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(54) **CONSTRUCTION WEATHER SHIELD AND SHELTER SYSTEM**

(52) **U.S. Cl. .... 52/127.4; 135/115; 135/119**

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(57) **ABSTRACT**

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A weather shield to protect workers and materials in a structure under construction from inclement weather while selectively providing stress relief to the weather shield from high winds in order to prevent damage to the weather shield is disclosed. The weather shield comprises a sheet of substantially flexible, substantially weatherproof material having a closeable opening for wind relief. The sheet protects the structure from inclement weather when the closeable opening is closed. When the closeable opening is open, it allows the passage of wind therethrough thereby tending to avoid wind damage to the weather shield. A temporary shelter for a structure under construction having a plurality of temporary guard rail supports and a weather shield is also disclosed, as well as a temporary shelter kit having a plurality of temporary guard rail supports and a weather shield.

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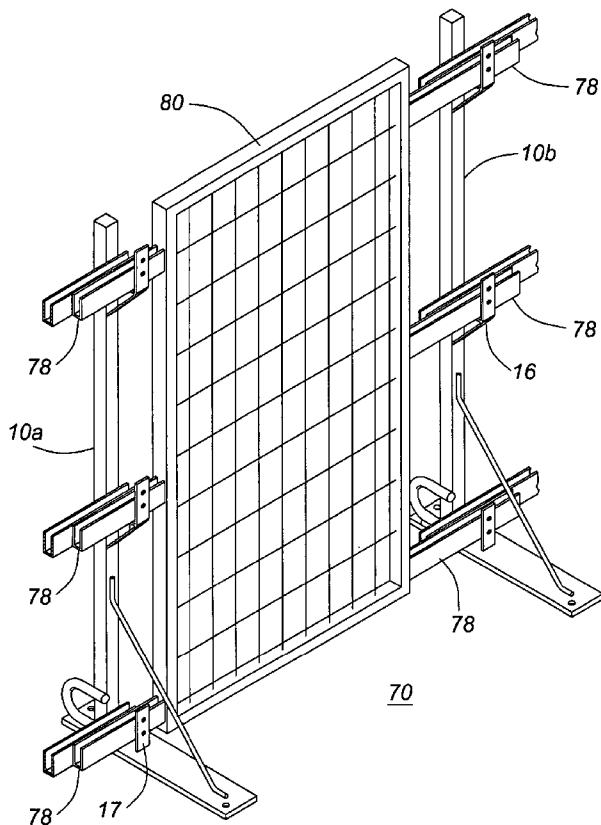
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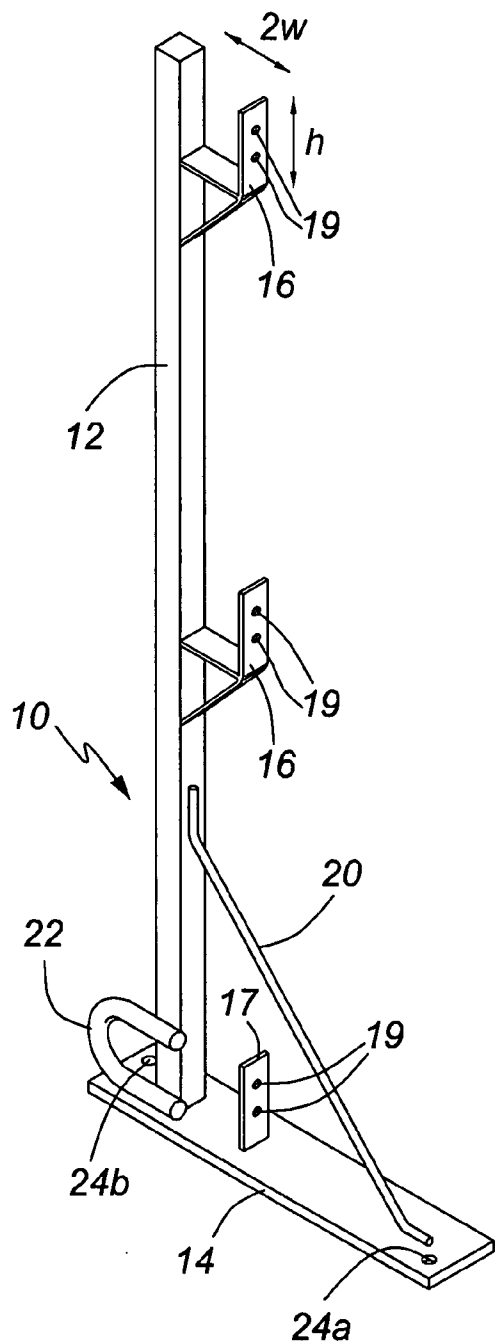
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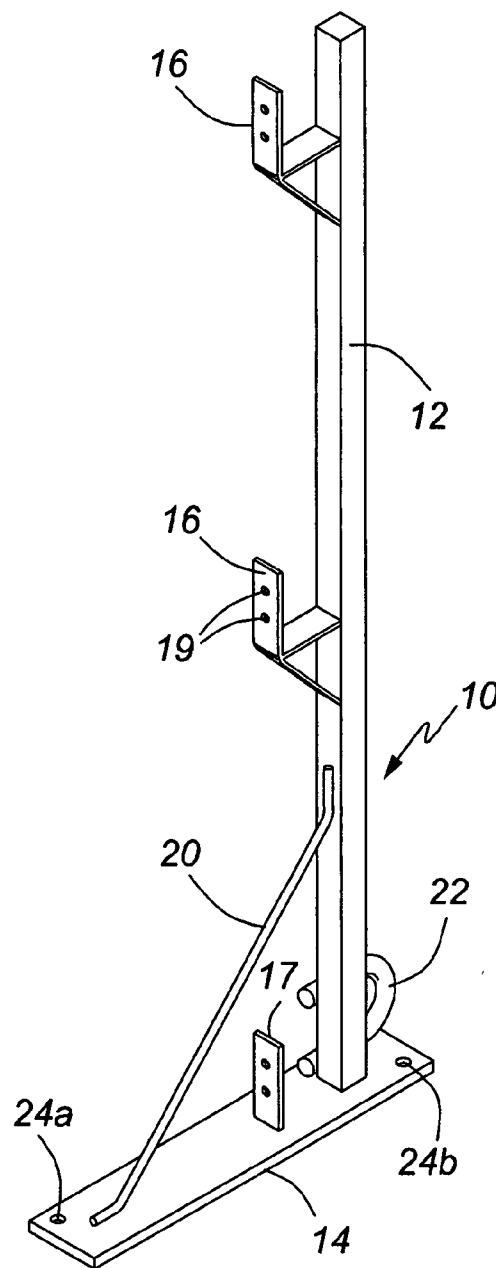
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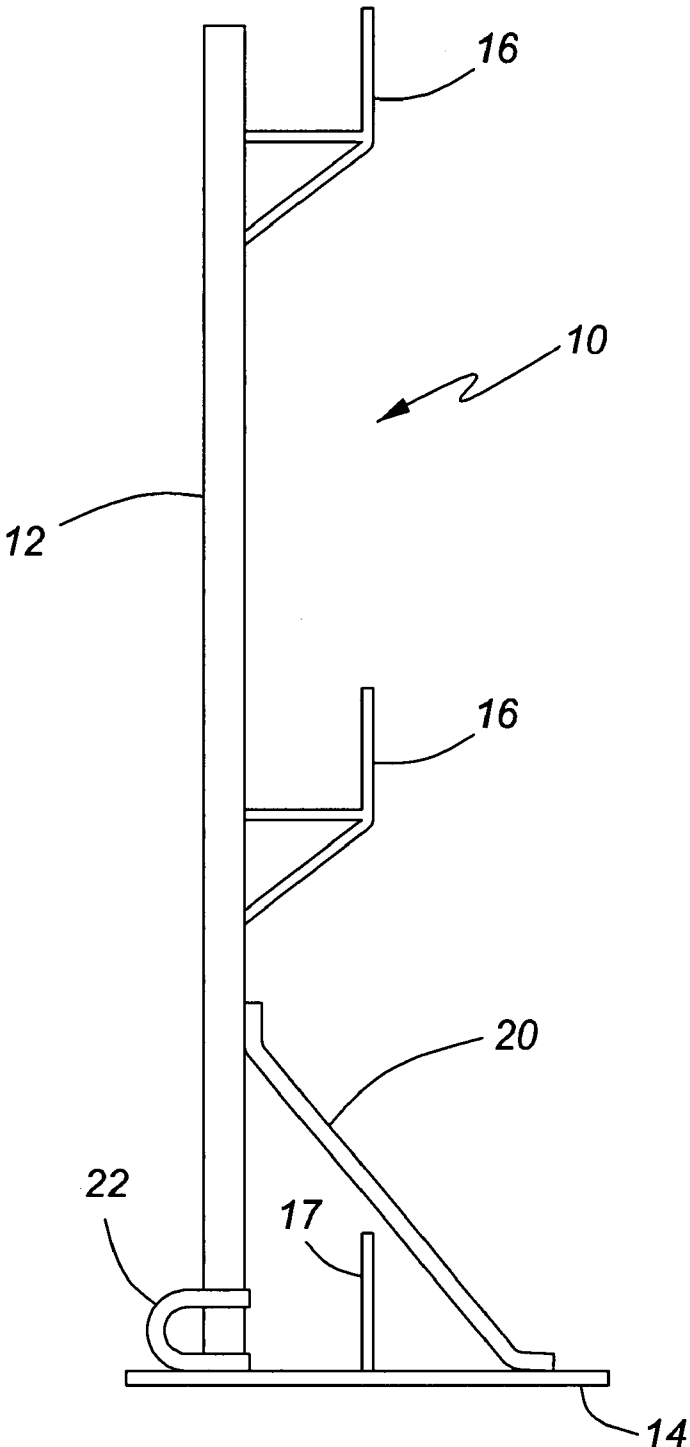




