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(54) **METHOD AND SYSTEM FOR A FOLDABLE STRUCTURE EMPLOYING MATERIAL-FILLED PANELS**

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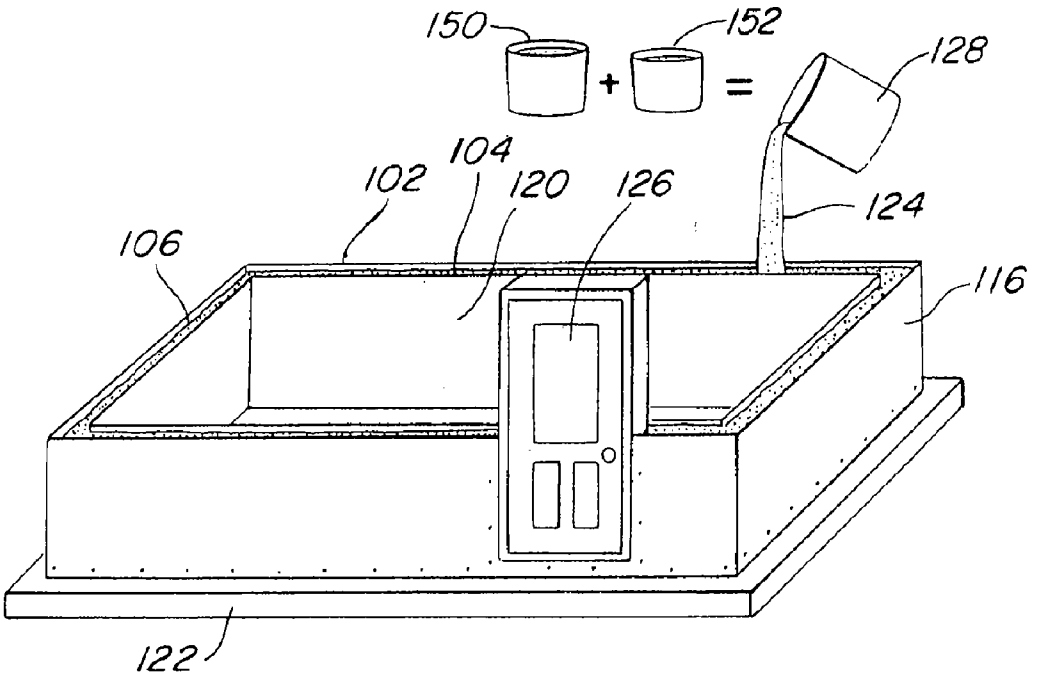
E04B 1/00	(2006.01)

(52) **U.S. Cl.** **52/309.4**; 52/578; 52/588.1; 52/698; 52/742.13; 52/745.05; 52/745.15

(57) **ABSTRACT**

In one embodiment, the present invention can include a foldable structure employing material-filled panels which can be used as an emergency shelter in disaster areas. A building can formed from one or more building blocks. The building blocks can be in a compact position, such as when being transported to a disaster area, or in an expanded position, such as when the building is ready to be built in the disaster area. In the expanded position, the building blocks can be filled with various materials such as expanding foam material. The expanding foam material can be formed from two mixing materials. In addition, the expanding foam material can have insulating properties. The building of the present invention can also be used, for example, as sheds, tree houses, and/or permanent housing. The building blocks can have marine applications and/or military application due to their light weight, yet, ballistic nature.



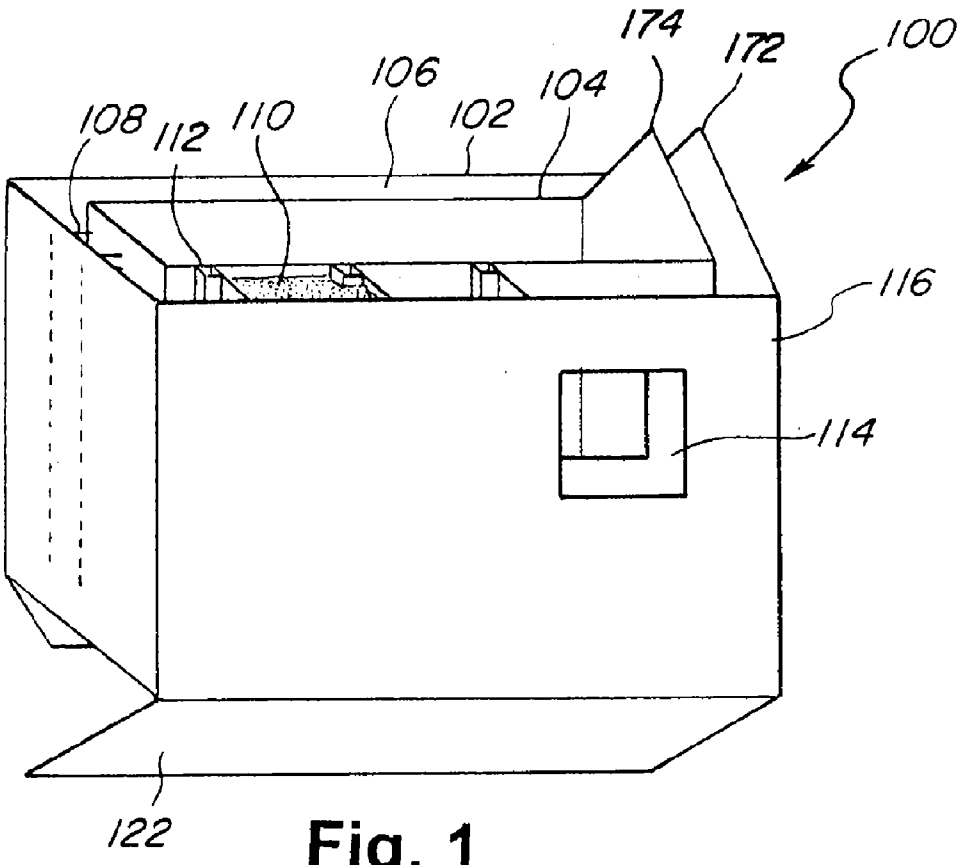


Fig. 1

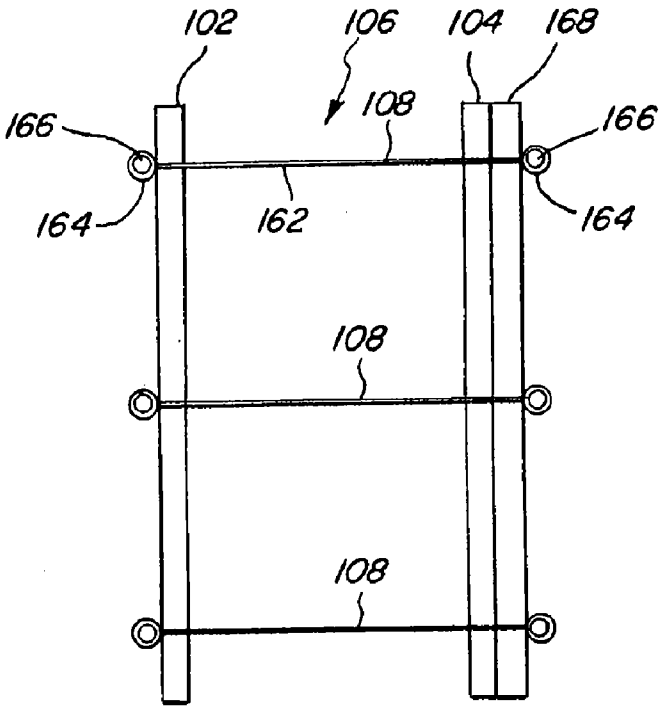


Fig. 2

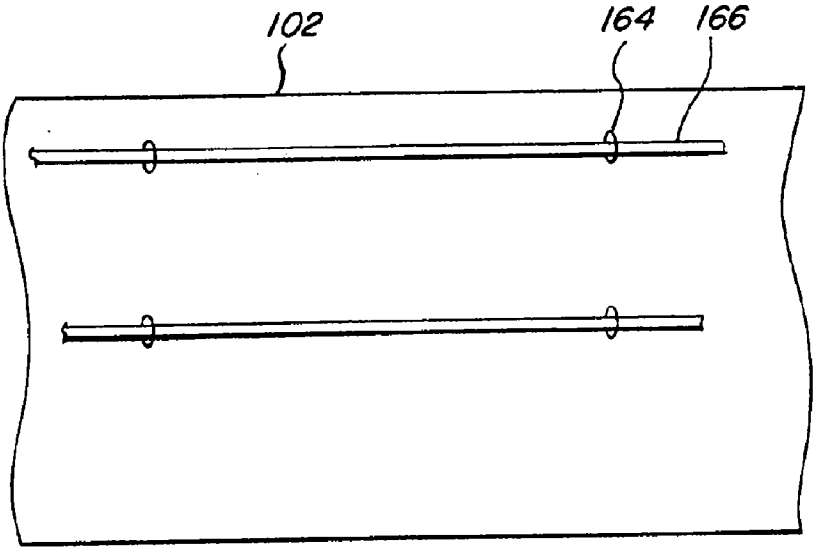
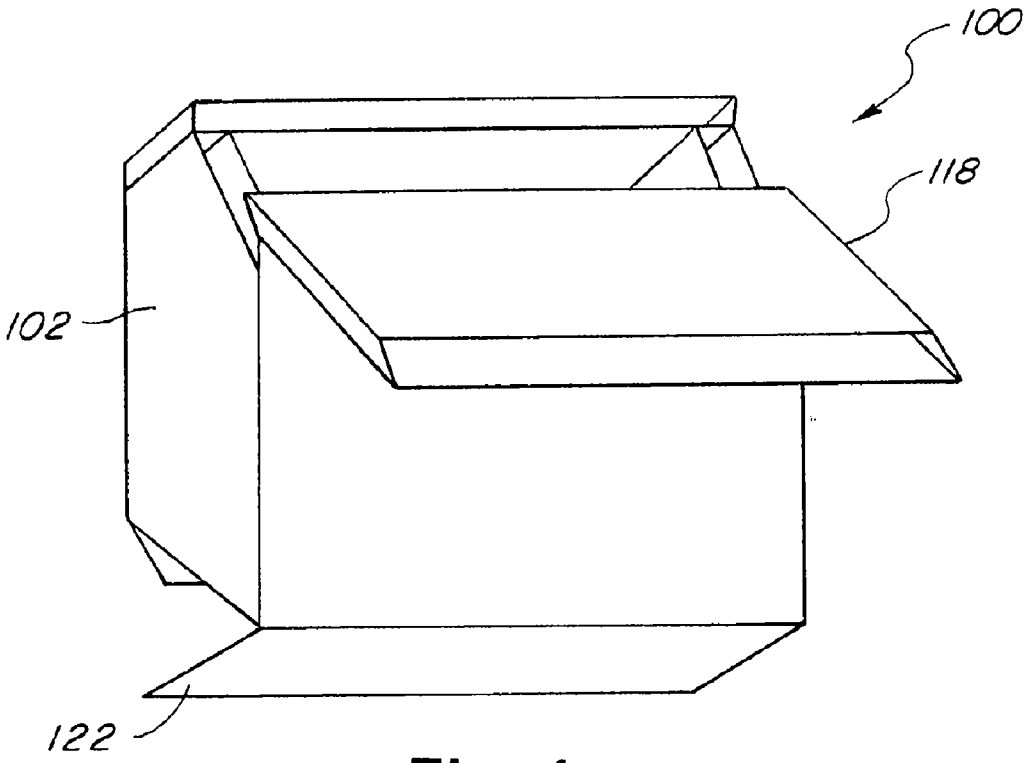


