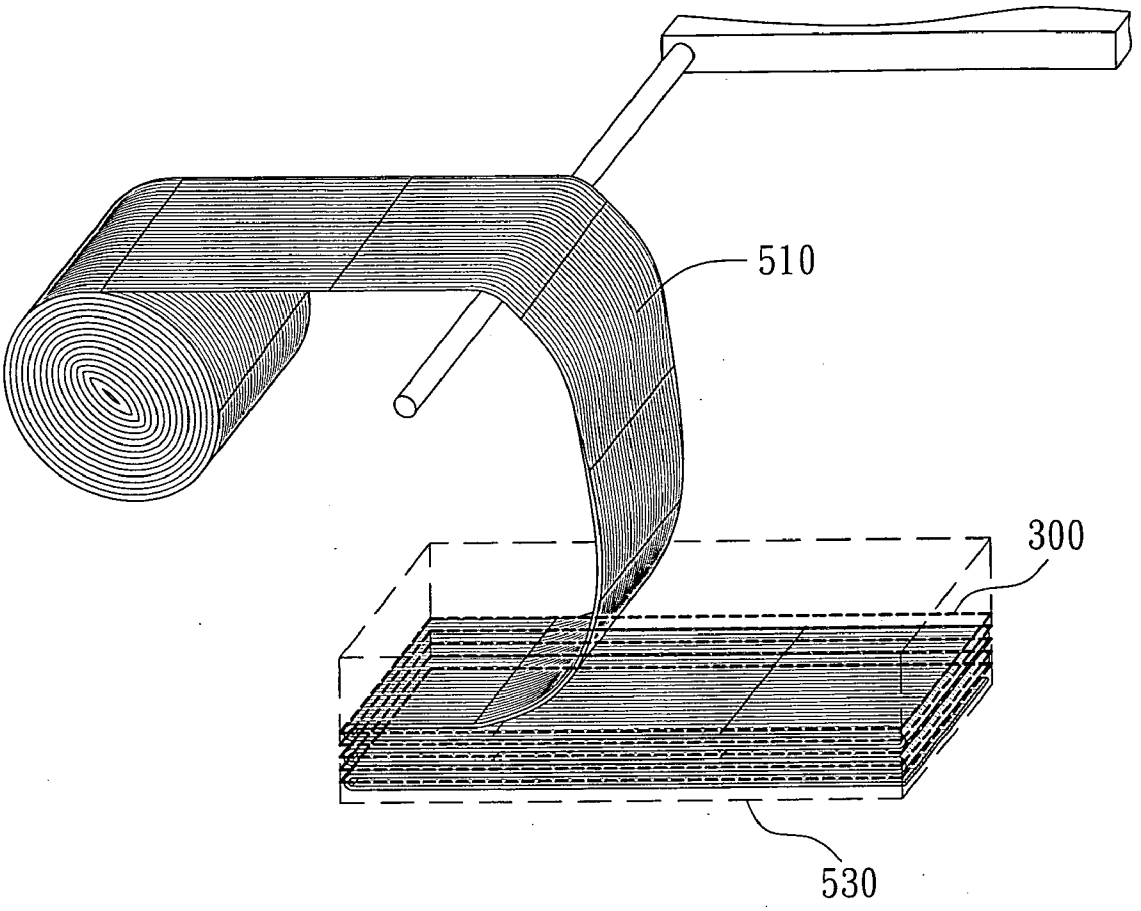


FIGURE. 9a

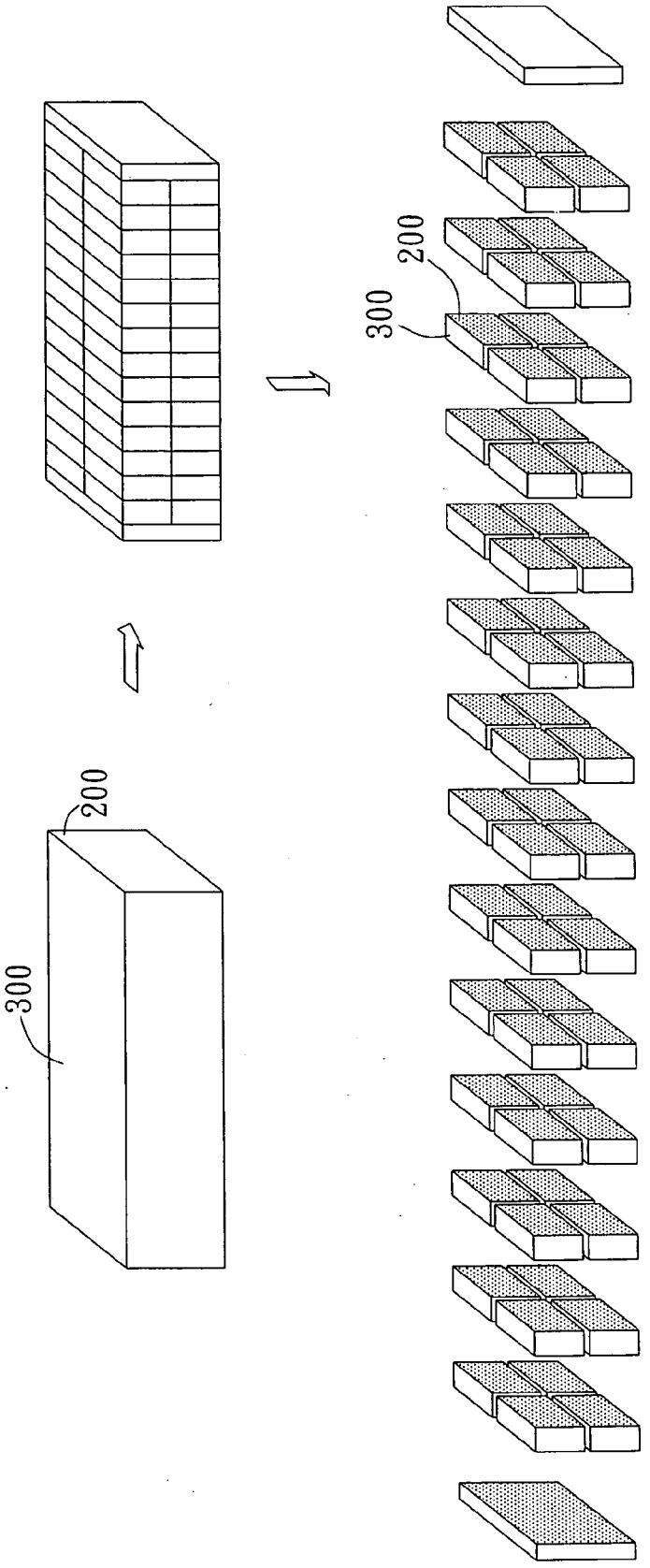


FIGURE. 9b

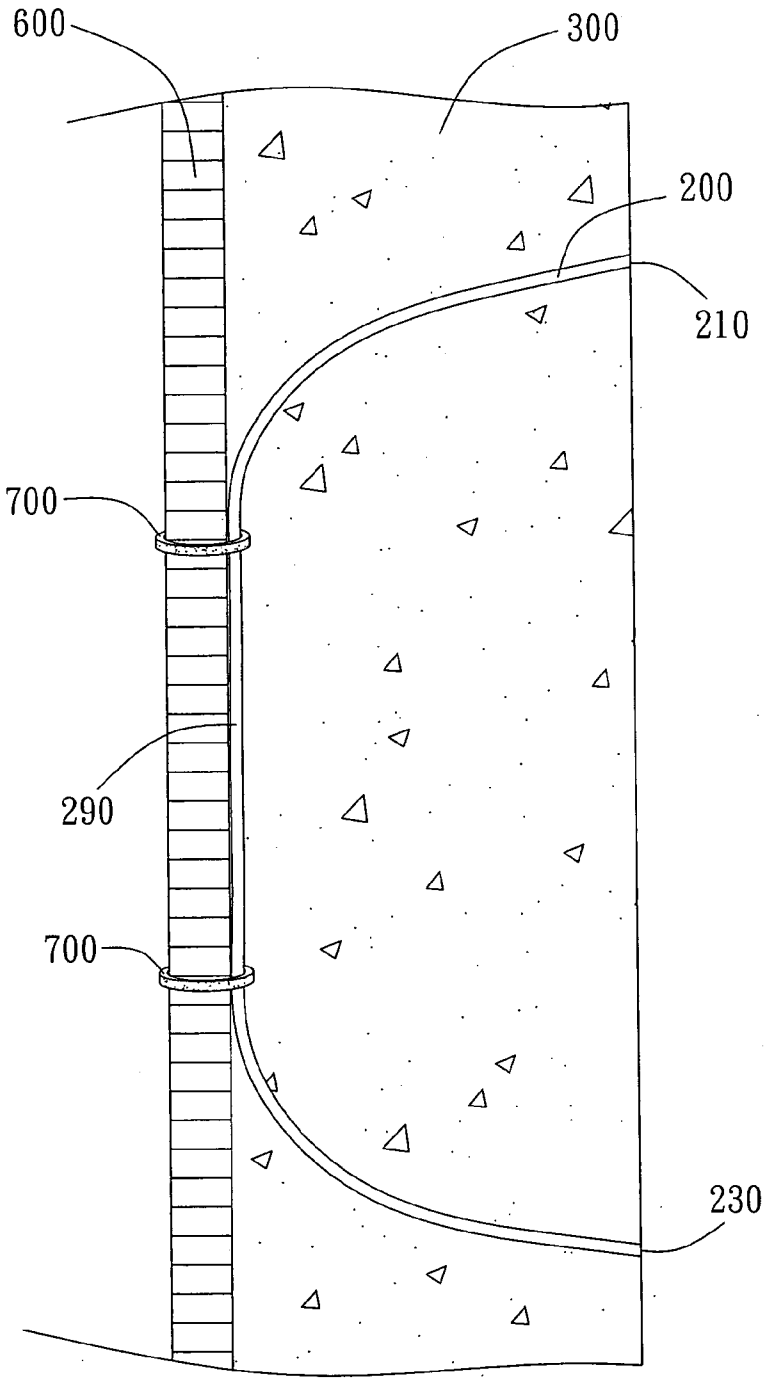


FIGURE. 10a

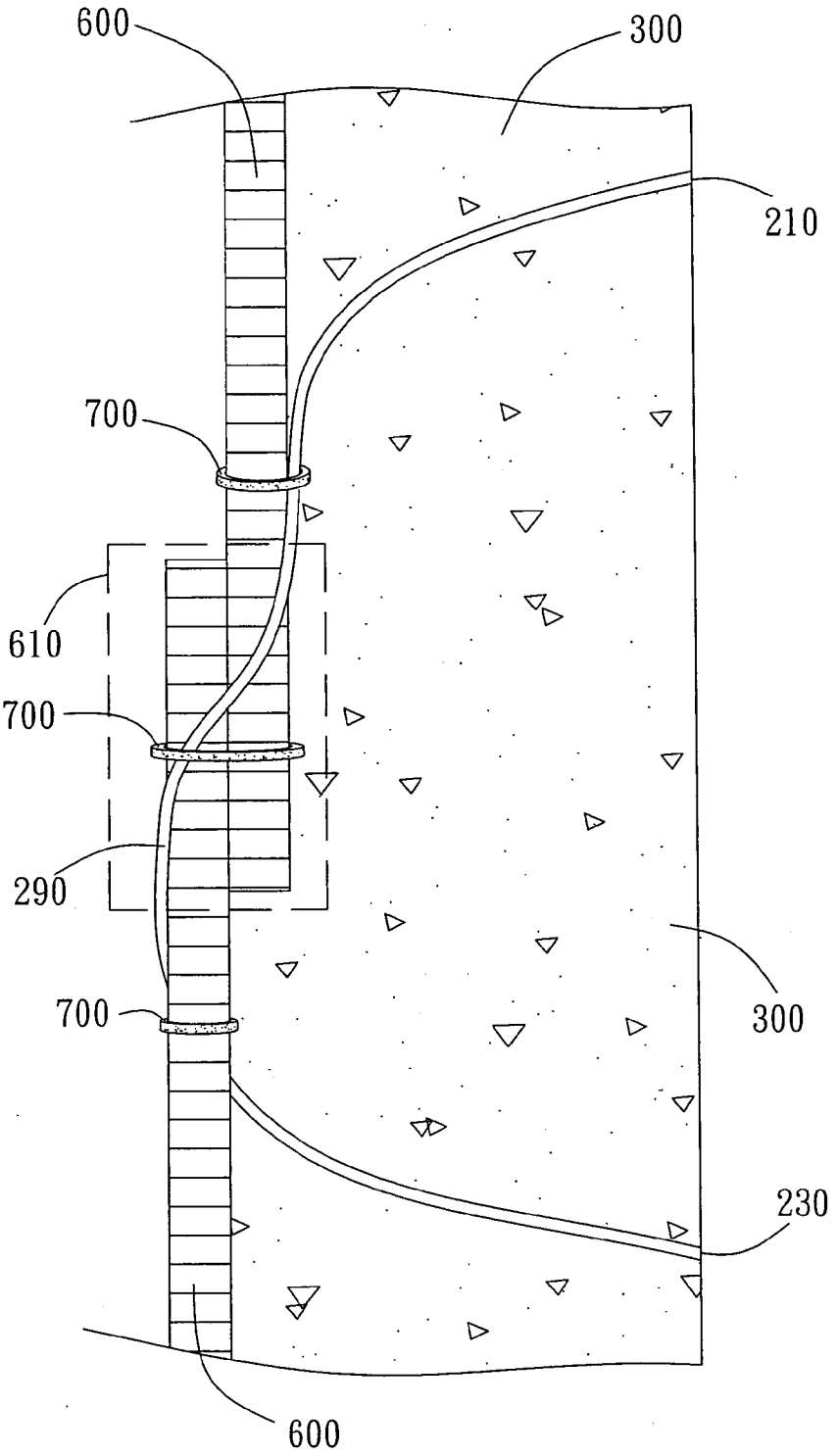


FIGURE. 10b

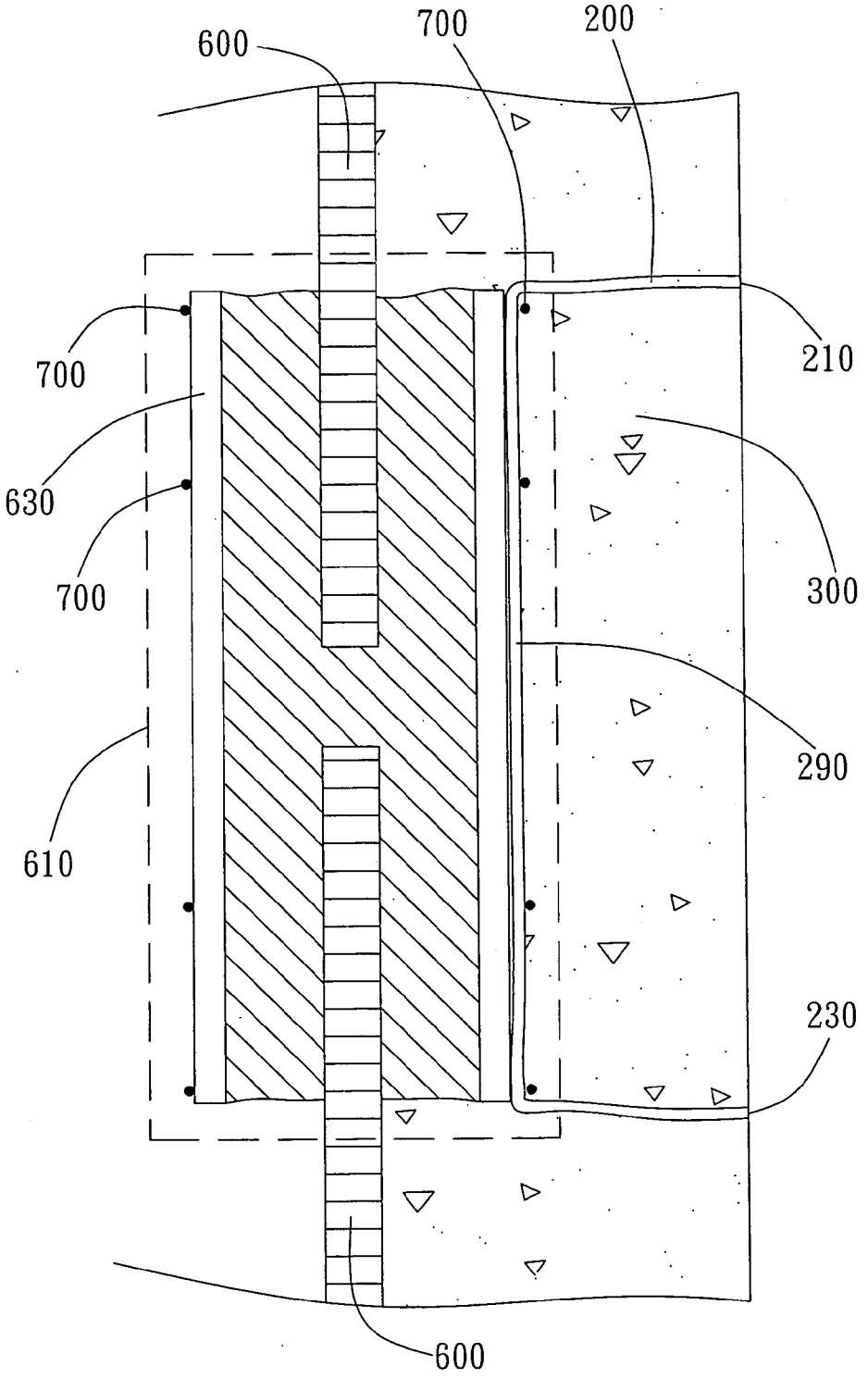


FIGURE. 10c

LIGHT-TRANSMISSIBLE CONSTRUCTION MATERIAL AND MANUFACTURING METHOD FOR THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates generally to a light-transmissible construction material and a method for manufacturing the same; particularly, the present invention relates to a material for constructing a light-transmissible or semi-light-transmissible structure and a method for manufacturing the same.

[0003] 2. Description of the Prior Art

[0004] Concrete plays a very important role for modern architecture structures in recent years. And its adjustable gravity and other multiple applications make it highly practicable for various construction designs and requirements.

[0005] However, most architects and engineers are more concerned about the use of concrete material on the structure design rather than the exterior design work. Even some architects and interior designers give concrete material higher value for its simple and plain characteristic recently, and apply it to the exterior design of the architecture, the main concerns are still focused on the traditional character of concrete material though.

[0006] In the field of architecture and interior design work, the use of light is very important. However, the traditional concrete, brick, wood and other construction material are mostly opaque in property. In order to satisfy the demand for the special effect resulted from light source, some architectures and interior designers would adopt the glass bricks to build a transparent structure, such as the transparent wall structure. But the architectonic sense of the glass brick structure is totally different from the one provided by the concrete material.