**FIG. 1**



**FIG. 2**



**FIG. 3**

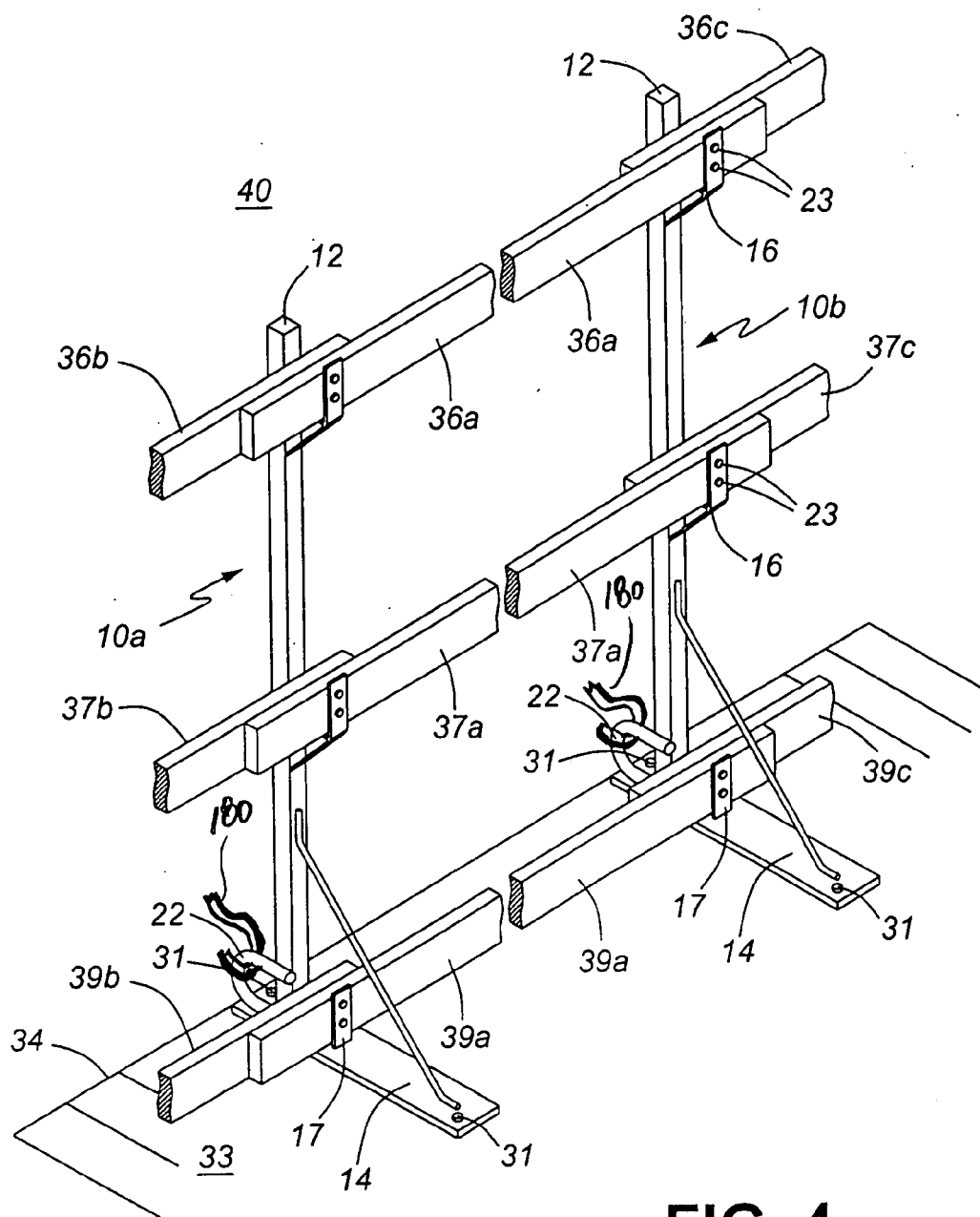
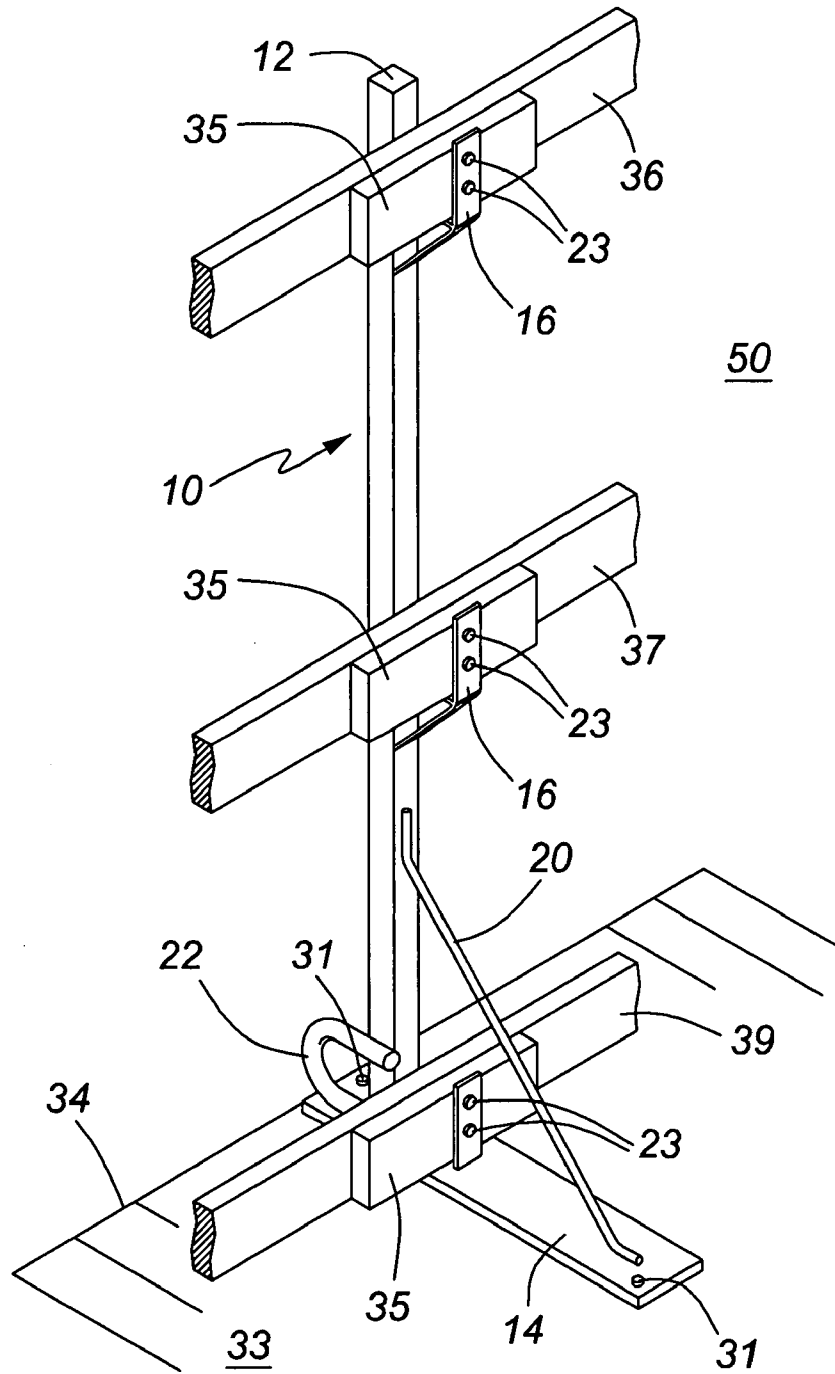