Fig. 3



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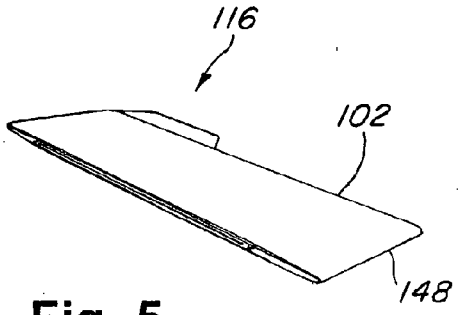


Fig. 5

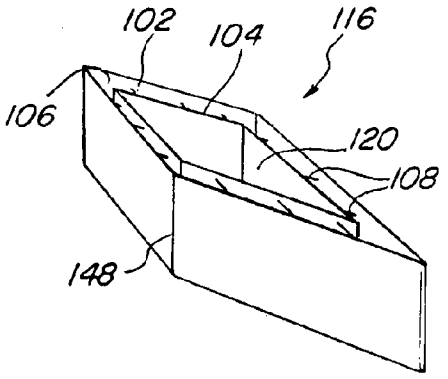


Fig. 6

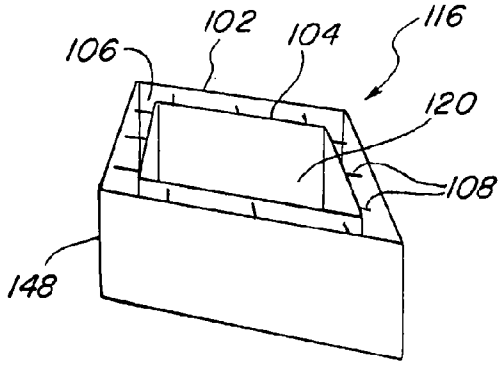
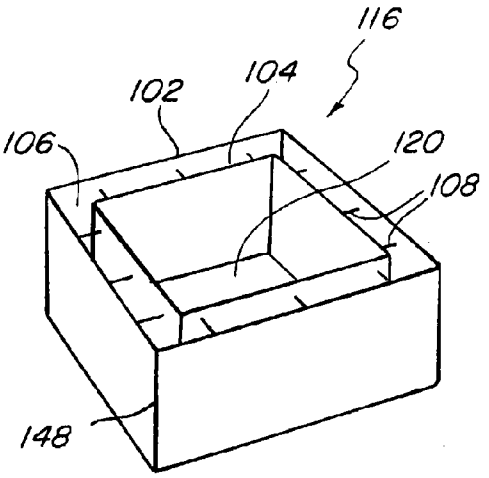


Fig. 7



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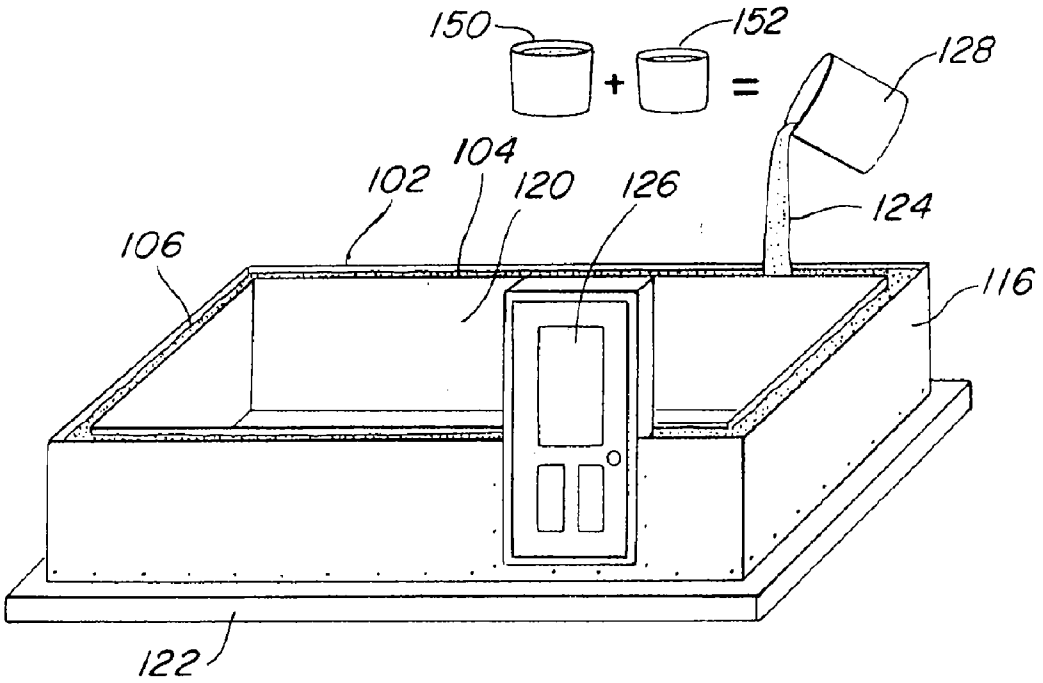
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Fig. 9

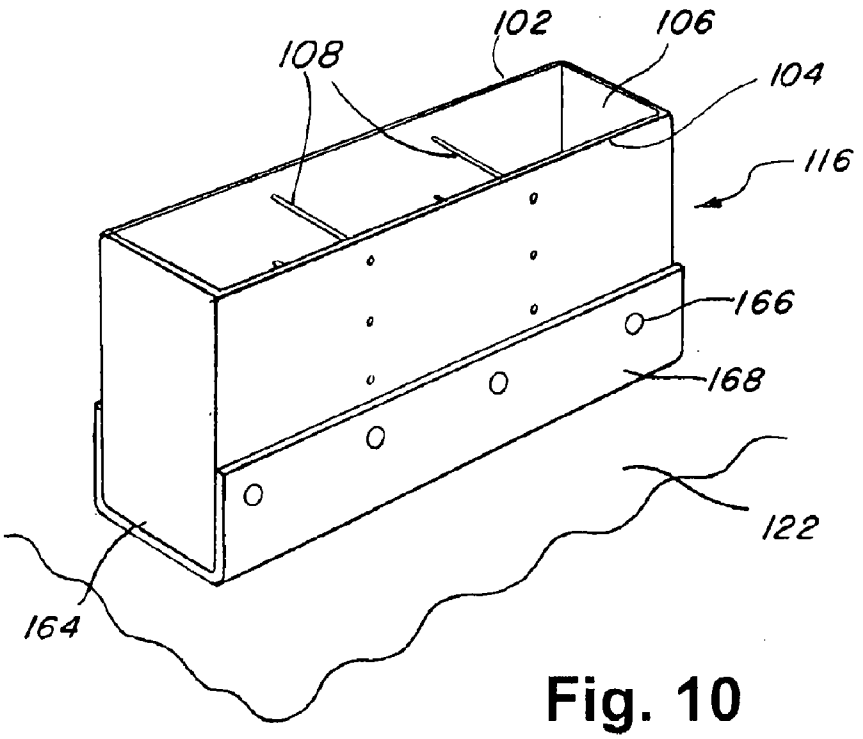
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Fig. 10

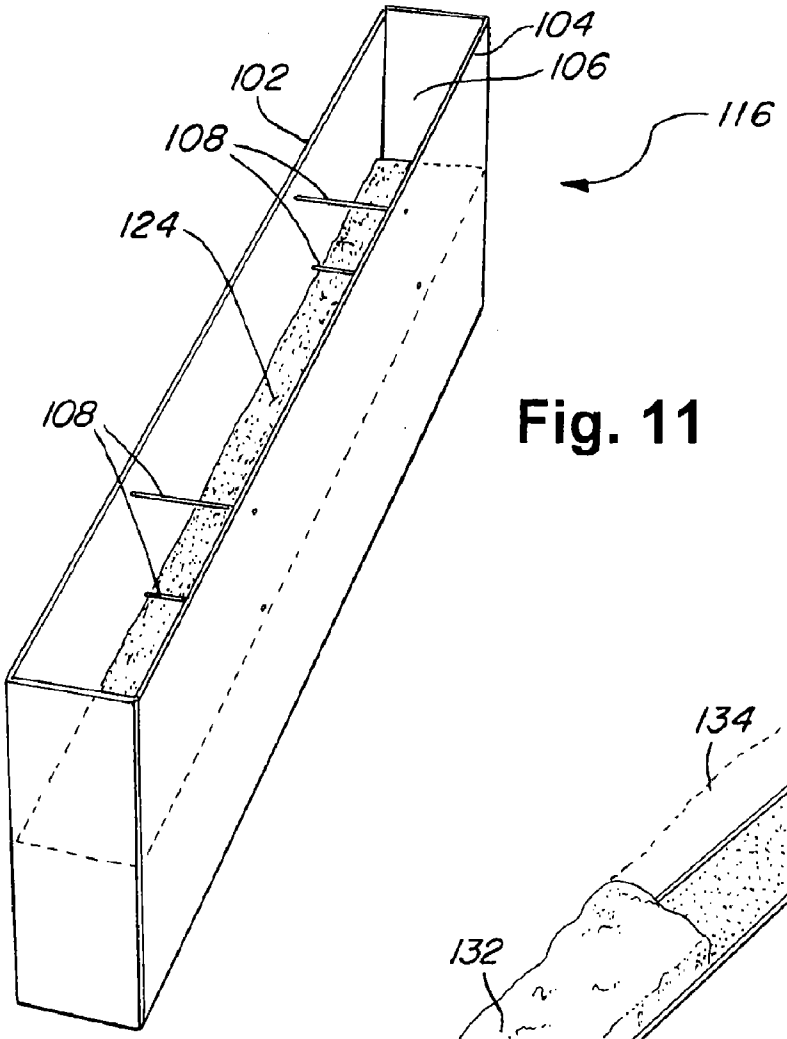
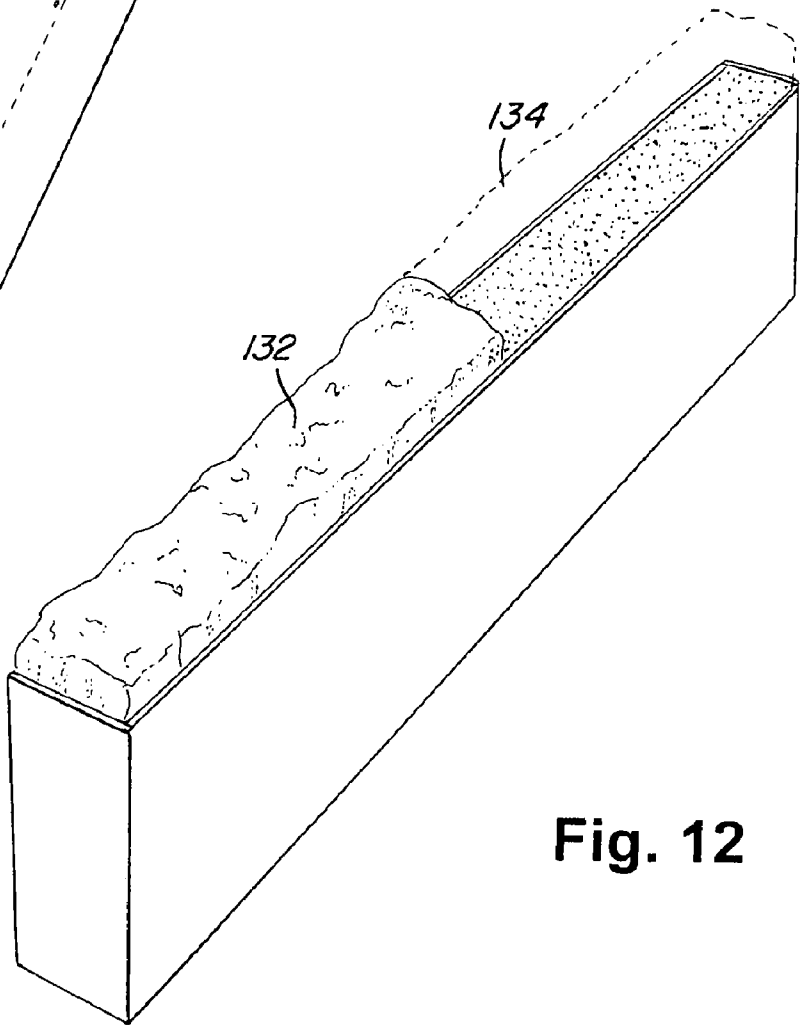