[0007] In addition, concrete material often becomes a load-bearing structure independently or joined with the steel frame structure to provide such supporting forces. Furthermore, as a result of the opaque character of concrete material, it is not easy to discover the internal structure fracture from the surface when the structure is affected by the external force.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to provide a light-transmissible construction material to construct a light-transmissible or semi-light-transmissible structure. It is another object of the present invention to provide a light-transmissible construction material, capable of transmitting light and remaining the characteristic of the concrete material. It is a further object of the present invention to provide a light-transmissible construction material, increasing the variety of architecture design. It is yet another object of the invention to provide a light-transmissible construction material, having the function of measuring the internal fracture. It is still another object of the invention to provide a method for effectively manufacturing a light-transmissible construction material. It is the other object of the invention to provide a construction structure system, having the function of measuring the internal fracture.

[0009] The light-transmissible construction material of the present invention comprises at least a light-transmissible unit and concrete unit. The light-transmitting unit has a light entrance end, a light exit end, and a lateral wall between both ends. The lateral wall of the light-transmitting unit is enclosed and surrounded with the concrete unit. The concrete structure also positions the light-transmissible unit and provides the structure strength as a whole. The light entrance and exit end of the light-transmitting unit are exposed from two opposite surfaces of the concrete unit.

[0010] By disposing the light-transmissible unit, light fully or partially penetrates, refracts and reflects through one side of the construction material to the other side. The present invention also provides a method for manufacturing the above light-transmissible construction material. At the beginning, placing at least one light-transmitting unit between two side formworks; then filling the concrete grout between above two side formworks; and drying the concrete grout to form the light-transmissible construction material. In the preferred embodiment, the dried construction material could be cut into different shapes and sizes to fulfill the needs for different designs and construction requirements.

[0011] The construction structure system of the present invention comprises a light-transmissible unit, frame unit and concrete unit. The light-transmitting unit has a light entrance end and a light exit end. After entering the light entrance end, the light is able to exit fully or partially from the light exit end. There is a middle part between the light entrance and exit end. The middle part of the light-transmitting unit is connected to the frame unit and thus attached to the frame unit. In the preferred embodiment, the middle part is connected to the frame unit by a binding device. The concrete unit encloses at least a part of the frame unit and the middle part of light-transmitting unit. The concrete unit is joined with frame unit to provide the structure strength as a whole. The light entrance and exit end of the light-transmitting unit are exposed from two surfaces of the concrete unit.

[0012] Because of the light-transmissible characteristic of the light-transmitting unit, the light entering the light entrance end may be received at the light exit end when the light-transmitting unit is continuous. When the frame unit or concrete unit has a fracture or other form of damages, the light-transmitting unit also breaks or produces the fracture accordingly. At the mean time, the inner part of the light-transmitting unit produces discontinuousness and unable to receive the light at light exit end. Therefore, this light-transmissible characteristic could be adopted to observe the internal fracture of construction structure or other forms of damages.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Examples of the present invention will now be described in detail with reference to the accompanying drawings, in which:

[0014] FIG. **1***a* is a preferred embodiment of the present invention light-transmissible construction material;

[0015] FIG. **1***b* is a perspective view of the preferred embodiment shown in FIG. **1***a;*

[0016] FIG. **1***c* shows another embodiment of the light-transmissible construction material;

[0017] FIG. **2** is a sectional view of the preferred embodiment shown in FIG. **1***a;*

[0018] FIG. **3** shows another embodiment of the light-transmissible construction material;

[0019] FIG. **4** is a flow chart of an exemplary method for manufacturing the light-transmissible construction material of the present invention;

[0020] FIG. **5** shows a preferred embodiment of an exemplary formworks assembling of the present invention;

[0021] FIG. **6** shows a preferred embodiment of the incision of the concrete material of the present invention;

[0022] FIG. **7** is a flow chart of another exemplary method for manufacturing the light-transmissible construction material of the present invention;

[0023] FIG. **7***a*, FIG. **7***b* and FIG. **7***c* show another exemplary formworks assembling of the present invention;

[0024] FIG. **8***a* and FIG. **8***b* show another exemplary formworks assembling of the present invention;

[0025] FIG. **8***c* is a sectional view of the preferred embodiment shown in FIG. **8***b;*

[0026] FIG. **9***a* and FIG. **9***b* show another exemplary method for manufacturing the light-transmissible construction material of the present invention;

[0027] FIG. **1**O*a* is a preferred embodiment of the construction structure system of the present invention;

[0028] FIG. **10***b* shows a preferred embodiment of the construction structure system of the present invention including a steel joint; and

[0029] FIG. **10***c* shows a preferred embodiment of the construction structure system of the present invention including a steel connecting tube.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0030] The present invention provides a light-transmissible construction material to construct a light-transmissible or semi-light-transmissible structure. The light-transmissible characteristic mentioned here refers to the phenomenon of light penetrating, refracting and reflecting fully or partially through the construction material of the present invention. A preferred embodiment of the present invention is making a light-transmissible concrete brick to build a structure. However, in the other embodiments, the construction material of the present invention could also be adopted to construct a platy, columnar or other shaped of construction material. In addition, the concrete material of the present invention could also be applied to measure an inner structure damage.