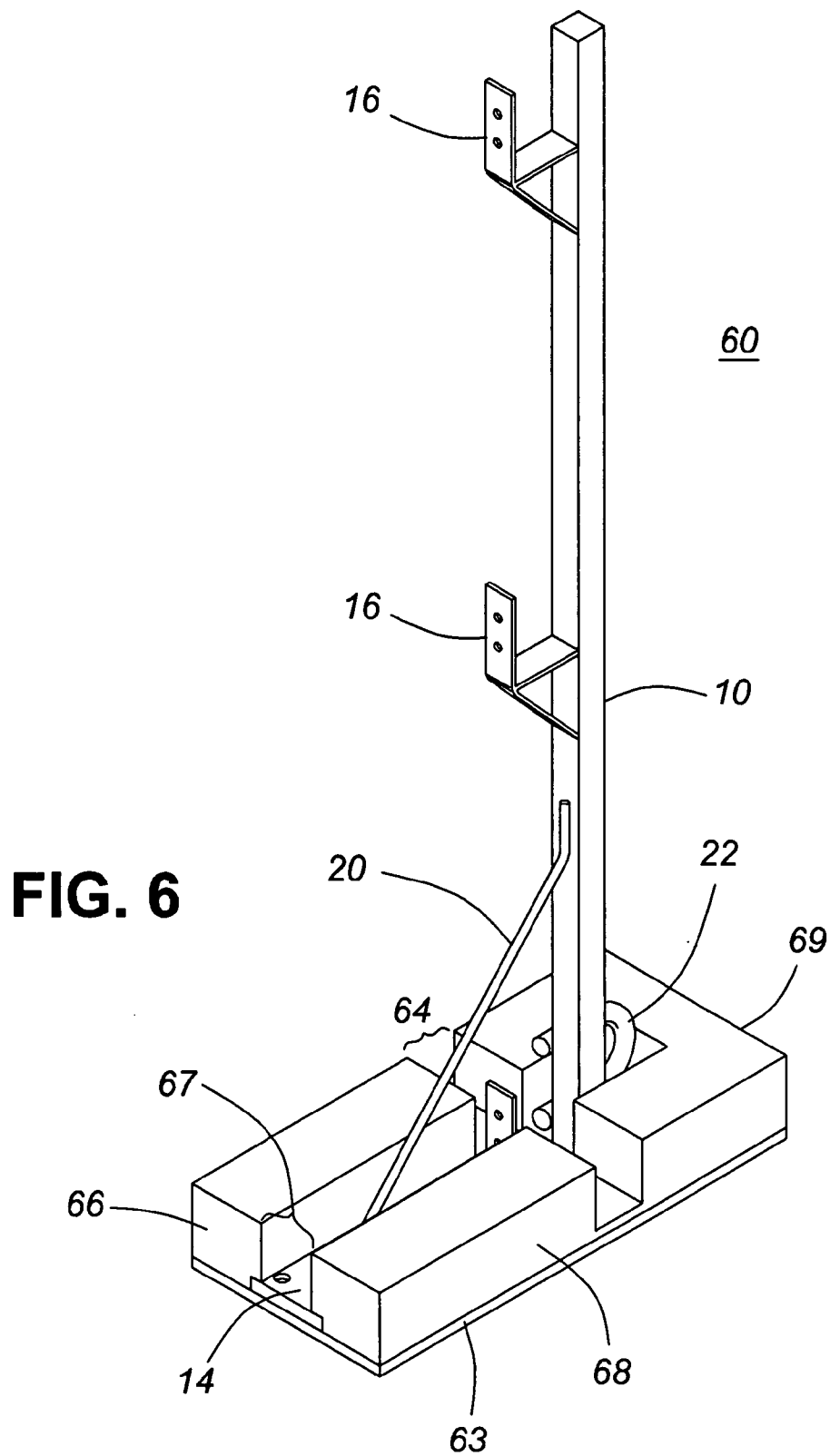
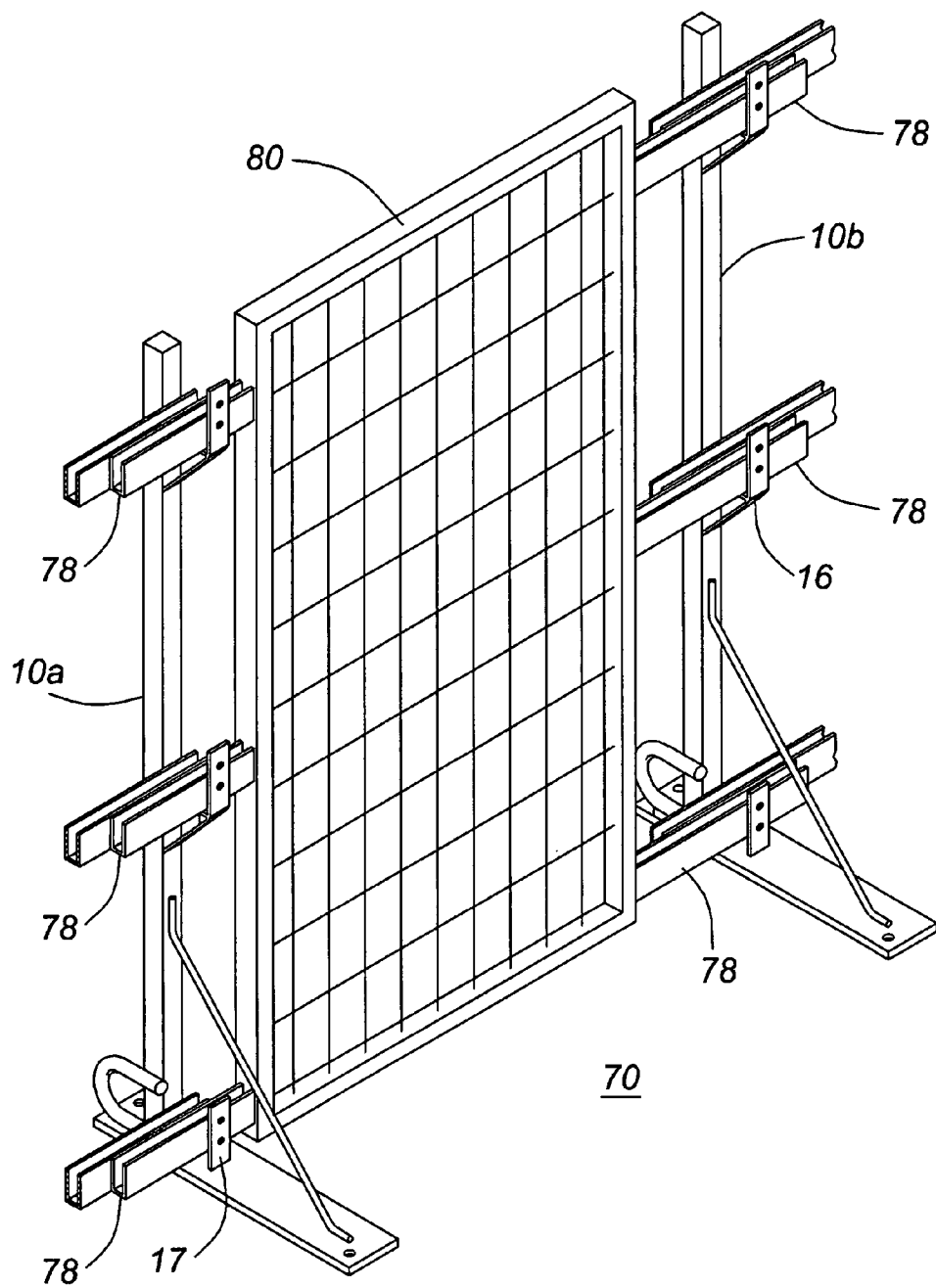