Fig. 11



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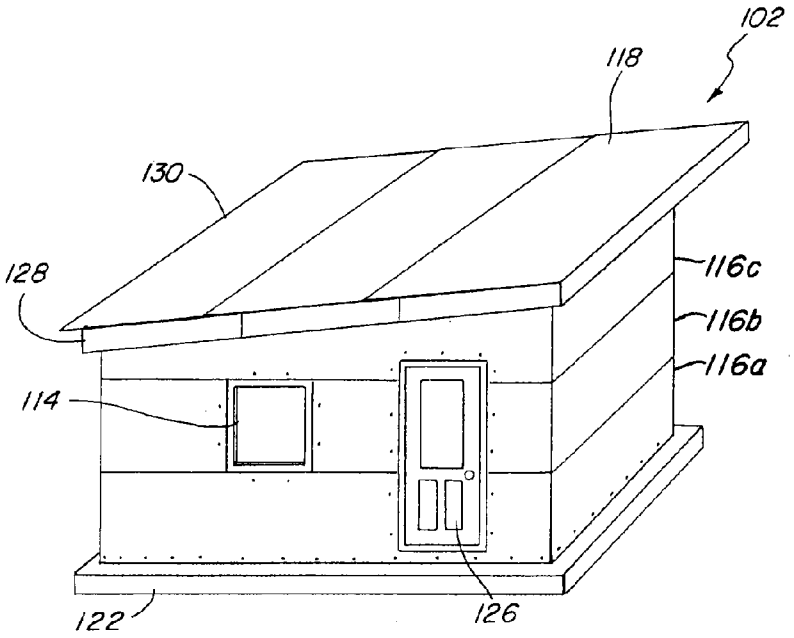

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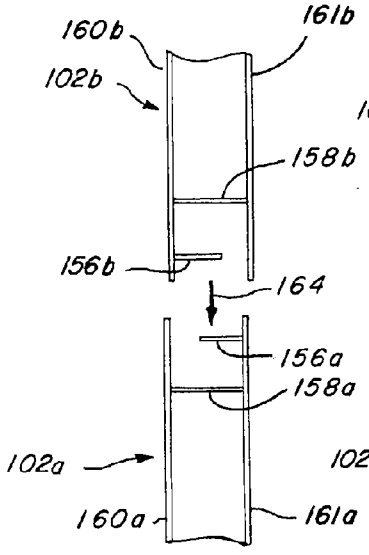

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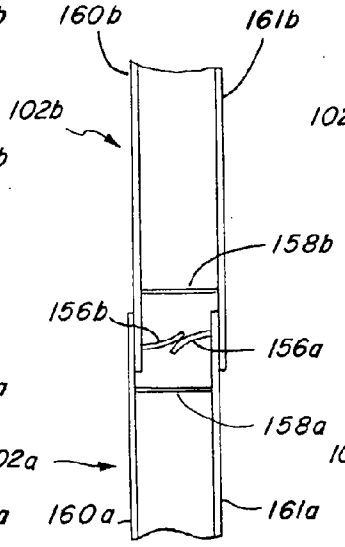


Fig. 15

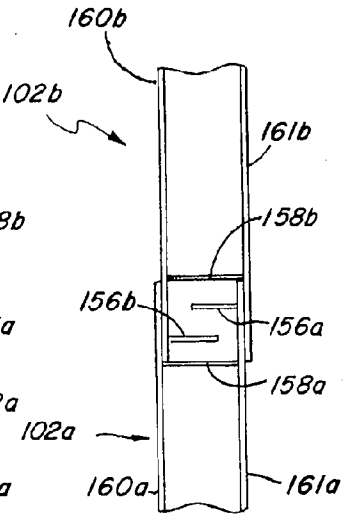
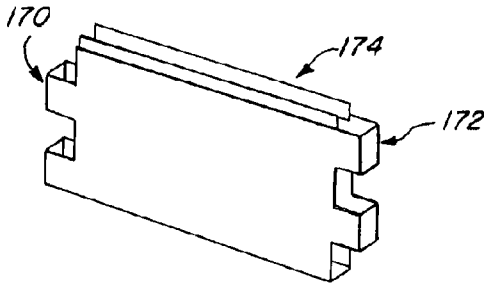


Fig. 16



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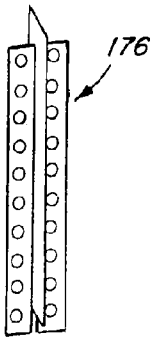

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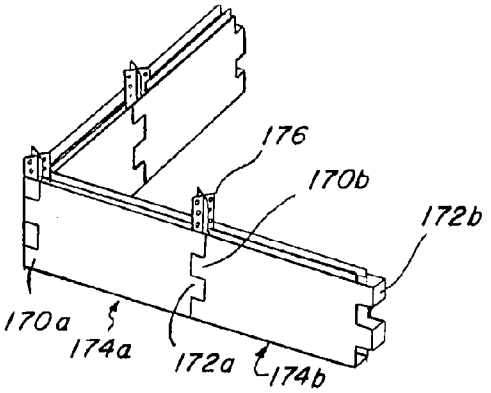

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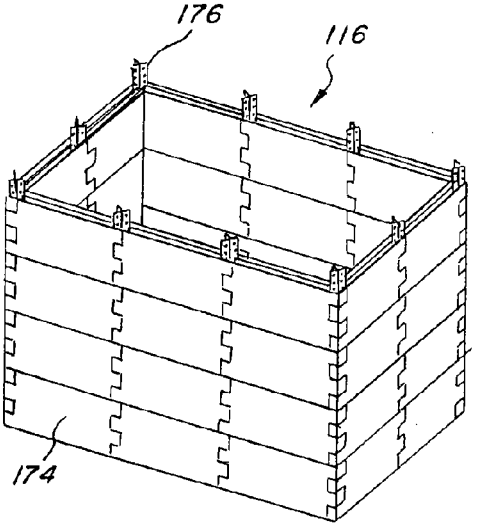
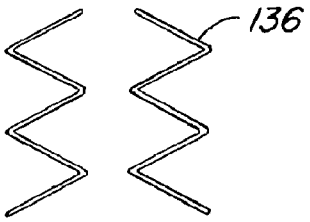


Fig. 20



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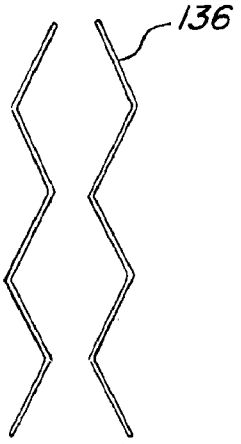

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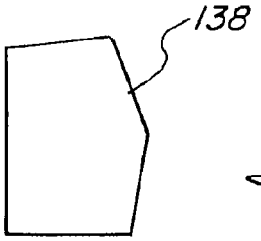

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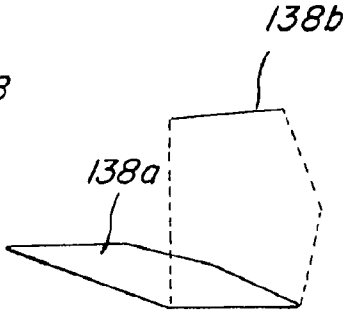

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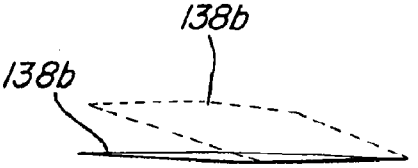