[0031] A preferred embodiment of the light-transmissible construction material of the present invention is illustrated in FIG. **1***a*. As shown in FIG. **1***a*, the construction material comprises at least a light-transmissible unit **200** and a concrete unit **300**. In the preferred embodiment, the light-transmissible unit **200** includes a plurality of light conductive fibers. In another embodiment, however, the light-transmissible unit **200** could also include a light conductive membrane or other element capable of transmitting light. Furthermore, in another embodiment, the construction material could simultaneously contain the light-transmitting fibers and the membrane as well.

[0032] As the perspective drawing shown in FIG. **1***b*, the light-transmitting unit **200** includes a light entrance end **210** and a light exit end **230**, which are the opposite ends of the light-transmitting fiber of the preferred embodiment. After entering the light entrance end **210**, the light fully or partially exits from the light exit end **230** as the physical phenomenon of light penetration, refraction and reflection in the light-transmitting unit **200**. The light-transmitting unit **200** has a lateral wall **250** between the light entrance end **210** and the light exit end **230**. In this preferred embodiment, the lateral wall **250** is in a round tubule shape to provide a better light-transmitting result. However, in another embodiment, the shape of the lateral wall **250** could be quadrate tubule, platy or in other forms as well.

[0033] As shown in Figure l*b*, the light-transmitting units **200** are preferably placed parallel to each other. However, in another embodiment, the light-transmitting units **200** could also be crossingly disposed and the light-transmitting units **200** may be bent freely according to different needs without affecting the light transmission. For example, in the embodiment shown in FIG. **1***c*, the light-transmitting units **200** are disposed in vertical and horizontal direction, thus the light in different directions can be directed. Besides, the preferred embodiment of the placement of the light-transmitting unit **200** is disposed as matrix as the cross-section drawing shown in FIG. **2**.

[0034] The concrete unit **300** covers the lateral wall **250** of the light-transmitting unit **200**. The concrete unit **300** also positions the light-transmitting unit **200** and provides necessary structure strength. It needs to be noticed that the concrete unit **300** merely covers the lateral wall **250** of the light-transmitting unit **200** without covering the light entrance end **210** and light exit end **230**. Namely, the light entrance end **210** and the light exit end **230** are exposed from two ends of concrete unit **300**. In the preferred embodiment, the light entrance end **210** and the light exit end **230** are exposed from two opposite surfaces of the concrete unit **300**. However in other form of embodiment, the light entrance end **210** and the light exit end **230** could be exposed from two adjacent surfaces of the concrete unit **300** as well.

[0035] The preferred embodiment of the concrete unit **300** is opaque, i.e., the light is not allowed to pass the concrete unit **300**. The characteristic could increase the light reflection effect within the light-transmitting unit **200** to raise the efficiency of the light transmission. In addition, the concrete unit **300** is made of concrete or grout containing light weight aggregate. The gravity of the concrete or grout is preferably smaller than the gravity of the light-transmitting unit **200** to prevent the light-transmitting unit **200** from floating during the process of filling the concrete grout. However, in another embodiment, the gravity of the concrete or grout could also be larger than the gravity of the light-transmitting unit **200**. In this embodiment, it may be necessary to position the light-transmitting unit **200** in advance or adopt a sequent concrete grout filling process to prevent the light-transmitting unit **200** from floating during the process of filling the concrete grout.

[0036] Because of the light-transmissible characteristic of the light-transmitting unit **200**, the light entering the light

entrance end **210** may be received at the light exit end **230** when the light-transmitting unit **200** is continuous, and thus producing the visual effect of light-transmissible, semi-light-transmissible or partially light-transmissible of the construction material of the present invention. In the embodiment shown in FIG. **3**, the light entrance end **210** may also extend to a light source **100**. The light generated by the light source **100** enters the light entrance end **210** of the light-transmitting unit **200** then exits to an internal space formed by the construction material through light exit end **230**. The characteristic could provide the practice of interior lighting design or other ambient lighting design. The preferred embodiment of the light source is the light in nature including sunshine. However in another embodiment, the light source **100** may be a spot light or other lighting device.

[**0037**] Besides, when the construction material of the present invention has a fracture or other form of damage as a result of an external force, the light-transmitting unit **200** also breaks or produces the fracture accordingly. In the mean time, the internal of the light-transmitting unit **200** becomes discontinuous and affects the light-transmissible characteristic. Therefore, when the light received at the light exit end **230** changes or terminates, it is considered that the interior structure of the construction material has a fracture or other form of damages.