FIG. 4



**FIG. 5**





**FIG. 7**

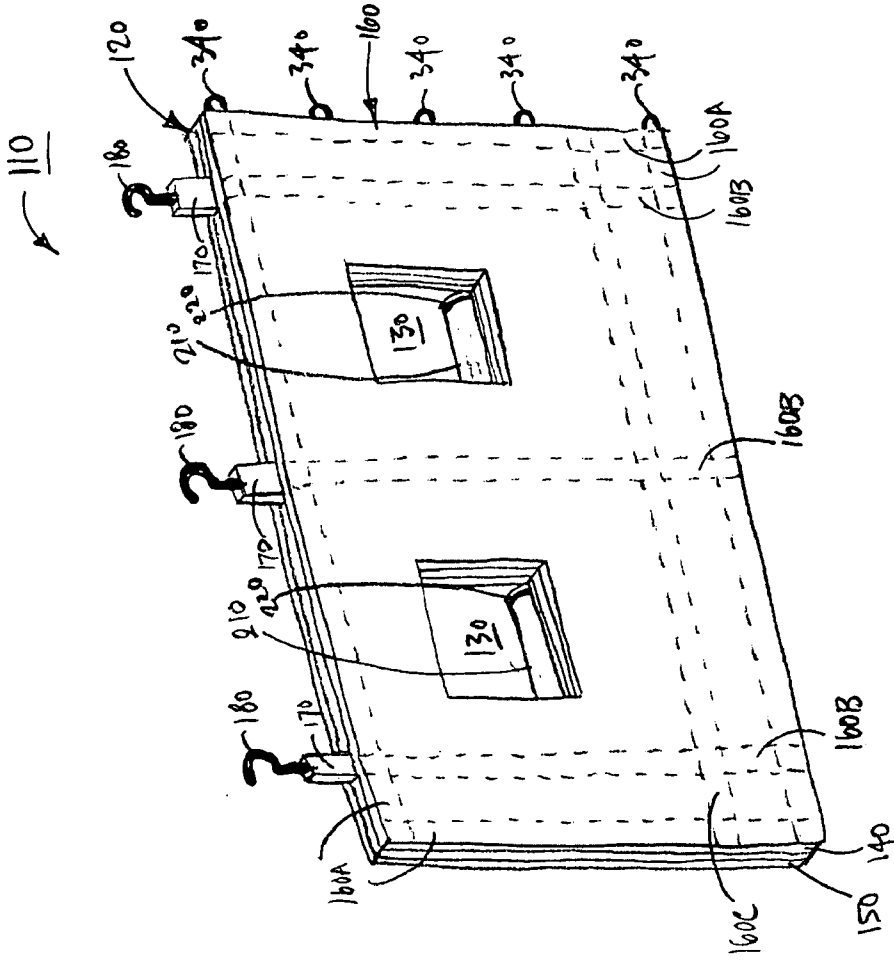


FIG. 8



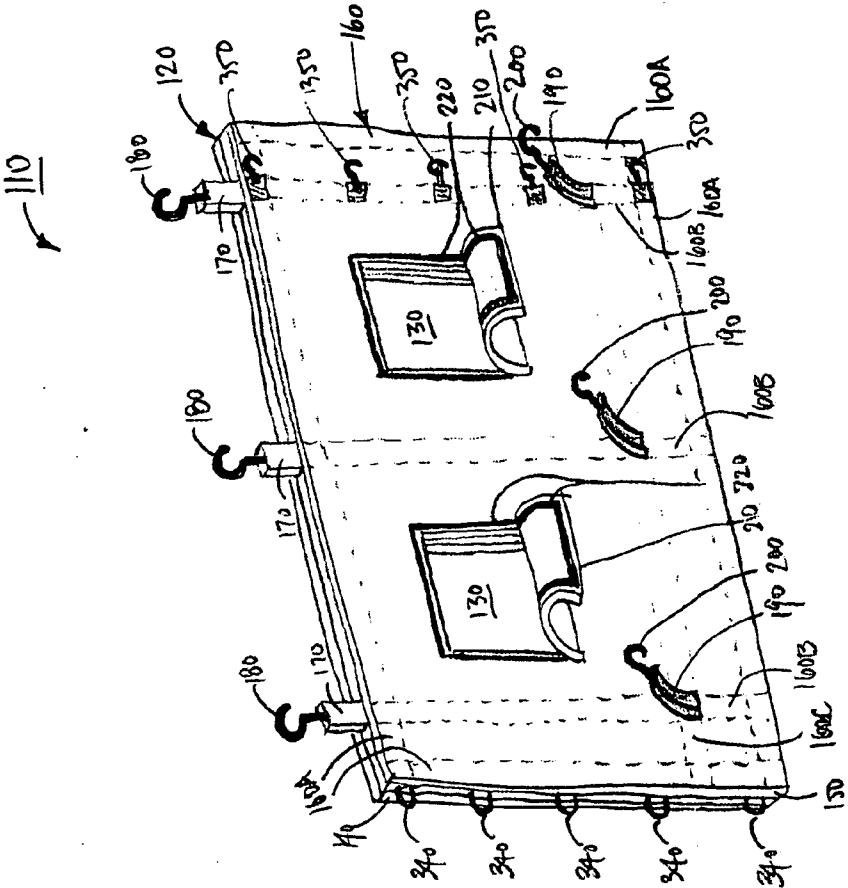


FIG. 9

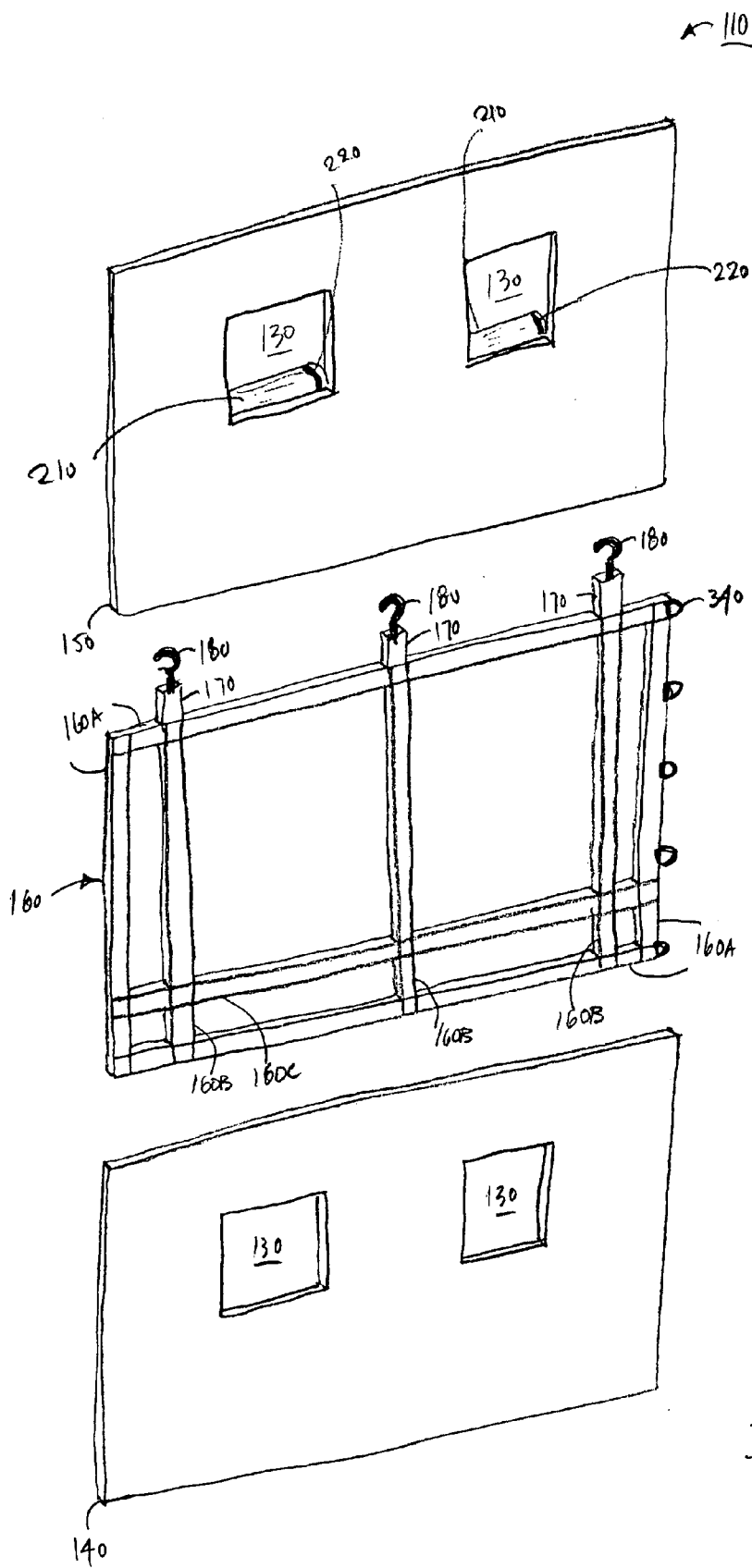


FIG. 10

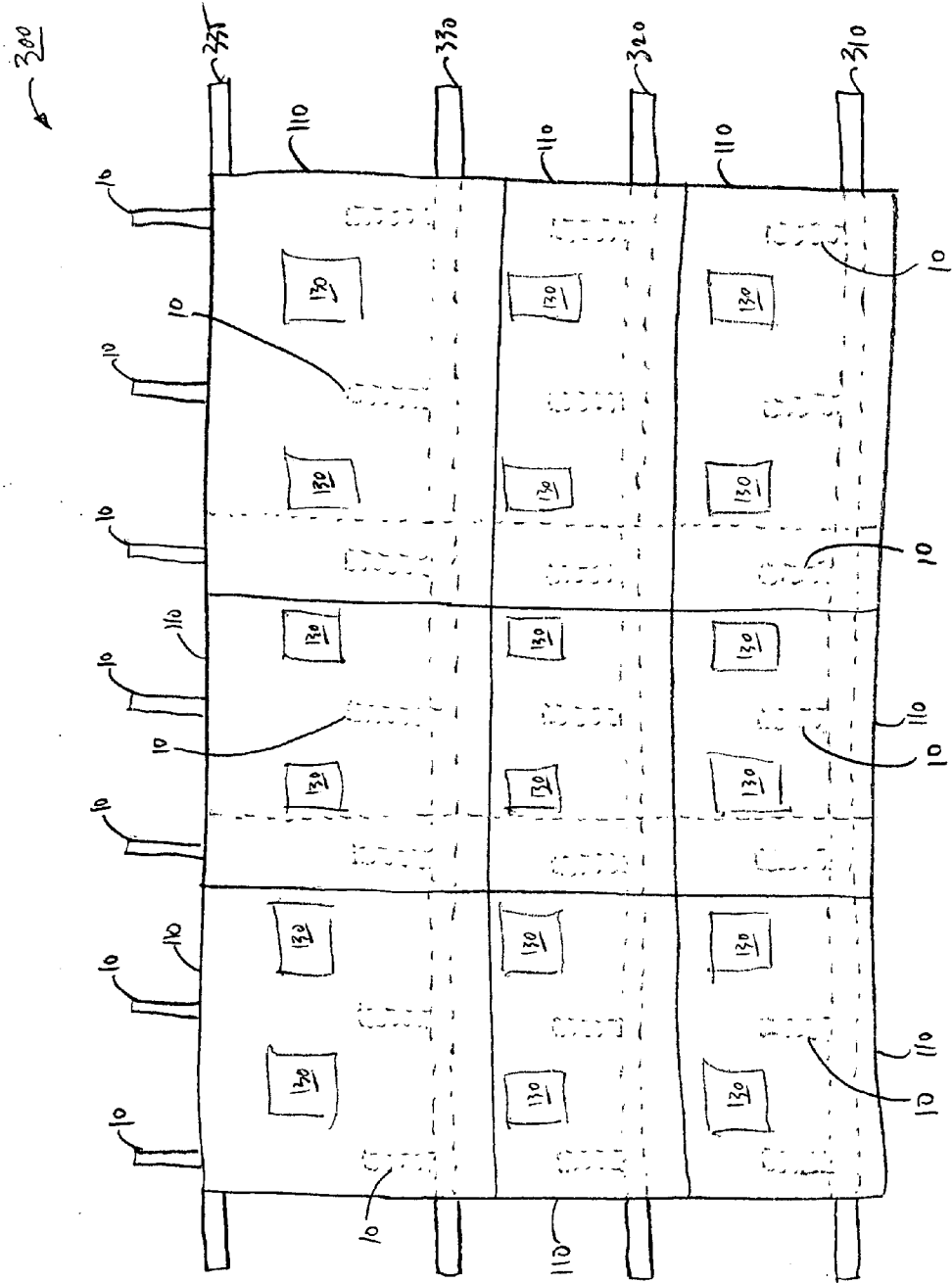


FIG. 11

**CONSTRUCTION WEATHER SHIELD AND SHELTER SYSTEM**

**FIELD OF THE INVENTION**

[0001] The invention relates generally to construction shelters and more particularly to temporary, portable shelters and shields against inclement weather for high-rise building construction.

**BACKGROUND**

[0002] During high-rise building construction, the storeys of buildings are typically open at the sides during at least a part of the construction life cycle exposing construction workers and building materials to a number of hazards including accidental falls and inclement weather conditions. Accordingly, modern high-rise building construction typically employs guard rails to protect the workers and materials from accidental falls, and weather shields to protect the workers and materials from inclement weather.

[0003] The general practice in the erection of guard rails involves the use of lengths of lumber, typically comprising two-by-four boards. Such boards are cut to length and then nailed together in an ad hoc fashion in order to provide the desired guard rails. After the rails have served their purpose, they are typically torn down. While longer boards can often be retained for the erection of future guard rails, shorter boards are usually not reusable. Furthermore, longer boards are frequently split or otherwise damaged due to the application thereto of repeated blows and multiple nail holes. While such makeshift guard rails can meet safety requirements, they frequently do not given their ad hoc construction. Furthermore, their construction often requires more than one person and an excessive amount of time. Additionally, the materials used are often destroyed when the makeshift guard rail is disassembled. Obviously, the additional labour and material costs add to the overall cost of the construction project.

[0004] Consequently, various structures have been proposed to aid in the construction of temporary guard rails which protect workers from accidental falls and which meet strict safety guidelines. Most of the proposed structures are, however, impractical, expensive and overly complicated to use. Furthermore, workers may be reluctant to use a proposed structure if it is overly complicated resulting in the absence of any guard rail thus endangering the workers.