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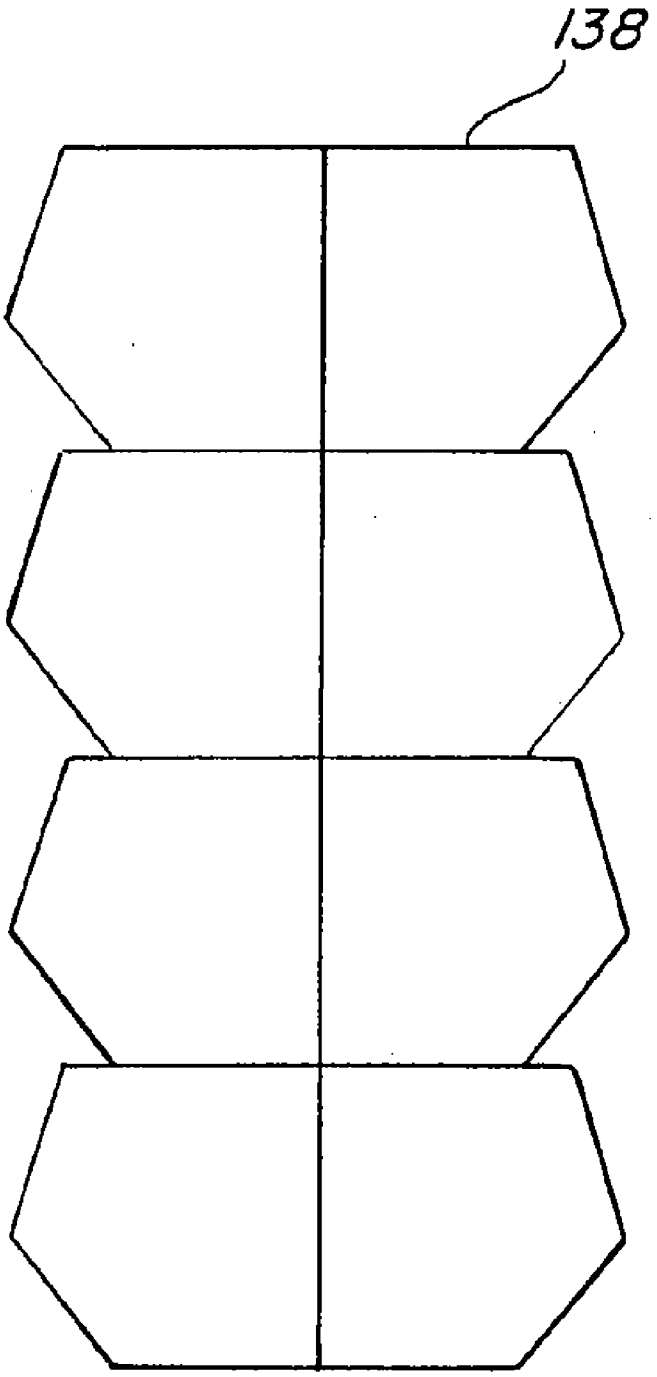

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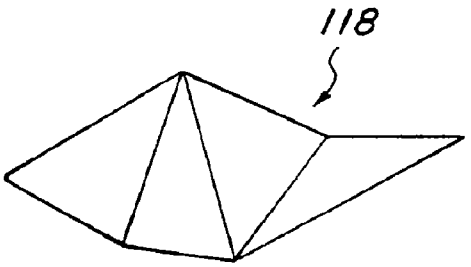

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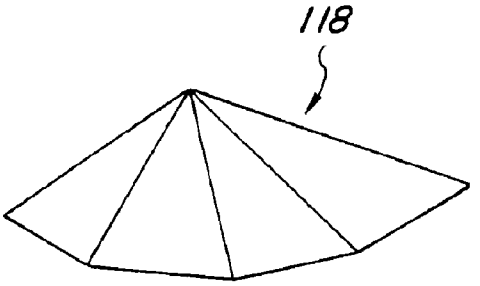
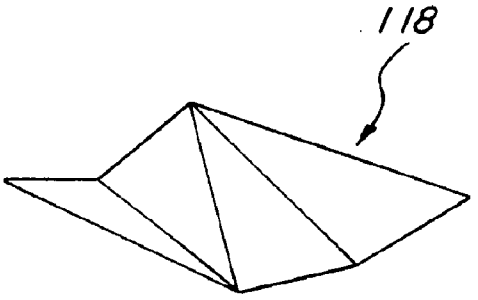


Fig. 28



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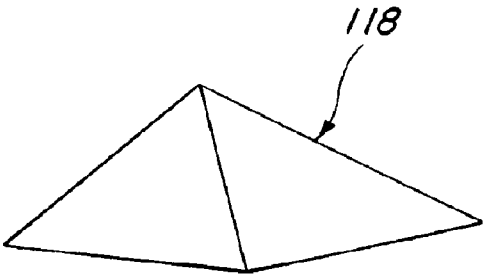