[**0038**] FIG. **4** shows a flow chart of an exemplary method for manufacturing the light-transmissible construction material. As shown in FIG. **4**, step **401** includes placing at least a light-transmitting unit **200** between the two side formworks **510**. As the embodiment shown in FIG. **5**, the formwork for manufacturing the construction material comprises a side formwork **510**, a bottom formwork **530** and a lateral formwork **550**. As shown in FIG. **5**, a plurality of light conductive fibers are parallelly disposed between the two formworks **510**.

[**0039**] Then fill the concrete grout between the two formworks **510** in step **403** and dry the concrete grout to produce the construction material in step **405**. As shown in FIG. **6**, the produced construction material may be cut into different shapes and sizes to satisfy the demands for different designs and construction requirements.

[**0040**] The other function flow diagram shown in FIG. **7** is another exemplary manufacturing method of the construction material of the present invention. In this embodiment, the above-mentioned step **401** further includes step **4011**, juxtaposing the two side formworks **510**. As shown in FIG. **7***a*, each side formwork **510** has a hole **511** which is opposite to the other hole located on the other side formwork **510**. When both side formworks **510** juxtaposes, the corresponding holes **511** on opposite side formworks **510** are aligned.

[**0041**] Step **4013** includes passing the light-transmitting unit **200** through corresponding holes **511** of the two side formworks **510**. In other words, as shown in FIG. **7***a*, both ends of the light-transmitting unit **200** are located outside the outer walls of the two side formworks **510**.

[**0042**] Step **4015** includes outwardly separating the two side formworks **510**. As shown in FIG. **7***b*, in the preferred embodiment, the two side formworks **510** are separated to opposite sides of the bottom formwork **530**. In this preferred embodiment, it also includes forming a fastening device **270** on the light-transmitting unit **200** to position the light-transmitting unit **200**. The fastening device **270** is placed at the outer wall of the side formwork **510** and engages the hole **511** to prevent the light-transmitting unit **200** from inwardly sliding. The fastening device **270** may be formed by tying one end of the light-transmitting unit **200** or by setting a screw, a clam or a sleeve. However, in another embodiment, as shown in FIG. **7***c*, exerting an outward pulling force F on two corresponding ends of the light-transmitting unit **200** may provide a tension to position the light-transmitting unit **200**

[**0043**] FIG. **8***a*, FIG. **8***b* and FIG. **8***c* show another embodiment of the manufacturing method of the present invention. In this embodiment, each side formwork **510** has an external wall **513** and an internal wall **515**. There are corresponding holes **511** on the external wall **513** and the internal wall **515**. After moving the side formworks **510** to both sides of the bottom formwork **530**, as shown in FIG. **8***b* and FIG. **8***c*, then parallelly changes a relative position between the external and internal plate to fix the position the light-transmitting unit **200**. As a result of the displacement between the external plate **513** and the internal plate **515**, the skewered holes **511** move relative to each other to bend and clip the light-transmitting unit **200** to fix the position.

[**0044**] FIG. **9***a* and FIG. **9***b* show another embodiment of the manufacturing method of the present invention. In this embodiment, the light-transmitting units **200** are disposed tier-by-tier and the concrete grout is filled sequently. After drying the concrete grout, as shown in FIG. **9***b*, cut off both ends of the construction material to expose the light entrance end **210** and light exit end **230**.

[**0045**] The present invention further provides a construction structure system. In the embodiment as shown in FIG. **1**O*a*, the construction structure system of the present invention comprises a light-transmitting unit **200**, a frame unit **600** and a concrete unit **300**. In the preferred embodiment, the light-transmitting unit **200** includes light conductive fibers. In another embodiment, however, the light-transmitting unit **200** may include a light conductive membrane or other elements capable of transmitting light.

[**0046**] As shown in FIG. **1**O*a*, the light-transmitting unit **200** has a light entrance end **210** and a light exit end **230**, which are the two opposite ends of the light conductive fibers in this embodiment. After entering the light entrance end **210**, the light fully or partially exits from light exit end **230** through the physical phenomenon of light penetration, refraction and reflection of the light-transmitting unit **200**. There is a middle part **290** between the light entrance end **210** and the light exit end **230** of the light-transmitting unit **200**

[**0047**] The middle part **290** of the light-transmitting unit **200** is connected to the frame unit **600**, i.e., the middle part **290** is attached on the frame unit **600**. In the embodiment shown in FIG. **1**O*a*, the frame unit includes a steel bar. In another embodiment, however, as shown in FIG. **10***b*, the frame unit **600** includes a steel joint **610**. In the embodiment shown as FIG. **10***c*, the steel joint **610** of the frame unit **600** is formed from a steel connecting tube **630**.

[**0048**] In the embodiment shown in FIG. **1**O*a*, FIG. **1**O*b* and FIG. **1**O*c*, the middle part **290** of the light transmitting unit **200** is connected to the frame unit **600** by a fastening device **700**. The preferred embodiment of the fastening

device **700** includes a steel wire. In another embodiment, however, the binding device **700** may include a plastic binding belt or other device capable of positioning.