[0005] The general practice of erecting weather shields involves the use of plastic or canvas tarpaulins. The tarpaulins are typically either haphazardly draped over various construction members or are nailed thereto in an ad hoc fashion. Tarpaulins which are draped over construction members are ordinarily vulnerable to displacement by heavy winds and gusts posing a danger to workers and materials. While tarpaulins nailed to the construction members may be effective in enclosing an opening, thereby effectively protecting the enclosed workers and materials from inclement weather, they have a number of disadvantages. Firstly, the repeated installation and removal of such tarpaulins tends to damage and eventually destroy them by the creation of progressively greater numbers of nail holes at the periphery. Furthermore, in strong winds and gusts the tarpaulins tend to behave like sails, catching the wind and transmitting the force thereof to the tarpaulin's mounting points. This tends

to cause tearing of the tarpaulins at the nail holes leading to their eventual destruction. Secondly, installation of the tarpaulins in this fashion is labour-consuming and requires the use of a large number of nails which are generally discarded when the tarpaulins are torn down. Both of these factors tend to increase the overall cost of the construction project.

[0006] A number of proposals have also been made for systems combining the benefits of guard rails with the benefits of weather shields for buildings under construction. However, these proposals typically involve complex mounting brackets or mounting systems requiring the use of additional equipment. Furthermore, the weather shields commonly proposed in these systems are rigid and designed to withstand high wind pressure rather than mitigate the stress caused by high wind pressure on the shields. One weather shield proposed provides small perimeter openings, i.e. grommet holes, for releasing some potentially damaging stress on the shield caused by high wind pressure. Another provides for flexion of the shields to allow to some extent the passage of high winds and, consequently, some wind pressure release at the borders of the shield. None, however, provides a means for selectively mitigating the stress of high wind pressure on the shield. In none of the proposed systems are guard rails proposed for integrated combination with weather shields for easy, quick and inexpensive installation overall, while allowing for selective wind pressure relief to prevent stress damage to the weather shields during high wind conditions.

[0007] Consequently, there is a need for a weather shield for providing temporary shelter from inclement weather to workers and materials in a structure under construction that provides relief from high wind pressure in order to prevent stress damage to the weather shield. Furthermore, there is a need for a system of guard rails and weather shields that is easily, quickly and inexpensively installable and which shields workers and building materials in a structure under construction from both accidental falls and from inclement weather conditions while providing for wind pressure relief during high wind conditions.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] An understanding of the exemplary embodiments will be obtained from the following description, with reference to the following drawings in which:

[0009] FIG. 1 shows a front perspective view of a portable guard rail support in accordance with an aspect of the invention;

[0010] FIG. 2 shows a rear perspective view of the portable guard rail support according to FIG. 1;

[0011] FIG. 3 shows a side view of the portable guard rail support according to FIG. 1;

[0012] FIG. 4 shows a portion of a safety barrier constructed with overlapping wooden guard rails in accordance with an aspect of the present invention;

[0013] FIG. 5 shows a portion of a safety barrier constructed with wooden guard rails in accordance with a further aspect of the present invention;

[0014] FIG. 6 shows a perspective view of a portable guard rail support having a concrete-filled steel base in accordance with an further aspect of the present invention;

[0015] FIG. 7 shows a portion of a safety barrier constructed with a safety mesh in accordance with a further aspect of the present invention;

[0016] FIG. 8 shows a view of the outward-facing side of one embodiment of a weather shield, i.e. the side of the weather shield which faces the outside of the building under construction when mounted to the building;

[0017] FIG. 9 shows a view of the inward-facing side of the weather shield of FIG. 8, i.e. the side of the weather shield which faces the inside of the building under construction when mounted to the building;

[0018] FIG. 10 shows a blown-up view of the weather shield of FIG. 8 to better illustrate its parts;

[0019] FIG. 11 shows a view of the outward-facing side of a partial construction shelter according to one embodiment.

[0020] Where appropriate, the same reference numerals are used in the drawings to indicate like features in all of the drawings.

#### DETAILED DESCRIPTION

[0021] The invention overcomes the deficiencies of the prior art by providing a weather shield for protecting workers and materials in a structure under construction from inclement weather while providing relief from high wind pressure in order to prevent stress damage to the weather shield. The invention further provides a system of guard rails and weather shields that is easily, quickly and inexpensively installable and which shields workers and building materials in a structure under construction from both accidental falls and from inclement weather conditions while providing for selective wind pressure relief to the shield during high wind conditions.

[0022] According to one aspect of the invention, a weather shield for providing temporary protection from inclement weather to a structure is provided. The weather shield comprises a sheet of substantially flexible, substantially weatherproof material having at least one closeable opening for wind relief. The sheet is mountable to the structure and protects the structure from inclement weather when the at least one closeable opening is closed. When the at least one closeable opening is open it allows the passage of wind therethrough thereby tending to avoid wind damage to the weather shield.

[0023] According to a further aspect of the invention, a temporary construction shelter for sheltering a structure under construction from inclement weather is provided. The temporary construction shelter comprises a plurality of temporary guard rail supports mounted to the structure providing a framework of anchors. The temporary construction shelter further comprises a plurality of weather shields attached to the framework of anchors. Each of the plurality of weather shields is attached adjacent at least one other of the plurality of weather shields, whereby the plurality of weather shields together form at least one wall. The at least one wall shelters the structure under construction from inclement weather.

[0024] A weather shield to protect workers and materials in a structure under construction from inclement weather while selectively providing stress relief to the shield from high winds in order to prevent damage to the weather shield

is disclosed herein. A system of guard rails and weather shields that is easily, quickly and inexpensively installable and which shields workers and building materials in a structure under construction from both accidental falls and from inclement weather conditions while selectively providing for wind pressure relief during high wind conditions is also disclosed herein. The guard rails will be described first, followed by the weather shield, followed by the system providing a temporary construction shelter.

[0025] FIGS. 1 and 2 depict front and rear isometric views, respectively, of a guard rail support 10 according to an aspect of the invention. The guard rail support 10 consists of a rectangular upright column 12, the lower end of which is affixed to a substantially flat rectangular metallic base plate 14 in a central symmetric axis thereof. The flat base plate 14 is provided with at least two bores or holes 24a and 24b for receiving suitable fastening means (not shown) in order to anchor or secure the guard rail support 10 to a floor or ground surface (not shown). In one embodiment, the fastening means comprises expansion anchors known to those skilled in the art; however, any suitable fastening means (e.g. screws) may be used. First and second L-shaped rail supporting brackets 16 are affixed one above the other to the upright column 12 as shown to provide supporting means for wooden guard rails (not shown). A retaining flange 17, spaced apart from the upright column 12, is affixed to the baseplate 14 of the guard rail support 10 in order to receive and secure a kick board (not shown) in position. The rail supporting brackets 16 and the retaining flange 17 have bores 19 formed therein for receiving fasteners to secure wooden guard rails within the rail supporting brackets 16 and the retaining flange 17. An angle brace 20 is affixed between the upright column 12 and the base plate 14 in the manner shown to provide for structural stability of the guard rail support 10. Finally, a fall protection (or safety) tie-off ring 22 is affixed to the lower end of the upright column 12 and to the base plate 14.

[0026] The L-shaped rail supporting brackets 16 and retaining flange member 17 are preferably dimensioned to accommodate two adjacent, overlapping wooden rails which may be secured to each other and within the brackets 16 and retaining flange 17 by suitable fastening means such as nailing or the like. In one embodiment, the wooden rails would be comprised of stock lumber such as lengths of two-by-four boards. In this case, the brackets would be dimensioned so as to accommodate two two-by-fours (i.e. a width, 2w, of 4 inches and a height, h, of at least 4 inches). Thus, it may be seen that the rail supporting brackets 16 and retaining flange 17 may be dimensioned in any appropriate manner, 2w×h, to accommodate any size, w×h, of stock lumber desired.

[0027] In order to implement a guard rail assembly (safety barrier) at a construction site according to a first aspect of the invention, a plurality of guard rail supports 10 are located at set distances apart—and preferably slightly less than the length of stock lumber to be used for the guard rails—along the outer edge or perimeter of a floor undergoing construction. The guard rail supports 10 are secured to the floor via suitable fasteners through the bores 24a and 24b formed in the base plate 14 of each guard rail support 10. Lengths of stock lumber (at least spanning the distance between the corresponding rail supporting brackets 16 and retaining flanges 17 of consecutively aligned guard rail

supports 10) may then be positioned and secured within the corresponding rail supporting brackets 16 and retaining flanges 17 of adjacent guard rail supports 10 so as to form a guard rail assembly (safety barrier) consisting of upper and lower wooden guard rails and a kick board. The configuration of such a guard rail assembly is discussed further in relation to FIG. 4.

[0028] As seen in FIGS. 1 and 2, the fall protection tie-off (safety) ring 22 has the preferred shape of a sideways “U” with one end portion affixed to the lower end of the upright column 12 and the other end affixed to the base of the upright column 12 and the flat base plate 14. The fall protection tie-off ring 22 provides for numerous advantages. Firstly, the fall protection tie-off ring 22 may serve as retaining and attachment means for a safety cable which is frequently used by workers at sites undergoing construction. In this respect, a continuous safety cable may be run through the fall protection tie-off rings 22 of consecutively aligned guard rails supports comprising a guard rail assembly (see FIG. 4) constructed in accordance with the present invention. A workman may then “tie off” to such a safety cable at any desired location thereby providing protection from accidental falls. Alternatively, a workman may tie off to the actual fall protection tie-off ring 22 of an individual guard rail support 10, if desired. Secondly, the fall protection tie-off rings 22 of individual guard rail supports 10 comprising a guard rail assembly may be used to fasten improved weather shields according to an aspect of the invention (not shown) to protect workmen and the site under construction from inclement weather conditions.

[0029] FIG. 3 is a side view of the guard rail support 10 in FIGS. 1 and 2 wherein like features are denoted by like numerals.