Fig. 30

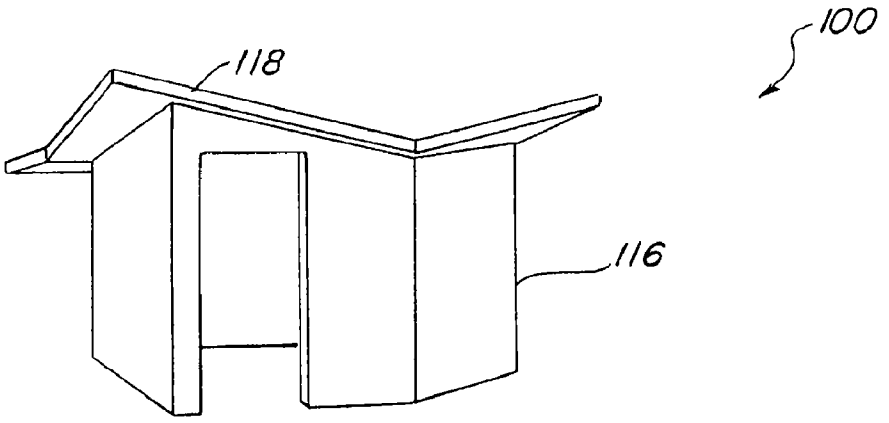

Fig. 31

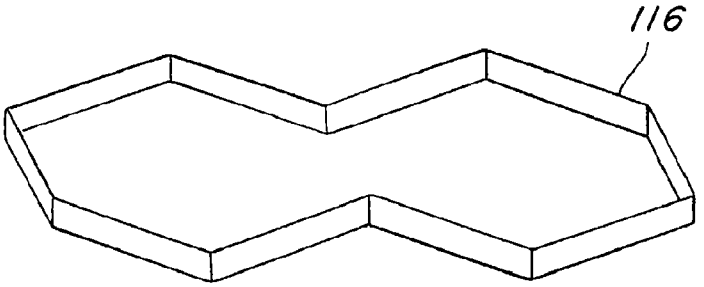

Fig. 32

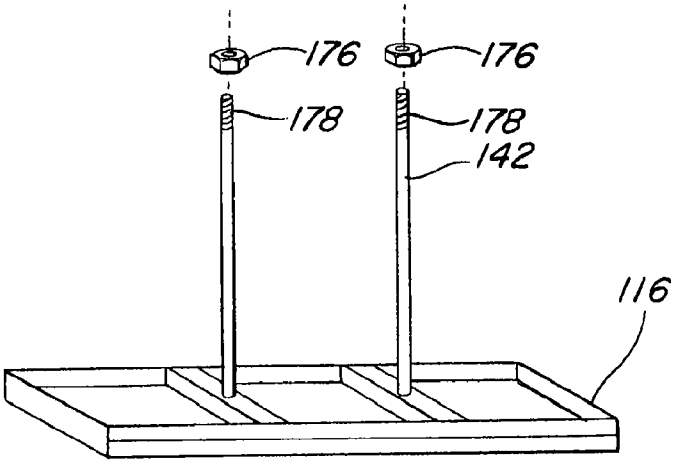

Fig. 33

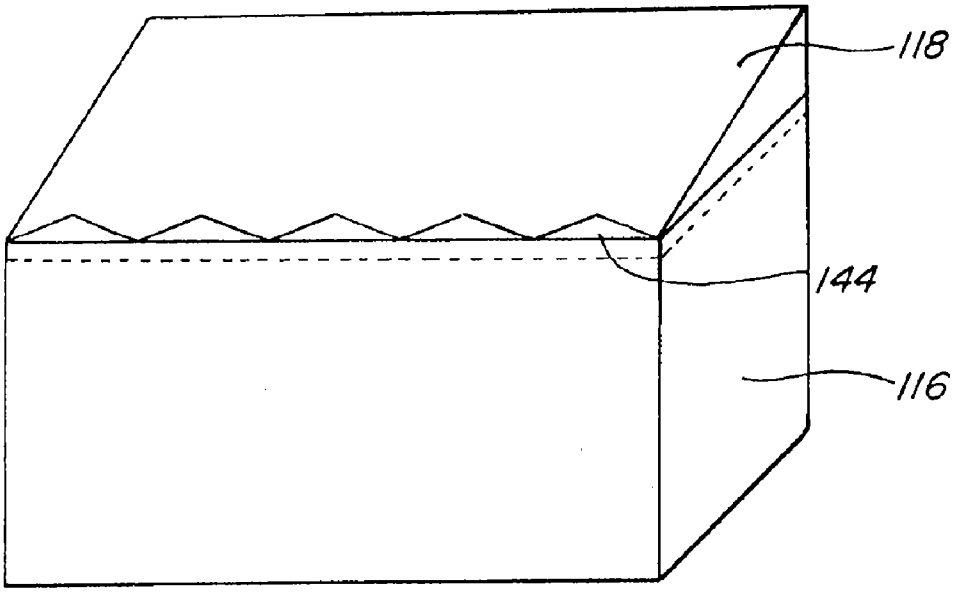

Fig. 34

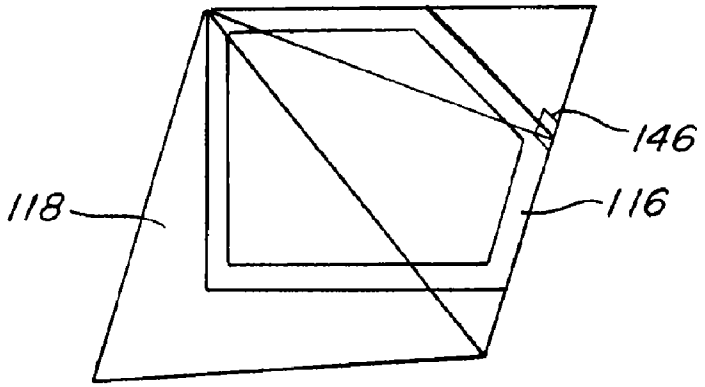

Fig. 35

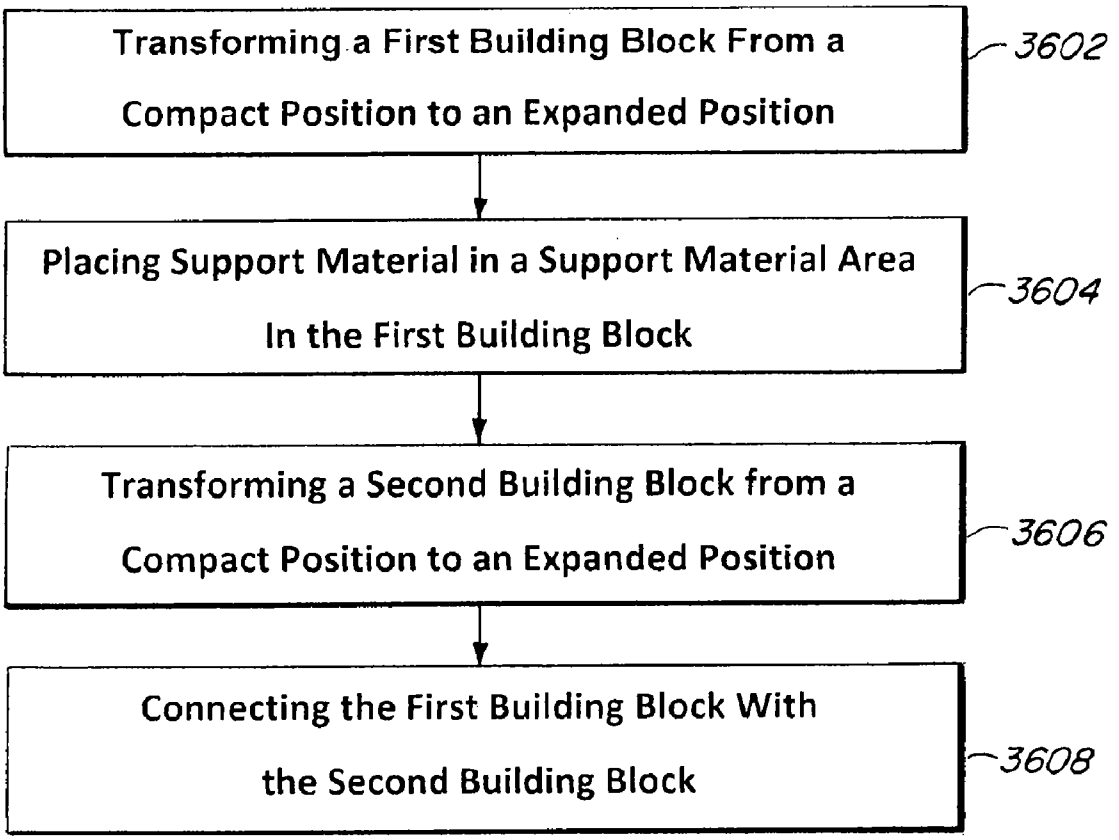
Transforming a First Building Block From a Compact Position to an Expanded Position
3602
Placing Support Material in a Support Material Area In the First Building Block
3604
Transforming a Second Building Block from a Compact Position to an Expanded Position
3606
Connecting the First Building Block With the Second Building Block
3608

Fig. 36

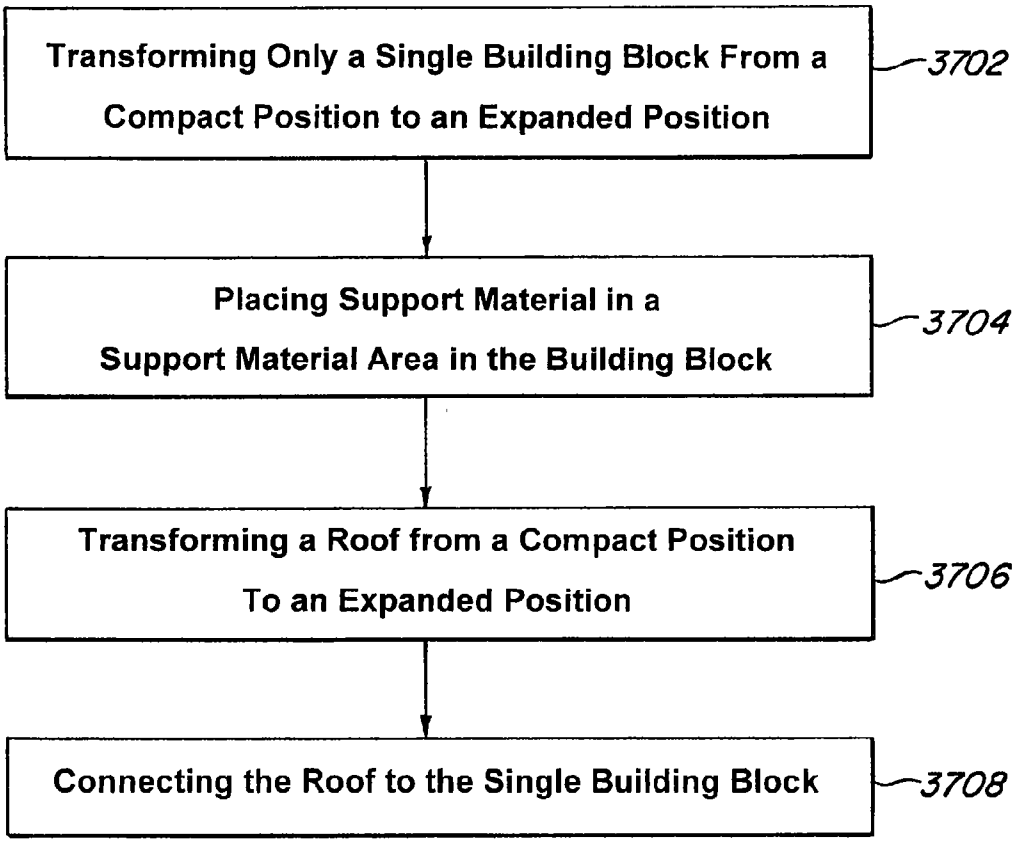
Transforming Only a Single Building Block From a Compact Position to an Expanded Position
3702
Placing Support Material in a Support Material Area in the Building Block
3704
Transforming a Roof from a Compact Position To an Expanded Position
3706
Connecting the Roof to the Single Building Block
3708

Fig. 37

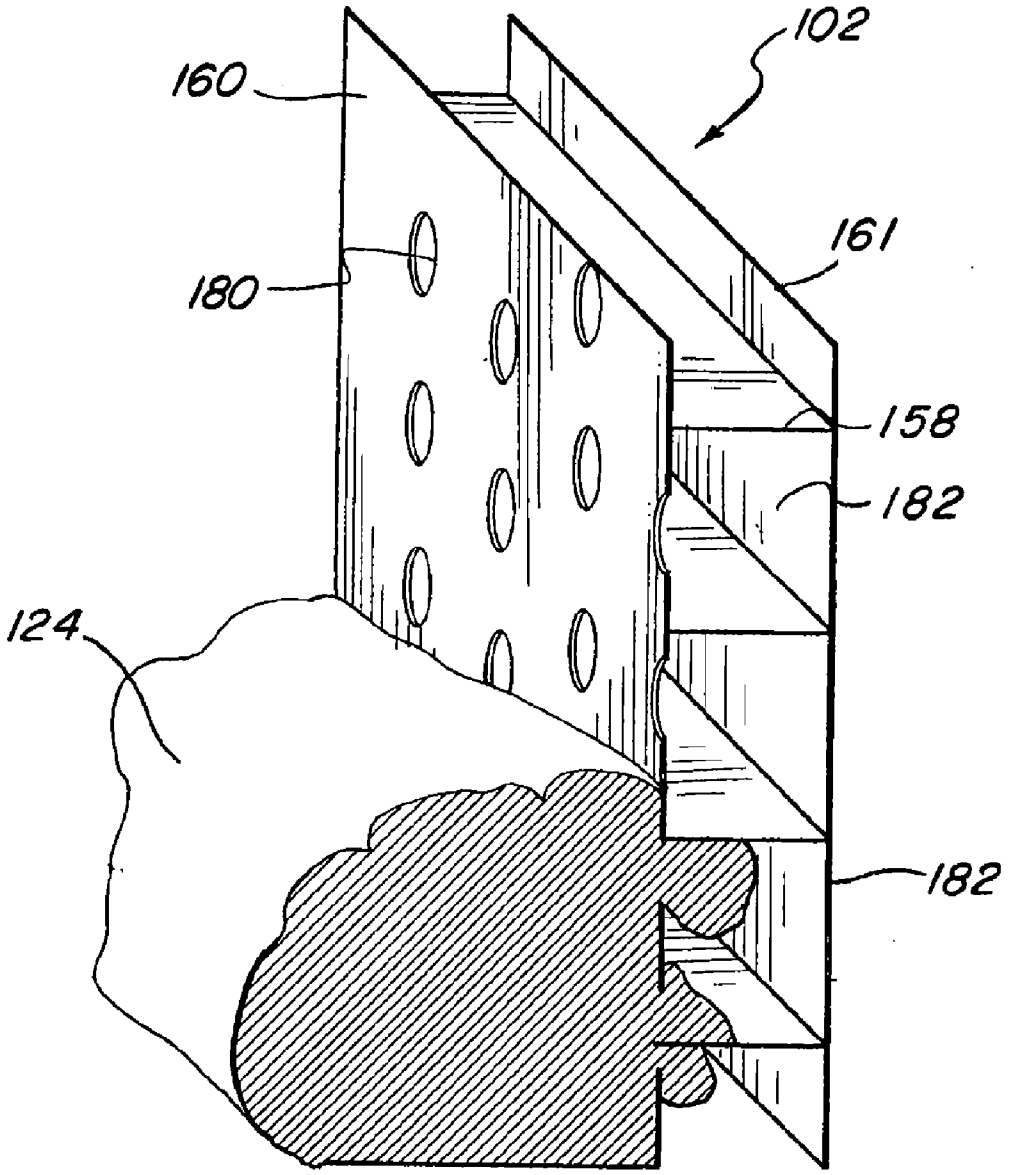

Fig. 38

METHOD AND SYSTEM FOR A FOLDABLE STRUCTURE EMPLOYING MATERIAL-FILLED PANELS

RELATED APPLICATIONS

[0001] This application claims the benefit of provisional application No. 61/219,281 entitled "FOLDABLE BUILDING STRUCTURE EMPLOYING FOAM-CORE BUILDING PANELS" filed on Jun. 22, 2009, and which is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Disclosure

[0003] The present disclosure generally relates to a method and system for a foldable structure employing material-filled panels.

[0004] 2. Description of the Related Art

[0005] Each year natural disasters such as earthquakes, tornados, floods, tsunamis, storms, and/or hurricanes occur in areas all over the world. These natural disasters are often unpredictable, terrifying, and devastating causing millions of dollars in damage and tremendous loss of life. The first hours and days of a natural disaster are critical to relief workers when attempting to mitigate the damage and casualties of the natural disaster area. However, the relief workers often have little to no place to stay due to the damage caused by the natural disaster to suitable shelters such as hotels, vacant apartments, or houses. In addition the displaced native population will generally utilize any vacancies in housing. Moreover, to the extent that the natural disaster damages houses, apartments and hotels belonging to the native population, this displaced native population will also be in dire need of suitable shelter.

[0006] Because the building of even temporary housing is time consuming and expensive and can require, for example, natural resources which may not be readily available in the area affected by the natural disaster, the critical first hours and days of the natural disaster, are either wasted building housing for the relief workers rather than the displaced native population or are spent erecting temporary shelters that typically do not provide a long term solution for the displaced native population.

[0007] In the meantime, the critical first hours and days are not used efficiently since a limited amount of relief workers will be present, and furthermore, energy is wasted building housing for the limited amount of relief workers. This can lead to a high amount of damages and casualties.