[**0049**] The concrete unit **300** encloses at least a part of the frame unit **600** and the middle part **290** of the light-transmitting unit **200**. The concrete unit **300** positions the light-transmitting unit **200** and the frame unit **600** simultaneously and joins the frame unit **600** to provide the structure strength as a whole. What worth noticed is that the concrete unit **300** only covers the middle part **290** of the light-transmitting unit **200** without covering the light entrance end **210** and the light exit end **230**. That is, the light entrance end **210** and the light exit end **230** are respectively exposed outside the concrete unit **300**. In the preferred embodiment, the light entrance end **210** and the light exit end **230** are respectively exposed from the same surface of the concrete unit **300**. However, in another embodiment, the light entrance end **210** and the light exit end **230** may be exposed from different surfaces of the concrete unit **300** as well.

[**0050**] As a result of the light-transmissible characteristic of the light-transmitting unit **200**, while the light-transmitting unit **200** is continuous, the light entering the light entrance end **210** may be received at the light exit end **230**. When the construction structure system is affected by an external force and thus produces a fracture or other form of damages in frame unit **600** or concrete unit **300**, the light-transmitting unit **200** becomes broken or fractured accordingly. Owing to the internal discontinuousness of the light-transmitting unit **200**, the property of transmitting the light is also changed. Therefore, while it is unable to receive the light at the light exit end **230**, or the light received at light exit end **230** changes, it deems that the internal of the construction structure system has fractures or other damages. In addition, when the inside of the construction structure system disposes a plurality of light-transmitting units **200** in different places or different frame units, it is able to determine the position of internal damage by observing the light at the light exit ends **230** of each light-transmitting unit **200**.

[**0051**] Although the preferred embodiments of the present invention have been described herein, the above description is merely illustrative. Further modification of the invention herein disclosed will occur to those skilled in the respective arts and all such modifications are deemed to be within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A light-transmissible construction material, comprising:

at least a light-transmitting unit having a light entrance end, a light exit end corresponding to said light entrance end, and a lateral wall between said light entrance end and said light exit end; and

a concrete unit covering said lateral wall of said light-transmitting unit,

wherein said light entrance end and said light exit end of said light-transmitting unit are exposed outside said concrete unit.

2. The light-transmissible construction material of claim 1, wherein said light entrance end and said light exit end are exposed from two opposite surfaces of said concrete unit.

3. The light-transmissible construction material of claim 1, wherein said light-transmitting unit includes a plurality of light conductive fibers.

4. The light-transmissible construction material of claim 3, wherein said plurality of light conductive fibers are parallel to each other.

5. The light-transmissible construction material of claim 3, wherein said plurality of light conductive fibers are crossingly disposed.

6. The light-transmissible construction material of claim 1, wherein said light-transmitting unit includes at least a light conductive membrane.

7. The light-transmissible construction material of claim 1, wherein said concrete structure is made of concrete grout containing light weight aggregate.

8. The light-transmissible construction material of claim 7, wherein a gravity of said concrete grout is smaller than a gravity of said light-transmitting unit.

9. A method for manufacturing a light-transmissible construction material, comprising:

placing at least one light-transmitting unit between two formworks;

filling concrete grout between said two formworks; and

drying said concrete grout to form said light-transmissible construction material.

10. The method of claim 9, further comprising positioning said light-transmitting unit.

11. The method of claim 9, wherein the placing step includes:

juxtaposing said two frameworks;

passing at least one light-transmitting unit through corresponding holes of said two formworks; and

outwardly separating said two formworks.

12. The method of claim 11, further comprising forming a fastening device on said light-transmitting unit corresponding to an outer wall of said formwork to position said light-transmitting unit.

13. The method of claim 11, wherein each said formwork has an external plate and an internal plate, the placing step includes parallelly changing a relative position between said external and internal plate to position said light-transmitting unit.

14. The method of claim 11, further comprising exerting an outward pulling force on two opposite ends of said light-transmitting unit to provide the said light-transmitting unit with a tension.

15. A construction structure system, comprising:

a light-transmitting unit, each said unit including a light entrance end, a light exit end, and a middle part between said light entrance end and said light exit end;

a frame unit, the middle part of said light-transmitting unit connecting and attaching to said frame unit; and

a concrete unit enclosing the middle part of said light-transmitting unit and at least a part of said frame unit, wherein the light entrance end and the light exit end of said light-transmitting unit are exposed outside said concrete unit.

16. The construction structure system of claim 15, wherein said light entrance end and said light exit end are respectively exposed from a surface of said concrete unit.

17. The construction structure system of claim 15, wherein said light-transmitting unit includes a light conductive fiber.

18. The construction structure system of claim 15, wherein said frame unit includes a steel bar.

19. The construction structure system of claim 15, wherein said frame unit includes a steel joint.

20. The construction structure system of claim 15, further comprising a binding device connecting said middle part of said light-transmitting unit to said frame unit.

* * * * *