[0030] FIG. 4 depicts a portion of a guard rail assembly or safety barrier 40 assembled along the perimeter of a floor 33 under construction in accordance with one aspect of the present invention. In FIG. 4, first and second guard rail supports 10a and 10b are located at a set distance d apart and secured along an outer floor edge 34 via expansion anchors 31 driven through the corresponding bores 24a and 24b of each guard rail support 10a and 10b into the floor 33. Upper and lower wooden rails 36a and 37a, (e.g. suitable lengths of two-by-four boards) span at least the distance between corresponding rail supporting brackets 16 on the guard rail supports 10a and 10b. Similarly, kick board 39a spans at least the distance between the retaining flanges 17 on the guard rail supports 10a and 10b. In one embodiment, the distance d between guard rail supports 10a and 10b is slightly less than the lengths of two-by-fours comprising the wooden rails such that the upper and lower wooden rails 36a and 37a and kick board 39a will have some overshoot at each rail supporting bracket 16 or retaining flange 17.

[0031] Considering guard rail support 10a, upper and lower wooden rails 36a and 37a, and kick board 39a are secured with overlapping wooden rails 36b, 37b and 39b, respectively, within the corresponding rail supporting brackets 16 and retaining flange 17 via suitable fasteners 23 placed through bores 19. Suitable fasteners 23 may include nails, screws, rivets or the like. Similarly, upper and lower wooden rails 36a and 37a and kick board 39a are secured with overlapping wooden rails 36c, 37c and 39c, respectively, within the corresponding rail supporting brackets 16

and retaining flange 17 of guard rail support 10b via suitable fasteners 23 placed through corresponding bores 19. As shown, the left end of upper wooden rail 36a overlaps with the right end of upper wooden rail 36b at the uppermost rail supporting bracket 16 of the first guard rail support 10a. Similarly, the right end of upper wooden rail 36a overlaps with the left end of upper wooden rail 36c at the uppermost rail supporting bracket 16 of the second guard rail support 10b. It should be understood that the configuration described above for the upper wooden rails 36 holds for lower wooden rails 37 and kick boards 39. It will further be appreciated that upper wooden rails 36b and 36c, lower wooden rails 37b and 37c and kick boards 39b and 39c span the distance to other respective guard rail supports 10 (not shown) and may be secured within the corresponding rail supporting brackets and retaining flanges of the other guard rail supports 10 in the same manner as described above.

[0032] In cases where it is not desired or possible to use the overlapping wooden rail scheme depicted in FIG. 4, for whatever reason, an alternative configuration may be used at each guard rail support 10 of the present invention to construct a safety barrier 50 as shown in FIG. 5. In this case, a short stub 35 of the same stock lumber used for the wooden guard rails (e.g. two-by-fours) may be used at the rail supporting brackets 16 and retaining flange 17 of each guard rail support 10 in order to firmly secure the upper and lower wooden guard rails 36 and 37 and kickboard 39 in place. As before, at the rail supporting brackets 16 and retaining flange 17 of each guard rail support 10, the upper and lower wooden rails 36 and 37 and kick board 39 may be secured to their corresponding short wooden stubs 35 and to the rail supporting brackets 16 and flanges 17 via suitable fasteners 23 such as nails or the like.

[0033] It will further be appreciated that the safety barrier configuration 50 depicted in FIG. 5 also represents the configuration present at the guard rail supports defining the ends of the safety barrier 40 constructed in accordance with the embodiment of FIG. 4. As can be envisioned, at each guard rail support defining an end of the safety barrier 40, there will be no overlapping wooden rail scheme at the rail supporting brackets 16 and retaining flange 17. Thus, short stubs of stock lumber (preferably of the same type used for the wooden rails) will be needed to firmly secure the wooden rails within their respective brackets and retaining flanges.

[0034] FIG. 6 depicts a guard rail support 60 in accordance with a further aspect of the present invention. Again, like numerals are used to denote like features with the guard rail support 10 of FIGS. 1 and 2. As can be seen, the guard rail support 60 comprises the guard rail support 10 of FIGS. 1 and 2, slidably received within a concrete-filled steel base 68. The steel base 68 provides for greater stability and adequate support in cases where it is not possible, for whatever reason, to secure the base plate 14 of the guard rail support 10 to a floor surface via fasteners (e.g. expansion anchors or screws) placed through holes 24a and 24b. As shown, the concrete-filled steel base 68 is constructed so as to have a groove formed on the bottom surface thereof for slidably receiving the base plate 14 of the guard rail support 10. The groove extends to an open end 66 of the steel base 68 in order to provide means for allowing the guard rail support 10 to slide into the steel base 68. It will be appreciated that the groove terminates before reaching an opposite end 69 of the steel base 68 such that the guard rail support

**10** may only be slidably received within and removed from the steel base **68** at the open end **66**.

[0035] The concrete-filled steel base **68** has a first channel or cavity **67** formed along its central longitudinal axis and dimensioned accordingly to receive angular brace **20**, retaining flange **17** and tie-off ring **22** of the guard rail support **10**. Furthermore, the steel base **68** has a pass-through channel or cavity **64** formed therein proximal the flange **17** and dimensioned to correspond to the distance between the flange **17** and the upright column **12**. The pass-through cavity **64** advantageously provides for pass-through of kick board rails (not shown), as appropriate.

[0036] In the embodiment of FIG. 6, the guard rail support **10** is securely maintained within the concrete-filled steel base **68** due to the precise tongue-groove type of fitting of the base plate **14** within the groove and the weight of the steel base **68**. Advantageously, the substantial weight afforded by the concrete-filled base **68** provides the necessary stability and support to maintain the guard rail support **10** in a fixed and upright position. It will be appreciated that a resilient, non-slip pad **63** may also be fastened by suitable adhesive means to the underside of the concrete-filled steel base **68** to provide a frictional wear resistant non-slip surface for contacting and engaging a floor surface. A plurality of such guard rail supports **60** may then be located along the outer edge of a floor under construction and a safety barrier constructed in the manner shown by either of FIGS. 4 or 5.

[0037] In accordance with a further aspect of the present invention, a mesh-like fence structure may be used in conjunction with any of the guard rail supports **10** or **60** described in relation to FIGS. 1 and 2 or 6 to form a mesh-like (or fence) safety barrier at any desired site under construction. For example, a portion of a fence-like safety barrier **70** constructed in accordance with the present invention is depicted in FIG. 7. Again, like features are denoted by like numerals. As shown, a framed mesh **80** includes three projecting U-beams **78** affixed to opposite vertical sides thereof. The U-beams **78** are preferably made of metal and are supported and secured within the rail supporting brackets **16** and retaining flanges **17** of the guard rail supports **10a** and **10b** in the same overlapping manner as described in relation to FIG. 4. In this case, however, holes corresponding to the holes **19** of the rail supporting brackets **16** and retaining flanges **17** are pre-drilled into each U-beam. In this manner, two overlapping U-beams may be placed within the rail supporting brackets **16** and retaining flanges **17** of each guard rail support **10** and secured with suitable fasteners. Thus, in this particular embodiment, the rail supporting brackets **16** and retaining flange **17** of each guard rail support **10** are dimensioned so as to accommodate two adjacent and overlapping U-beams. It will be appreciated that the mesh-like structure **80** of FIG. 7 need not include three U-beams projecting from each side, as shown. Two projecting U-beams may provide for sufficient stability and support. In this case, a single rail supporting bracket along with the retaining flange would be used, as required.

[0038] The guard rail supports **10** and **60** of the present invention each have two rail supporting brackets **16** affixed to their upright column **12** and a single retaining flange **17** affixed to their base plate **14** for supporting upper and lower wooden rails and kick boards, respectively. Although the retaining flange **17** on each guard rail support is a necessary

requirement for supporting kick boards in accordance with safety standards and regulations, it will be appreciated that the precise number of rail supporting brackets **16** affixed to the upright column **12** of a given guard rail support is not material to the invention. Those skilled in the art will appreciate that construction safety regulations in most jurisdictions require guard rail systems of the type described to have a top rail, an intermediate rail and a toe or kick board as a minimum. Thus, at least two rail supporting brackets (for supporting upper and lower wooden guard rails) and a retaining flange (for supporting the kick board) are provided in the guard rail support of the present invention in order to adhere to safety regulations. However, more than two rail supporting brackets for supporting more than two rails in addition to the kick board may be employed in alternative embodiments without departing from the scope of the invention.

[0039] In addition, it will be appreciated that safety regulations in most jurisdictions require that the top rail of a guard rail barrier be located at least 3 feet but not more than 3.5 feet above the floor or ground surface to which the guard rail barrier is to be anchored while the intermediate rail be midway between the top rail and the floor surface. Thus, in a preferred embodiment of the present invention, the rail supporting brackets **16** are spaced along the upright column **12** of the guard rail support **10** and **60** in such a manner so as to adhere to the above-prescribed safety regulations when fitted with upper and lower rails. In addition, safety regulations generally dictate that the top and intermediate rails be at least 1.5 inches by 3.5 inches in dimension and that the kick board be at least 3.5 inches in height. Advantageously, the rail supporting brackets **16** and retaining flange **17** of the guard rail support **10** and **60** of the present invention are preferably dimensioned so as to accommodate 2"x4" wooden rails, thereby conforming to safety regulations. It will be appreciated, however, that the rail supporting brackets and retaining flange may be dimensioned in any appropriate manner that meets the minimum safety guidelines in the jurisdiction of concern.

[0040] To further comply with safety regulations, it will be appreciated that the spacing between guard rail supports of the present invention when used in the construction of a safety barrier as described should not exceed approximately 8 feet. With regard to safety line anchorage points, most safety regulations specify that the anchorage must be capable of supporting a static load on the order of 17.8 kN (or 4000 lbs) in any direction, with proper provision to accept a safety line connection. Advantageously, the safety tie-off ring **22** of the guard rail support **10** and **60** of the present invention has been tested to support a static load of 5000 lbs.

[0041] A guard rail system constructed with the guard rail support of the present invention provides for easy installation at, and removal from, sites under construction. As will be appreciated, installation may be accomplished by a single worker, if necessary. A first step in the installation procedure is to locate a plurality of supports **10** at spaced intervals up to eight feet long about the perimeter of a ground surface under construction and to attach the baseplate of each support to the ground surface using suitable fasteners or anchors. Once a series of supports according to the present invention are located and secured to the floor of a building under construction, the upper and lower safety rails may be

individually placed and secured within the brackets of adjacent supports in the manner shown in FIG. 4, so that the rails extend completely about the perimeter of a floor under construction. Thus, the assembly of a safety guard rail fence or barrier, together with kick boards may be quickly mounted in place. An advantage of the preferred embodiment is that each support may be attached to the floor of an existing building structure prior to insertion of the wooden rails or safety fences, thereby minimizing weight and bulk so that a single worker may install a guard rail assembly without assistance from another worker. Additionally, once construction is completed, the disassembly of such a guard rail assembly as well as the removal of the guard rail supports, may also be carried out in an efficient manner.