[0008] Temporary solutions such as tents are generally unsatisfactory since they may not provide adequate shelter against extreme temperatures at night or the day. In addition, such temporary solutions are generally uncomfortable, which can fatigue and tax the rescue workers. This can reduce the efficiency of the rescue workers. In addition to natural disasters, additional housing may be needed during military conflicts and/or during peacekeeping missions. Temporary solutions are also generally undesirable during such problematic issues.

[0009] More permanent temporary shelters are typically expensive both in terms of the purchase price and to transport to the location of the natural disaster. Thus, there is a need for a building which can be easily erected in an efficient manner while providing a comfortable and adequate shelter.

BRIEF SUMMARY OF THE INVENTION

[0010] The present invention is directed, for example, to a building which can be easily erected in an efficient manner while providing a comfortable and adequate shelter. In one embodiment, the present invention can be a foldable structure employing material-filled panels which can be used as an emergency shelter in disaster areas.

[0011] The present invention can be, for example, a building formed from one or more building blocks. The building blocks can be in a compact position, such as when being transported to a disaster area, or in an expanded position, such as when the building is ready to be built in the disaster area. In the expanded position, the building blocks can be filled with expanding foam material. The expanding foam material can be formed, for example, from two mixing materials, allowing for the easy generation of the expanding foam material. This reduces the amount of natural resources used to erect the building. In addition, the expanding foam material can have insulating properties to provide adequate shelter against extreme temperatures during the day or night. The building blocks can also be formed, for example, from other types of materials such as cement, organic material, rubble, earth, adobe, plant matter, or any type of local material. Thus, the building of the present invention can be easily deployed to a natural disaster area, and can be easily erected without a huge tax on the natural resources. This can allow a large number of buildings to be for relief workers in an efficient manner. This can also increase a number of housing available for victims and/or relief workers. This can provide immediate housing for the victims and also increase the number of relief workers available during the critical first hours and days of a natural disaster. The present invention can also be permanent housing for the victims. In addition, during military conflicts, the present invention can provide housing, for example, for refugees. For peacekeeping missions, the present invention can house the peacekeepers.

[0012] In addition, the present invention is sturdy enough such that when the relief workers are not needed anymore, the buildings can provide shelter for any displaced native population, reducing the recovery time period. The building of the present invention is also not limited to the emergency shelter, but can also be used, for example, as storage sheds, field hospitals, tree houses, and/or permanent housing. In addition, the building blocks can have marine applications and/or military application due to their light weight, yet, durable and ballistic nature.

[0013] In one embodiment, the present invention is a building block including a first panel, a second panel opposing the first panel, and a plurality of stringers connecting the first panel and the second panel, wherein the first panel, the second panel, and the plurality of stringers are configured to switch between a compact position and an expanded position.

[0014] In another embodiment, the present invention is a building including a plurality of building blocks, each of the building blocks including, a first panel, a second panel opposing the first panel, and a plurality of stringers connecting the first panel and the second panel, wherein each of the building blocks is configured to switch between a compact position and an expanded position.

[0015] In yet another embodiment, the present invention is a building kit including a building block in a compact posi-

tion, a roof in a compact position and configured to be connected to the building block, a first mixing material, and a second mixing material, the first mixing material and the second mixing material selected such that a mixture of the first mixing material and the second mixing material forms an expandable foam material which can be placed within the building block.

[0016] In still another embodiment, the present invention is a method for constructing a building including transforming a first building block from a compact position to an expanded position, placing support material in a support material area in the first building block, transforming a second building block from a compact position to an expanded position, and connecting the first building block with the second building block.

[0017] In still yet another embodiment, the present invention is a method for constructing a shed including transforming only a single building block from a compact position to an expanded position, placing support material in a support material area in the building block, transforming a roof from a compact position to an expanded position, and connecting the roof to the single building block.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The exact nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification in conjunction with the accompanying drawings in which like numerals designate like parts through the figures thereof and wherein:

[0019] FIG. **1** is a perspective view of a building according to an embodiment of the present invention;

[0020] FIG. **2** is a side view of an outer panel and inner panel connected by stringers according to an embodiment of the present invention;

[0021] FIG. **3** depicts a portion of an outer panel according to an embodiment of the present invention;

[0022] FIG. **4** is a perspective view of a building including a roof according to an embodiment of the present invention;

[0023] FIG. **5** is a perspective view of a building block in a compact position according to an embodiment of the present invention;

[0024] FIG. **6** is a perspective view of a building block in an intermediate position according to an embodiment of the present invention;

[0025] FIG. **7** is a perspective view of a building block in an intermediate position according to an embodiment of the present invention;

[0026] FIG. **8** is a perspective view of a building block in an expanded position according to an embodiment of the present invention;

[0027] FIG. **9** is a perspective view of a building block according to an embodiment of the present invention;

[0028] FIG. **10** is a perspective view of a building block attached to a floor according to an embodiment of the present invention;

[0029] FIG. **11** is a perspective view of a building block partially filed with expanding foam material;

[0030] FIG. **12** is a is a perspective view of a building block filled with expanding foam material;

[0031] FIG. **13** is a building according to an embodiment of the present invention;

[0032] FIG. **14** depicts a snap together connection of two outer panels of two building blocks according to an embodiment of the present invention;

[0033] FIG. **15** depicts a snap together connection of two outer panels of two building blocks according to an embodiment of the present invention;

[0034] FIG. **16** depicts a snap together connection of two outer panels of two building blocks according to an embodiment of the present invention;

[0035] FIG. **17** is an interlocking building unit according to an embodiment of the present invention;

[0036] FIG. **18** is a column unit according to an embodiment of the present invention;

[0037] FIG. **19** depicts interlocking building units connected to each other according to an embodiment of the present invention;

[0038] FIG. **20** depicts a building block formed by interlocking building units according to an embodiment of the present invention;

[0039] FIG. **21** depicts a folding section in a compact position according to an embodiment of the present invention;

[0040] FIG. **22** depicts a folding section in an expanded position according to an embodiment of the present invention;

[0041] FIG. **23** depicts a folding section according to an embodiment of the present invention;

[0042] FIG. **24** depicts a folding section between an expanded position and a compact position according to an embodiment of the present invention;

[0043] FIG. **25** depicts a folding section in a substantially compact position according to an embodiment of the present invention;

[0044] FIG. **26** depicts a folding section laid out in an open position according to an embodiment of the present invention;

[0045] FIG. **27** depicts a roof according to an embodiment of the present invention;

[0046] FIG. **28** depicts a roof according to an embodiment of the present invention;

[0047] FIG. **29** depicts a roof according to an embodiment of the present invention;

[0048] FIG. **30** depicts a roof according to an embodiment of the present invention;

[0049] FIG. **31** depicts a building according to an embodiment of the present invention;

[0050] FIG. **32** depicts a building block according to an embodiment of the present invention;

[0051] FIG. **33** depicts roof anchors according to an embodiment of the present invention;

[0052] FIG. **34** depicts a building including inserts according to an embodiment of the present invention;

[0053] FIG. **35** depicts a building including drains according to an embodiment of the present invention;

[0054] FIG. **36** depicts a process according to an embodiment of the present invention;

[0055] FIG. **37** depicts a process according to an embodiment of the present invention; and

[0056] FIG. **38** depicts an outer panel of a building block according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0057] Reference will now be made in detail to the preferred embodiments of the invention which set forth the best modes contemplated to carry out the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not

intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, molding procedures have not been described in detail as not to unnecessarily obscure aspects of the present invention.

[0058] In one embodiment, the present invention includes a building **100** as seen, for example, in FIG. **1**. The building can be, for example, a house, a shed, a tree house, a storage unit, a geodesic dome, and/or any other type of structure which requires a relatively short build time. Thus, the building **100** can be easily built to provide, for example, housing for relief workers or displaced persons in disaster areas. The building **100** can also be, for example, easily built as a shed for personal use in a backyard. The building **100** can also be, for example, easily used as a tree house for children and/or adults.

[0059] The building **100** can be constructed from, for example, a building block **116**. The building block **116** can be formed from an outer panel **102**, and an inner panel **104**. The outer panel **102** can oppose the inner panel **104**. However, the outer panel **102** and the inner panel **104** need not be parallel with each other, but instead can merely just face each other. A plurality of outer panel **102** and a plurality of inner panel **104** can form, for example, an outer shell **172** and an inner shell **174**. The outer panel **102** and the inner panel **104** can be formed, for example, from plastic, polyurethane, polycarbonate, cardboard, UV resistant material, anti-microbial material, or any other type of lightweight, yet durable material. In one embodiment, the outer panel **102** and/or the inner panel **104** can be treated to make them UV-resistant, anti-microbial, water-resistant, water-proof, sound-resistant, and/or sound-proof. In addition, the outer panel **102**, and/or the inner panel **104** can be treated with fire-resistant material. The inner shell **174** can define, for example, a usable area **120**. The usable area **120** can be habitable and/or able to store materials. Thus, the usable area **120** can provide a space for one or more person to sleep in the usable area **120** or leave materials in the usable area **120**.

[0060] The outer panel **102** and the inner panel **104** are connected by a plurality of stringers **108**. The outer panel **102**, the inner panel **104**, and the stringers **108** define a support material area **106**. The support material area **106** can be filled, for example, with support material **110**. The support material **110** can provide, for example, support for the building **100**. The support material can be, for example, expanding foam material, sand, dirt, rocks, sawdust, wood, straw, hay bales, rubble from destroyed buildings in disaster areas, other natural resources which may be abundant or easily usable at a location of the building **100**, and/or any combination of the above. In one embodiment, the natural material can be, for example, fire resistant, or develop to be fire resistant. For example, hay bales can be mineralized with nitrogen, which is fire resistant and is a good insulator.

[0061] Since the support material can be easily formed, such as in the case of the expanding foam material, or is constructed from abundant material, such as in the case of the natural resources, the building **100** can be built in a relatively inexpensive manner without costly materials and little effort. The support material area **106** can have a width, for example, of 8 inches or more. However, the width can be reduced or increased depending on the type of support material **110** used and/or the type of material used for the outer panel **102** and/or the inner panel **104**. Furthermore, the width can be reduced or increased depending on the type of uses for the building **100**.

[0062] The outer panel **102** and the inner panel **104** connected by stringers **108** can be seen, for example in FIG. **2**. As seen in FIG. **2**, the stringers **108** span the support material area **106**. The stringers **108** provide support for the support material **110**. In addition, the number of stringers **108** provided can be large enough such that failures of some of the stringers **108** will not substantially compromise the integrity of the building **100**. The stringers **108** can be formed, for example, from dowels, plastic rods, twisted wires, a plurality of strong filaments or strips, zip ties, Kevlar® wires, kite strings, baling wires, nylon cords, metal piping, and/or other material suitable for supporting the support material **110**.