[0042] Advantageously, the guard rail support and associated guard rail assembly of the present invention reduces or eliminates the liability which may result from inadequately re-installed guard rails. Specifically, at sites under construction, workmen sometimes need to temporarily remove portions of a guard rail in order to gain access to certain regions. With prior art conventional wooden rail assemblies, the workmen typically just hammer out the appropriate section when required. Occasionally, however, workmen do not return the guard rails back to their original state, thereby compromising the integrity of the guard rail assembly and causing safety concerns. The guard rail support 10 of the present invention provides for a fast and efficient disassembling and reassembling of a portion of a guard rail assembly if need be. Furthermore, by preventing the damage of lumber which would ordinarily result from such crude hammering out, the inventive guard rail support prevents the possible reassembly of a hammered out portion of a guard rail assembly with damaged lumber. The all-steel construction of the guard rail support of the present invention also ensures durability and repeated use for many years, thereby providing a high return on investment and cost savings.

[0043] The temporary guard rail support and associated assembly of the present invention have been described in connection with the provision of a safety guard rail along the outer drop-off edge or perimeter of a concrete floor slab which defines an upper story level of a building while it is under construction, wherein the principle purpose of the guard rail support and assembly is to protect workmen on the floor slab from falls. It will be appreciated, however, that the guard rail support and assembly may be useful in other embodiments and a guard rail support embodying the principles of the invention may, if desired and with or without modification as required, be employed for guard rail support purposes in a wide variety of other situations or environments as, for example, in the provision of a temporary guard railing around the perimeter of a roof structure, along the sides of a bridge construction until such time as the permanent guard railings are installed, or along any drop-off edge wherever it may occur.

[0044] As mentioned above, the fall protection tie-off rings 22 of individual guard rail supports 10 comprising a guard rail assembly may conveniently be used for the purpose of fastening weather shields according to an aspect of the invention. Advantageously, a plurality of weather shields may be attached using the tie-off rings 22 of individual guard rail supports in order to shield and protect workers and building materials in a building or structure

under construction from inclement weather. Such a weather shield according to an aspect of the invention will now be described.

[0045] A weather shield 110 according to one embodiment is shown in FIGS. 8 to 10. FIG. 8 shows a view of the outward-facing side of the weather shield 110, i.e. the side of the weather shield which faces the outside of the building under construction when mounted to the building. FIG. 9 shows a view of the inward-facing side of the weather shield 110, i.e. the side of the weather shield which faces the inside of the building under construction when mounted to the building. FIG. 10 shows a blown-up view of the weather shield 110 to better illustrate its parts. The weather shield 110 is constructed and configured to be used in building construction (e.g. in high-rise building construction) to provide temporary shelter from inclement weather to workers and materials while selectively providing wind pressure relief during high winds in order to prevent stress damage, such as tearing, to the weather shield 110.

[0046] The weather shield 110 comprises a sheet 120, preferably made of a substantially flexible, substantially weatherproof material, having at least one closeable opening 130 for wind relief. In one embodiment, as shown in FIGS. 8 to 10, the sheet has two closeable openings 130 for wind relief. The sheet 120 is preferably constructed of flexible materials allowing for convenient installation, removal and storage of the weather shield 110. The sheet 120 is preferably comprised of a water-proof outer layer 140 and a thermal insulating inner layer 150. While the outer layer 140 and inner layer 150 may each be composed of any suitable materials, the outer layer 140 is preferably composed of nylon in one embodiment. The outer layer 140 and inner layer 150 may be affixed together by any suitable means; in one embodiment, the outer layer 140 and inner layer 150 are stitched together along the periphery of the sheet 120. The sheet 120 may alternatively comprise a single layer or any number of layers suitably arranged.

[0047] The sheet 120 may be constructed to be any size, and may be constructed and configured to fit standard floor slab to floor slab building dimensions. In one embodiment, the sheet is 17' in length and 12' in width, being ordinarily horizontal and vertical, respectively, when the weather shield 110 is mounted to a structure. In another embodiment, the sheet is 24'6" in length and 12' in width.

[0048] The sheet 120 may be reinforced to give it strength and resistance to stress damage in the form of tearing, fraying or otherwise. At least one reinforcing strap 160 may be sandwiched between the outer layer 140 and inner layer 150 and stitched together with the outer layer 140 and inner layer 150. The reinforcing straps may be composed of any suitable material and in one embodiment are composed of nylon. The reinforcing straps may have any convenient and suitable dimensions, and in one embodiment are each 1/8" thick and 3.5" wide.

[0049] While any number of reinforcing straps may be included in the above-described manner, in one embodiment, eight reinforcing straps are used. Note that FIGS. 8 and 9 show such reinforcing straps 160 as hidden (indicated by dash lines) between the outer layer 140 and inner layer 150, while FIG. 10 shows the reinforcing straps separately from the outer layer 140 and inner layer 150. The eight reinforcing straps include five vertical reinforcing straps



aligned parallel to the width of the sheet **120** and three horizontal reinforcing straps aligned parallel to the length of the sheet **120**. Four of the reinforcing straps **160** may be border reinforcing straps **160A** including two vertical border reinforcing straps and two horizontal border reinforcing straps disposed adjacent to the four edges of the sheet, one strap along and adjacent each edge. Four of the reinforcing straps **160** may be body reinforcing straps including three vertical body reinforcing straps **160B** (including two vertical reinforcing straps each disposed inwardly a distance from a corresponding vertical edge of the sheet **120**, and a third vertical reinforcing strap disposed in the centre of the sheet **120**), and a horizontal body reinforcing strap **160C** disposed upwardly a distance from the bottom edge of the sheet **120**. In this way, the reinforcing straps may provide reinforcement to the sheet at its periphery and throughout its body.

[0050] The weather shield **110** is constructed and configured to be mounted in or on a structure under construction (e.g. a multi-storey, or high-rise, building) preferably by means of attachment means attached or integral to the sheet **120**. The attachment means may comprise any means suitable for attaching the weather shield **110** to anchors mounted to or integral with the structure or building under construction. The attachment means may include any suitable means for attachment known in the art, including ties, grommets, snaps, ropes, straps, rings, hooks or Velcro™.

[0051] In the embodiment described above having eight reinforcing straps, the attachment means may comprise or be affixed to the reinforcing straps **160** described above. The three vertical body reinforcing straps **160B** may each protrude beyond the top edge of the sheet **120** as shown in FIGS. **8** and **9**. The protruding portions **170** of the three vertical body reinforcing straps **160B** may be used as ties to mount the weather shield **110** to a building under construction; alternatively, each vertical body reinforcing strap may end in a hook **180** for engagement with an anchor mounted to or integral with the building under construction, which in one embodiment is a fall protection tie-off ring **22** of a guard rail support **10** described above. The engagement of such hooks **180** with the fall protection tie-off rings **22** of a guard rail support **10** is illustrated in FIG. **4**. Each hook **180** may, alternatively, be attached directly to the sheet at the intersection of the top border reinforcing strap and a corresponding vertical body reinforcing strap. In either case, the weather shield **110** may be hung from the fall protection tie-off rings of a number of guard rail supports in the above-described manner.

[0052] The attachment means in this embodiment may further comprise tails **190** extending from the inward-facing side of the sheet **120**, with each tail **190** being attached to the sheet **120** at a location displaced vertically from the bottom edge of the sheet **120**; this vertical displacement of the tails **190** from the bottom edge of the sheet **120** is selected to provide that the vertical separation of the tails **190** from the top edge of the sheet **120** is substantially equal to the vertical separation of the floors of adjacent storeys in the building under construction to which the weather shield **110** is to be mounted. In the embodiment described above having eight reinforcing straps **160**, each tail **190** is attached at one end of the tail **190** to the sheet **2'6"** from the bottom of the sheet **120** and is horizontally disposed to overlap a corresponding vertical body reinforcing strap **160B**. In this case, the horizontal body reinforcing strap **160C** is also disposed

at the same distance from the bottom of the sheet **120** as the tail **190**; in this way, the horizontal body reinforcing strap **160C** and each corresponding vertical body reinforcing strap **160B** intersects at the locations of attachment of the tails **190** and reinforces the attachments. Each tail **190** may also have a hook **200** at the other end of the tail **190**. Each tail **190** may further have a one-way pull assembly (not shown) (e.g. similar to a seatbelt assembly) wherein the tail **190** may be shortened.

[0053] A weather shield as described above may therefore be mounted to the building as follows: the weather shield is first hung from the building at a first storey of the building by the straps and hooks extending from the top edge of the sheet, after which the tails are attached by the hooks to the building at a second storey which is below and adjacent to the first storey; the pull assemblies of each tail are then pulled to shorten the tails thereby tightening the weather shield against the building. As the weather shield extends vertically below the location of attachment of the tails, it extends a distance into the next lower storey and overlaps the top of any weather shield mounted to the next lower storey in the same fashion. Thus, in this manner, a plurality of weather shields may be mounted to the building so as to provide a wall of weather shields with vertically adjacent weather shields overlapping and each securely mounted to the building under construction.

[0054] The weather shield **110** has at least one closeable opening **130** for providing wind pressure relief in the event of high winds by allowing the passage of wind therethrough, thereby tending to prevent stress damage to the sheet **120**, and particularly along its perimeter at the attachment means affixed or integral to the sheet **120**. While the at least one closeable opening **130** may comprise any number of openings, in one embodiment, and as shown in FIGS. **8** to **10**, it comprises two openings each disposed in the geometrical centre of a corresponding area defined by the top border reinforcing strap **160A**, two corresponding adjacent vertical body reinforcing straps **160B**, and the horizontal body reinforcing strap **160C**. Each opening may be any suitable size, but the openings preferably together represent about **5%** of the area of the sheet, and in one embodiment each has dimensions of about **3'x3'**.

[0055] The weather shield **110** further comprises closing means for closing the closeable openings **130** when wind pressure relief is not needed and a more complete protection from inclement weather is desired. Although the closing means may be any means suitable for closing a closeable opening, in one embodiment, shown in FIGS. **8** to **10**, the closing means comprises a rectangular flap **210** affixed at its bottom edge to the sheet **120** adjacent the bottom of the corresponding closeable opening **130**. In this embodiment, the weather shield **110** further comprises flap retention means comprising Velcro™ strips **220** affixed about the periphery of the flap **210** facing each closeable opening **130**; matching Velcro™ strips **220** are affixed about the periphery of the corresponding closeable opening **130** facing the flap **210**, and disposed so as to come into contact with the matching Velcro™ strips **220** when the flap **210** is closed. In this way, and as is understood in the art, the matching opposing Velcro™ strips **220** will selectively hold the flap **210** closed and may be torn apart to open the closeable opening **130**. The closing means and flap retention means

may alternatively comprise any suitable means known in the art, including ties, grommets, snaps, ropes, straps, rings, hooks or Velcro™.

[0056] The Velcro™ strips **220** comprising the flap retention means described above may further be selected to have a specific holding strength whereby the flap **210** will be opened by the force of a wind of a given strength; in this way, the closing means may be advantageously configured to open automatically when wind blowing against the weather shield is stronger than a predetermined threshold strength.

[0057] The weather shield may be affixed to anchors on the structure to be protected by any convenient attachment means. The anchors may be mounted onto the structure or may be integral with the structure. In one embodiment, the anchors are preferably the temporary guard rail supports described above. A system comprising the guard rail supports and the weather shields providing an integrated construction shelter for a building under construction will now be described.

[0058] FIG. **11** shows a front view of a partial construction shelter **300** according to one embodiment. The construction shelter **300** is mounted to floor slabs of the first **310**, second **320**, third **330** and fourth **335** storeys of a building under construction and has a plurality of guard rail supports **10** erected along the perimeter of its floor edges to form a suitable guard rail assembly in accordance with an embodiment described above. (In FIG. **11**, only a subset of the guard rail supports and weather shields depicted are identified by numerals and lead lines for the sake of clarity. Hidden guard rail supports, floor slabs and edges of weather shields are indicated by dashed lines.) The construction shelter **300** partially encloses the first, second and third storeys of the building. Although the guard rail supports **10** on a given floor may be spaced at any desired distances, in one embodiment the guard rail supports **10** are spaced apart by distances of 7' 6", in accordance with known safety regulations. Weather shields **110** may then be suitably attached to the guard rail supports **10** in the manner described above such that the weather shields **110** hang down from the guard rail supports **10**.

[0059] As shown in FIG. **11**, a single weather shield **110** may have dimensions sufficient to span three guard rail supports **10** appropriately spaced along a construction floor edge; in this case, as in an embodiment described above, the weather shield would have a length of 17' and a width of 12'. Alternatively, the weather shield may have dimensions sufficient to span four guard rail supports; in this case, and as in another embodiment described above, the weather shield would have a length of 24'6" and a width of 12'. Each weather shield **110** may be attached to a number of guard rail supports **10** adjacent to the top of the weather shield **110** by any suitable means, including the means described above. As shown in FIG. **11**, a plurality of weather shields **110** may be mounted to a building in a substantial grid pattern and in the vertical overlapping fashion described above in order to collectively provide a wall. A number of weather shields **110** may be so mounted in order to provide an enclosure of the structure under construction, or to enclose any part of the structure that is desired.

[0060] In one embodiment, the length of a single weather shield **110** will be sufficient to span three successively

aligned guard rail posts with a 1' overlap at meeting sides of each pair of weather shields. As depicted in FIGS. **8**, **9** and **10**, each weather shield **110** may be further constructed with overlap connection means to connect horizontally adjacent overlapping weather shields **110** mounted to a building together in the above-described grid pattern. The overlap connection means may be any means suitable for connecting adjacent overlapping weather shields including ties, grommets, snaps, ropes, straps, rings, hooks or Velcro™.

[0061] As shown in FIGS. **8**, **9** and **10**, the overlap connection means in one embodiment comprises a plurality of D-rings **340** affixed and disposed along one vertical edge of the sheet **120** comprising the weather shield **110**. The D-rings **340** are affixed to the sheet **120** and to a vertical border reinforcing strap **160A** reinforcing the vertical edge of the sheet **120**. The overlap connection means in this embodiment further comprises a plurality of overlap hooks **350** affixed to the sheet **120** and disposed along a vertical body reinforcing strap **160B** nearest the vertical edge of the sheet **120** opposite the D-rings **340**; each overlap hook **350** is vertically disposed so as to be vertically aligned with a corresponding D-ring **340**.

[0062] Employing the above-described overlap connection means, a first weather shield may be mounted to a building under construction followed by a second weather shield mounted horizontally adjacent to the first weather shield. The second weather shield will thereby overlap the first weather shield along one vertical edge bringing each of the overlap hooks of the second weather shield into proximity with a corresponding D-ring of the first weather shield. Each overlap hook may be made to engage the corresponding D-ring, thereby securing the horizontally adjacent weather shields together. Accordingly, a plurality of weather shields may be mounted to a building in a substantial grid pattern and in the vertical and horizontal overlapping fashions described above in order to collectively provide a wall. A number of weather shields may be so mounted in order to provide an enclosure of the structure under construction, or to enclose any part of the structure that is desired.

[0063] As described above, each of the closeable openings **130** in each of the weather shields **110** may be closed to provide a more complete protection against inclement weather, when desired. Alternatively, the closeable openings **130** may be opened to allow the passage of wind there-through providing wind pressure relief and tending to prevent stress damage to the weather shields **130** from the high winds.

[0064] Together, the system of guard rail supports and improved weather shields provide shelter for buildings or other structures under construction, protecting workers and building materials from both accidental falls and inclement weather, while providing for wind pressure relief in cases of high winds to protect the weather shields from stress damage. A person understanding the invention described above may now conceive of alternative designs using the principles described herein in addition to the specific embodiments described. All such designs which fall within the scope of the claims appended hereto are part of the invention.

[0065] With the foregoing exemplary embodiments having been disclosed, it will be apparent to those skilled in the art that various changes and modifications can be made to appropriately suit the needs and objectives of another appli-

cation and still achieve the advantages of the invention; all such changes and modifications are intended to fall within the scope of the invention as defined by the claims that follow.

What is claimed is:

1. A weather shield for providing temporary protection from inclement weather to a building under construction while selectively increasing protection of the shield from damage due to high winds, the weather shield comprising a sheet of substantially flexible, substantially weatherproof material having at least one closeable opening for selective relief of wind pressure on the sheet when in use in high winds, and means for mounting the sheet to the building under construction.

2. The weather shield according to claim 1, wherein the sheet has a waterproof outer layer and an insulating inner layer.

3. The weather shield according to claim 2, wherein the sheet is reinforced about its perimeter by reinforcing straps sandwiched between and affixed to the waterproof outer layer and the insulating inner layer.

4. The weather shield according to claim 1 wherein the means for mounting comprises attachment means for releasably attaching the sheet to anchors on the building under construction.

5. The weather shield according to claim 4, wherein the attachment means comprise any of ties, grommets, snaps, ropes, straps, rings, hooks or Velcro™.

6. The weather shield according to claim 4, wherein the attachment means are for attachment to said anchors wherein said anchors are mounted to the building.

7. The weather shield according to claim 6, wherein the attachment means are for attachment to said anchors wherein said anchors comprise temporary guard rail supports.

8. The weather shield according to claim 1 further comprising closing means for selectively closing the closeable opening.

9. The weather shield according to claim 8, wherein the closing means comprises at least one flap.

10. The weather shield according to claim 9, wherein the closing means further comprises flap retention means for selectively retaining the flap when the closeable opening is closed.

11. The weather shield according to claim 10, wherein the flap retention means comprises at least one pair of Velcro™ strips having a first Velcro™ strip and a second Velcro™ strip, wherein the first Velcro™ strip is affixed along an edge

of the inward-facing surface of the flap, and the second Velcro™ strip is affixed along an edge of the closeable opening facing the first Velcro™ strip whereby the pair of Velcro™ strips are in contact when the flap closes the closeable opening thereby selectively retaining the flap.

12. The weather shield according to claim 11 wherein the at least one pair of Velcro™ strips is selected to have a specific holding strength whereby the flap will be opened by the force of a wind of a given strength.

13. The weather shield according to claim 1 further comprising overlap connection means for connecting to an adjacent weather shield at an overlapping edge thereof.

14. The weather shield according to claim 13, wherein the overlap connection means comprise any of ties, grommets, snaps, ropes, straps, rings, hooks or Velcro™.

15. A temporary shelter kit for a building under construction, said kit comprising:

a plurality of temporary guard rail supports for mounting adjacent to an edge of a floor of the building thereby to provide a framework of anchors; and

a weather shield according to claim 1 for attachment to the framework of anchors.

16. The temporary shelter kit according to claim 15, wherein the sheet of the weather shield has a waterproof outer layer and an insulating inner layer, and wherein the sheet is reinforced about its perimeter by reinforcing straps sandwiched between the waterproof outer layer and the insulating inner layer.

17. The temporary shelter kit according to claim 15, wherein the means for mounting of the weather shield comprises attachment means for releasably attaching the sheet to the framework of anchors.

18. A temporary shelter for a building under construction comprising:

a plurality of temporary guard rail supports mounted adjacent to an edge of a floor of the building thereby to provide a framework of anchors; and

a weather shield according to claim 1 attached to the framework of anchors.

19. The temporary shelter according to claim 18, wherein there is a plurality of said weather shields, and wherein adjacent weather shields overlap at their respective edges.

20. The temporary shelter according to claim 19 wherein said overlap is secured by overlap attachment means.

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