[0063] In one embodiment, the stringers **108** can include a stringing unit **162** and loops **164** at the end of the stringing unit **162**. The stringing unit **162** traverses the support material area **106**. The loops **164** are formed outside of the support material area **106**. The loops **164** can be connected to the outer panel **102** and/or the inner panel **104** by placing a wire **166** through the loops **164**. This can be seen, for example, in FIG. **3** with the wire **166** running through the loops **164** along a side view of the outer panel **102**. The wire **166** can be, for example, located on an inside or outside side of the outer panel **102**.

[0064] Instead of using the wire **166**, dowels, rods, or any other type of material can be used. In addition instead of using the wire **166** or the loops **164**, the stringers **108** can be connected to the outer panel **102** and/or the inner panel **104** by being sewn onto the outer panel **102** and/or the inner panel **104**, using a Chicago screw, or any other type of suitable method.

[0065] Referring back to FIG. **2**, the inner panel **104** can also optionally have a ballistic material **168** adhered to the inner panel **104** and/or the outer panel **102**. The ballistic material **168** can be, for example, an Aramid fabric layer, Kevlar® layer, E-glass, ceramic material, and or any other type of ballistic material which have ballistic properties. The ballistic material **168** can provided, for example, penetration protection to the building **100**. In addition, should the building **100** suffer an explosion, the ballistic material can reduce the likelihood of damaging shrapnel emanating from the building **100**.

[0066] Referring back to FIG. **1**, conduits **112** can also be formed inside the support material area **106**. The conduits **112** can be used, for example, to drain material from a roof, or provide a location for safe passage of pipes and/or wires. In addition, the conduits **112** can also be used, for example, for venting.

[0067] In one embodiment, the building **100** can include a floor **122** and/or windows **114**. The floor **122** in FIG. **1** is attached to the building block **116** as foldable panels which can be folded into place to form the floor for the building **100**. However, other flooring can be used, such as a wood flooring, a concrete flooring, tarp, flooring made from local materials, or any other type of flooring. In addition, the building **100** can be anchored to the ground using, for example, a foundation anchor attached to the building **100**.

[0068] The windows **114** can be formed, for example, by cutting through the outer panel **102**, the inner panel **104**, and/or the stringers **108** after the supporting material **110** has been deposited into support material area **106**. In the case where the supporting material **110** is expanding foam material, the expanding foam material, will have already set, allow for easy creation of the windows **114**. In one embodiment, the windows **114** can be formed before the supporting material **110** has been deposited into support material **106**. In another embodiment, the windows **114** can be pre-cut and/or pre-formed.

[0069] As seen in FIG. **4**, the building **100** can also include, for example, a roof **118**. In one embodiment, the roof **118** can be attached to the building block **116** as foldable panels which can be folded into place to form the roof of the building **100**. However, other types of roofing can be used, such as roof tiles, wood, branches, and/or any other type of roofs formed from local materials.

[0070] In one embodiment, the building block **116** can be configured to switch between a compact position and/or an expanded position as seen in FIG. **5**, FIG. **6**, FIG. **7**, and/or FIG. **8**. As seen in FIG. **5**, the building block **116** is in a compact position with the outer panel **102** bent at the corners **148** and in a flat position. The inner panel **104** can also be in a flat position and can be located inside the outer panel **102**.

[0071] The building block **116** can also be switched to an expanded position as seen in the intermediate positions FIG. **6** and FIG. **7**. In FIG. **6** and FIG. **7**, the building block **116** is transformed from its flattened position and the outer panel **102**, and/or the inner panel **104** is no longer flat, but instead begins to define the usable area **120**, and/or the support material area **106**. The building block **116** is in the expanded position in FIG. **8**. Although the building block **116** is formed in the shape of a square or rectangle, the expanded position can be, for example, any shape. In one embodiment, the position depicted in FIG. **6** or FIG. **7** could be considered, the expanded position.

[0072] In one embodiment, the building **100** can be formed, by a series of building blocks **116** instead of only a single building block. For example, as seen in FIG. **9**, a building block **116***a* can be first placed on the floor **122** in an expanded position. In FIG. **9**, the building **100** can be attached to a floor **122** formed, for example, from concrete or steel. In the case where the support material **110** is an expanding foam material, the building **100** can be attached to a floor **122** by letting the expanding foam material expand and leak out of the building block **116***a* and form a bond with the floor **122**. In FIG. **9**, the floor **122** is not flaps formed from the building block **116***a*, but instead is a separate item.

[0073] In one embodiment, as shown in FIG. **10**, the building block **116***a* can be attached to the floor **122** through a base plate **168**. The base plate **168** can include a receiving area **164** for receiving the building block **116***a*. The base plate **168** can be attached to the floor **122** prior to receiving the building block **116***a*. After receiving the building block **116***a*, the base plate **168** can be attached to the building block **116***a* using connecting units **166**. Connecting units **116** can be, for example, studs, screws, fasteners, nails, or any other types of devices which can connect two devices together.

[0074] Referring back to FIG. **9**, the support material **110** is an expanding foam material **124**. To form the expanding foam material **124**, a first mixing material **150** is added with a second mixing material **152** in a bucket **128**. The resulting expanding foam material **124** is poured onto the support material area **106** as seen, for example in FIG. **11** and FIG. **12**. The expanding foam material **124** begins expanding and substantially completes its expansion before it substantially sets, as seen in FIG. **12**. For example, the foam material **124** can substantially complete rising before it substantially sets. This can reduce, for example, an amount of pressure exerted on the outer panel **102** and/or the inner panel **104** and reduce an amount of bulging on the outer panel **102** and/or the inner panel **104**. Excess expanding foam material **132**, or expanding foam material **124** that spills out of the building block **116** can be removed as seen in the portion **134** through sawing or other removal methods. In one embodiment, the expanding foam material **124** can be a slow setting type of foam which can take, for example, 5 minutes or more to set. The quickness of the set time may not be critical since a set time which is longer than normal will generally still be faster than constructing a building **100** using conventional methods. In one embodiment, one inch of expanding foam material **124** when initially prepared through mixing the first mixing material **150** and the second mixing material **152** can generate between a 20 inch to 30 inch expanding foam material **124** when the expanding foam material **124** has finished expanding and has set. However, in another embodiment, one inch of expanding foam material **124** can generate any amount of expanding foam material such as less than 20 inches of expanding foam material **124** or more than 30 inches of expanding of foam material **124** such that it can provide adequate material for the building **100**.

[0075] Once the building block **116***a* has its expanding foam material **124** set and any excess expanding foam material **132** removed, building block **116***b* can be placed on top of the building block **116***a*. The process for placing expanding foam material in the building block **116***a* can be repeated for the building block **116***b*. In one embodiment, to secure the building block **116***a* to the building block **116***a*, ribs **156***a*, **156***b*, **158***a*, and **158***b* can be used as shown in FIG. **14**, FIG. **15**, and FIG. **16**.

[0076] FIG. **14** depicts a cross-section of an outer panel **102***a* for the building block **116***a* and an outer panel **102***b* for the building block **116***b*, which can be snapped together. The outer panel **102***a* and the outer panel **102***b* can be, for example, an approximately 0.5 inch twin-wall sheet stock that is formed from plastic. Although the outer panel **102***a* and/or the outer panel **102***b* are depicted, the inner panels can be used in the same manner. The outer panel **102***a* includes, for example, the rib **156***a*, the rib **158***a*, an inner side **160***a* and an outer side **161***a*, while the outer panel **102***b* includes, for example, the rib **156***b*, the rib **158***b*, an inner side **160***b* and an outer side **161***b*. The rib **156***a* and the rib **156***b* are shorter than the rib **158***a* and the rib **158***b*, respectively. The rib **156***a* and the rib **156***b* do not extend all the way across the outer panels **102***a* and **102***b*, and instead is connected only on one end to the outer panels **102***a* and **102***b*. For example, the rib **158***a* extends across the inner side **160***a* and the outer side **161***a*, while the rib **158***b* extends across the inner side **160***b* and the outer side **161***b*. However, the rib **156***a* does not extend across the inner side **160***a* and the outer side **161***a*, and the rib **156***b* does not extend across the inner side **160***b* and the outer side **161***b*. The outer panel **102***a* and the outer panel **102***b* can be placed together as indicated by the arrow **164**.

[0077] As seen in FIG. **15**, the rib **156***a* and the rib **156***b* bend as they touch and force is exerted on them. As seen in FIG. **16**, eventually the rib **156***a* and the rib **156***b* slide past each other, forming a lock to couple the outer panel **102***a* to

the outer panel **102***b*. Even if the outer panel **102***b* was lifted straight up, the rib **156***a* and the rib **156***b* would contact each other and provide resistance for such a movement. This reduces the likelihood that outer panels **102***a* and/or **102***b* will be dislodged from each other. Furthermore, the outer panel **102***b* now rests on the rib **158***a*, while the rib **158***b* prevents the outer panel **102***a* from sliding past the rib **158***b*. The use of the ribs **156***a*, **156***b*, **158***a*, and **158***b* can provide an effective and low-cost option for connecting the outer panel **102***a* to the outer panel **102***b*, and the building block **116***a* to the building block **116***b*. The same principles can be applied, for example, to the inner panels **104** for the building block **116***a* and the building block **116***b*.

[0078] Referring back to FIG. **13**, once the building block **116***b* is attached to the building block **116***a*, the building block **116***c* can be attached to the building block **116***b*. The roof **118** can then be attached to the building block **116***c*. In one embodiment, the building block **116***c* does not have a uniform height, but instead is slanted to allow the roof **118** to be slanted. The roof **118** can include, for example, a base unit **128**, and a cover **130**. The cover **130** can be overlayed on top of the base unit **128**.

[0079] In one embodiment, the building **100** includes a window **114** and a door **126**. The window **114** can be directly cut through the building blocks **116***b*. In addition, the window **114** can also include, for example, a clear plastic or glass. Likewise, the door **126** can be formed by cutting through the building blocks **116***a*, **116***b*, and/or **116***c*. However, a portion of the outer block **102** and/or the inner block **104** for the building blocks **116***a*, **116***b*, and/or **116***c* can remain uncut in order to provide a hinge for the door **126**.

[0080] In one embodiment, the building block **116** can be formed, for example, from one or more interlocking building units **174** as seen in FIG. **17** and one or more column units **176** as seen in FIG. **18**. Each of the interlocking buildings units **174** can have an interlocking section **170** and an interlocking section **172**. The interlocking section **170** of one interlocking building unit **174** can mate with the interlocking section **172** of another interlocking building unit **174**. For example, as seen in FIG. **19**, the interlocking building unit **174***a* includes interlocking sections **170***a* and **172***a*, while the interlocking building unit **174***b* includes interlocking sections **170***b* and **172***b*. The interlocking building unit **174***a* can be connected to the interlocking building unit **174***b* by connecting the interlocking section **172***a* and the interlocking section **170***b* together.

[0081] The column unit **176** can be inserted between the interlocking building unit **174***a* and the interlocking building unit **174***b* in the area occupied jointly by the interlocking sections **172***a* and **170***b*. This prevents, for example, the interlocking sections **172***a* and **170***b* from becoming separated and substantially locks them in place. As seen in FIG. **20**, the process can be repeated to form the building block **116**, which can hold, for example, support material.

[0082] In one embodiment, the outer panel **102** can be physically bonded to the expanding foam material **124** as shown in FIG. **38**. As seen in FIG. **38**, the outer panel **102** can be, for example, a 0.5 inch twin-wall sheet stock. The outer panel **102** can include an inner side **160** and an outer side **161**, and a plurality of ribs **158**. The plurality of ribs **158**, the inner side **160**, and the outer side **161** define a plurality of hollow sections **182**. The inner side **160** defines a plurality of holes **180**, which allow the expanding foam material to enter the hollow sections **182**. By entering the hollow sections **182**, the expanding foam material **124** forms a physical bond with the outer panel **102**. This can allow, for example, the expanding foam material **124** to be secured to the outer panel **102**. The principles depicted in FIG. **38** can be applied, for example, to the inner panel **104** to form a physical bond between the expanding foam material **124** and the inner panel **104**.

[0083] In one embodiment, the outer panel **102**, the inner panel **104**, the roof **118**, and/or the floor **122** can be formed, for example, from a folding section **136** as seen in FIG. **21** and FIG. **22**. As seen in FIG. **21**, the folding section **136** can be folded into a compact position, while in FIG. **22**, the folding section **136** can be switched into an expanded position. By placing the folding section **136** in the compact position, it can be easily transported allowing for more folding sections **136** to be placed in a small area. However, when the folding section **136** is ready to be used as an outer panel **102**, inner panel **104**, roof **118**, and/or floor **122**, it can be switched to the expanded position. The folding section **136** can be sewn or joined together with stringers.

[0084] In one embodiment, the outer panel **102**, the inner panel **104**, the roof **118**, and/or the floor **122** can be formed, for example, from a folding section **138** as seen in FIG. **23**, FIG. **24**, FIG. **25**, and/or FIG. **26**. As seen in FIG. **23**, the folding section **138** can be a variety of different shapes, such as a pentagon. As seen in FIG. **24** and FIG. **25**, the folding shape **138** can also be moved from a compact position to an open position and/or stored in a compact position by being folded. As seen in FIG. **26**, the folding shape **138** can be laid out in an expanded position as shown in FIG. **26**. In such a case, the folding shape **138** can be desirable as the roof **118**.

[0085] The roof **118** can also be a variety of shapes as shown in FIG. **27**, FIG. **28**, FIG. **29**, and/or FIG. **30**. The roof **118** can be designed, such that it can still be folded and stored in a compact position or switched to an expanded position when it is ready to be used. This can allow larger roofs to be implemented, even through the use of a standard 8 feet shipping container. Furthermore, the unconventional shapes can allow for greater overhang of the roof **118** in the building **100** as shown in FIG. **31**. The overhang can allow water or other material to be drained away at a distance from the building block **116**. This can reduce a likelihood of damage to the building block **116** and/or the building **100**.

[0086] In one embodiment, the building block **116** can be expanded into a variety of shapes in the expanded position as shown in FIG. **32**. For example, the building block **116** can be expanded into a figure-8. However, the building block **116** can also be expanded into other shapes, such as triangle, octagon, circle, or any other type of shapes that are suitable for a building.

[0087] In one embodiment, the roof **118** can be secured to the building block by using roof anchors **142** as shown in FIG. **33**. The roof anchors **142** can be punched through the roof **118** and/or be aligned with a hole in the roof **118**. The roof anchors **142** can include, for example, a threaded portion **178**, which can then be mated with a threaded nut **176** to secure the roof **118** between the threaded nut **176** and the building block **116**. In one embodiment, the roof **118** can be engaged to the building block **116** before, or after support material **110** and/or expanding foam material **124** has been placed in the roof **118**.

[0088] In one embodiment, the roof **118** need not be formed to be flush with the building block **116** as shown in FIG. **34**. Instead, the roof **118** can be, for example, accordion shaped. Inserts **144** can be used in conjunction with the roof **118** and

the building block to fill in the gaps between the roof **118** and the building block **116**. Thus, the roof **118** can be slanted, pitched, irregular, and/or have a variety of sizes and shapes with the use of the inserts **144** to reduce the gaps between the roof **118** and the building block **116**. The inserts **144** can be of a variety of sizes and shapes to fill in the gap between the roof **118** and the building block **116**.

[0089] In one embodiment, the roof **118** can include drains **146** to aid in draining the rainwater on the roof **118** as shown in FIG. **35**. The drains **146** can align, for example, with a conduit **112** (FIG. **1**). The drains **146** and/or the conduit **112** can be inside the building **116**, between the outer panel **102** and the inner panel **104**, and/or outside the building **116**. The drains **146** and/or the conduit **112** can be formed, for example, from polypropylene or any other mildew or rot resistant material.

[0090] In one embodiment, the present invention is a process as shown in FIG. **36**. In Step **3602**, a first building block is transformed from a compact position to an expanded position. For example, the building block **116***a* can be transformed from a compact position to an expanded position. (FIG. **13**) In Step **3604**, support material is placed in the first building block. For example, supporting material **110**, or expanding foam material **124** can be placed in the support material area **116***a*. In Step **3606**, a second building block is transformed from a compact position to an expanded position. For example, the building block **116***b* is transformed from a compact position to an expanded position. (FIG. **13**) In Step **3608**, the first building block is connected with the second building block. For example, the building block **116***a* can be connected to the building block **116***b*. (FIG. **13**)

[0091] In another embodiment, the present invention is a process according to FIG. **37**. In Step **3702**, only a single building block is transformed from a compact position to an expanded position. For example, a building block **116** can be transformed from a compact position to an expanded position. (FIG. **1**) In Step **3704**, support material is placed in the building block. For example, the support material **110** can be placed in the building block **116**. In Step **3706**, a roof can be transformed from a compact position to an expanded position. For example, the roof **118** can be transformed from a compact position to an expanded position. (FIG. **4**) In Step **3708** the roof is connected to the single building block. For example, the roof **118** can be connected to the building block **116**. (FIG. **4**)

[0092] In another embodiment, the present invention can be, for example, a building kit. The building kit can include, for example, only a single building block **116**, a roof **118**, a first mixing material **150**, and/or a second mixing material **152**. The single building block **116** and/or the roof **118** can be packaged in a compact position. This can, for example, reduce transportation costs and/or storage costs for the building kit. Furthermore, the first mixing material **150** and/or the second mixing material **152** can be stored in substantially flat tubes to also reduce transportation costs and/or storage costs. Thus, the building kit can therefore be a low-cost and easy solution for a user who wishes to build, for example, a small structure. The compact size of the building kit can reduce transportation and/or storage costs which can reduce overhead costs for a merchant selling the building kit. Part of the reduction in overhead costs can be passed onto the consumer so that the consumer can also partake in such savings. In addition, the consumer will also enjoy savings in other manners since the building kit can reduce an amount of time and resources that it takes to build a building.

[0093] In addition, the building block **116** can also be used for other applications, such as for maritime uses, road barriers, security barriers, insulation uses, ballistic uses, and/or any other type of uses which can be suitable for the properties of the building block **116**. The maritime uses can be, for example boat hulls, docks, or any other type of marine applications. Due to the ballistic properties of the building block **116**, the building block **116** can also have military uses, such as for ammunition sheds, or any buildings which may be exposed to explosions. In addition, the building blocks **116** can be used, for example, to provide armor for a vehicle.

[0094] In another embodiment, the building **100** also be easily deconstructed to allow for the building **100** to be reused at another site. In the case that the support material **110** is the expanding foam material, a dissolving compound can be poured over the expanding foam material **124** to dissolve the expanding foam material **124**.

[0095] The previous description of the disclosed examples is provided to enable any person of ordinary skill in the art to make or use the disclosed methods and apparatus. Various modifications to these examples will be readily apparent to those skilled in the art, and the principles defined herein may be applied to other examples without departing from the spirit or scope of the disclosed method and apparatus. The described embodiments are to be considered in all respects only as illustrative and not restrictive and the scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope

We claim:

1. A building block comprising:
a first panel;
a second panel opposing the first panel; and
a plurality of stringers connecting the first panel and the second panel, wherein the first panel, the second panel, and the plurality of stringers are configured to switch between a compact position and an expanded position.

2. The building block of claim **1** wherein the first panel, the second panel, and the plurality of stringers define a support material area.

3. The building block of claim **2** wherein the support material area is configured to receive a support material.

4. The building block of claim **3** wherein the support material is at least one of an expanding foam material, cement, organic material, rubble, earth, adobe, or plant matter.

5. The building block of claim **4** wherein the support material is an expanding foam material which substantially completes its expansion prior to substantially setting.

6. A building comprising:
a plurality of building blocks, each of the building blocks including:
a first panel;
a second panel opposing the first panel; and
a plurality of stringers connecting the first panel and the second panel, wherein each of the building blocks is configured to switch between a compact position and an expanded position.

7. The building of claim **6** wherein each of the building blocks further includes a plurality of ribs located within the first panel and the second panel.

8. The building of claim **7** wherein the building blocks includes a first building block and a second building block, and the first building block is connected to the second building block by connecting the ribs in the first building block and the ribs in the second building block.

9. The building of claim **6** each of the building blocks is configured to include an expandable foam material.

10. A building kit comprising:

a building block in a compact position;

a first mixing material; and

a second mixing material, the first mixing material and the second mixing material selected such that a mixture of the first mixing material and the second mixing material forms an expandable foam material which can be placed within the building block.

11. The building kit of claim **10** wherein the building block is configured to switch between the compact position and an expanded position, and the expandable foam material is placed within the building block when the building block is in the expanded position.

12. The building kit of claim **10** wherein the building block includes

a first panel,

a second panel opposing the first panel, and

a plurality of stringers connecting the first panel and the second panel.

13. The building kit of claim **10** further comprising a plurality of anchors configured to be attached to the building block.

14. A method for constructing a building comprising:

transforming a first building block from a compact position to an expanded position;

placing support material in a support material area in the first building block;

transforming a second building block from a compact position to an expanded position; and

connecting the first building block with the second building block.

15. The method of claim **13** wherein the support material is an expanding foam material.

16. The method of claim **15** further comprising mixing a first mixing material with a second mixing material to form the expanding foam material.

17. The method of claim **15** further comprising removing excess expanding foam material when the expanding foam material is substantially set.

18. A method for constructing a shed comprising:

transforming only a single building block from a compact position to an expanded position;

placing support material in a support material area in the building block;

transforming a roof from a compact position to an expanded position; and

connecting the roof to the single building block.

19. The method of claim **18** further comprising:

forming a door from the single building block.

20. The method of claim **18** further comprising mixing a first mixing material with a second mixing material to form the support material.

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