MOVABLE WINDBREAKER FOR STEEL BUILDINGS

Inventor: Jack F. Boss, Jr., 68 Lincoln Ave., North Olmsted, Ohio 44017

Filed: Nov. 3, 1971

Appl. No.: 195,229

U.S. Cl. 52/63, 52/222, 52/282
Int. Cl. E04b 1/34, 61/71

Field of Search 52/63, 71, 282, 222

References Cited
UNITED STATES PATENTS
3,555,754 11/1971 Kellogg 52/282
466,831 1/1892 Palmer 160/229 R
1,307,040 6/1919 Christensen 160/242
487,319 12/1892 Davis 52/63
2,840,400 6/1958 D’Azzo 52/63

FOREIGN PATENTS OR APPLICATIONS
143,864 6/1935 Austria 160/264
862,898 3/1961 Great Britain 52/63
1,193,643 6/1970 Great Britain 52/71
465,104 1/1914 France 52/63

ABSTRACT

A planar grid of relatively lightweight struts dismantlably disposed in predetermined fashion to provide a unitarily portable, relatively rigid framework over which is draped and anchored a sheet of a wind-impervious material which incorporates suitably reinforced grommets through which the sheet is anchored. The entire planar windbreaker or screen is disposed against the facade of a steel skeleton with the periphery of the screen in contact with the steel members to which it is anchored; the screen may be moved either vertically, by means of winches from which it is suspended, or horizontally, by relocating the winches, always maintaining the screen outside the skeleton. Under normal weather conditions, it is an effective weather seal, while under storm conditions it is believed to flex sufficiently so as to permit relief venting of the enclosed zone, at the same time preventing the screen from being torn asunder. In operation, the screen provides a seal under normal conditions and an automatic controlled leakage in high winds as a function of wind velocity.

9 Claims, 6 Drawing Figures
MOVABLE WINDBREAKER FOR STEEL BUILDINGS

BACKGROUND OF THE INVENTION

During the construction of high rise buildings, whether of a curtain-wall construction or otherwise, in which the skeleton of the building is a steel frame structure, it is sometimes imperative to isolate particular portions of the building during certain phases of its construction so as to provide a confined airspace. In winter, air confined to the working zone enables a construction crew to maintain a temperature within a range which will not adversely affect the curing of freshly-poured concrete and which, at the same time, will provide a tolerable, if not comfortable, working temperature.

In another application, a confined airspace permits materials to be sprayed within the working zone without unwittingly engulfing the neighborhood with the possibly noxious materials. For example, fireproofing material is commonly sprayed onto steel structural columns to provide a certain minimum fire tolerance. The material to be sprayed is easily airborne and maintains tackiness for a considerable period of time. When this material is wafted away and deposited upon other structures or objects, whether they be buildings, automobiles or shrubs, a chemical reaction usually occurs which results in the building being defaced, the finishes on the automobiles being marred, and the shrubs being damaged beyond revivification. The damage wrought by fireproofing materials escaping the working zone has forced large cities to enact an ordinance which makes an effective screen mandatory.

Still another application pertains to the coating of structures with moisture-curing organic elastomers such as, for example, polyurethanes. The peculiarity of these elastomers is that they require a certain minimum moisture level in the atmosphere, which moisture is critical to effect the chemical reaction which cures the polymer. Thus, where a polymeric coating is spread upon a roof-deck, parking lot, or similar structure during a season where the ambient humidity is less than that necessary to effect the moisture curing of the polymer, it is incumbent upon the contractor to provide sufficient moisture in the atmosphere to effect the cure. This is done by using misting nozzles in a confined airspace. It stands to reason that the humidity in the atmosphere is much more effectively controlled when the curing zone includes a confined airspace within which the moisture level can be controlled.

U. S. Pat. No. 3,555,754 discloses a portable shelter assembly for protection from bad weather and is made up of structurally strong light-transmitting panels which can be assembled in many different combinations by means of special, quickly detachable fasteners and related supporting means. The fasteners comprise a member having a notched head and an exposed handle. The entire structure is either assembled on a particular floor or lifted to the location within a building where it is to be used. After it is used at that location, it must be disassembled and moved to the next location since it is generally difficult to move the structure from deep within a building to its periphery and then effect its lifting to another level.

SUMMARY OF THE INVENTION

It has been discovered that a uniplanar windbreaker or screen may be fabricated from relatively lightweight, elongated metallic struts preselectively anchored at various positions to form a relatively rigid frame in conjunction with a wind-imperious flexible sheet fixedly disposed upon it. The wind-breaker is a relatively weathertight seal under normal conditions and, during gale conditions, automatically permits leakage of wind from the sides and through a multiplicity of grommets to act as a relief vent. The instant invention is born of a long-felt need to reduce costs for weather protection and for isolation of working zones in a structural framework.

DRAWINGS

FIG. 1 is a perspective view of plural, planar screens enclosing two floors of the skeleton of a steel building.

FIG. 2 is a detail of the anchoring of the sheet material with grommets over a unit planar grid.

FIG. 3 is a detail showing the lashing of the planar screen to a vertical steel structural column.

FIG. 4 shows a plan view detail of the screen next to a horizontal structural steel beam and steel angle bulkhead.

FIG. 5 is a side elevation of a grid frame of tubing without the wind-imperious sheet anchored to it.

FIG. 6 is a detail of an anchoring means for tubing.

PREFERRED EMBODIMENT OF THE INVENTION

Innumerable structures have been used as windbreakers to enable workers to perform their duties in relative comfort. A common shelter is one constructed within a steel building skeleton from struts of wood which have been temporarily nailed to horizontal timbers, which in turn are lashed to the structural steel framework. The struts of wood are then dressed with canvas. This archaic structure and variations of it have been used wherever a modicum of weatherproofing was required. It is still used in winter for pouring concrete in high rise structures. It is still used despite the fact that the fabrication of such a wood frame structure to provide necessary weather protection and its subsequent dismantling requires high-priced manual labor and the cost of this form of weather protection has become prohibitive.

Closures of easily dismantleable members have been generally directed to simplifying and speeding up the fabrication of the same basic structure as has been used for ages, namely, a rigid integral enclosure built and used within the steel skeleton of a structure to isolate a particular portion at a single level. The rigid closures isolate relatively small portions of a building and after they have served their purpose, they are disassembled and moved to another location or level. They are not adapted to be moved as a unitary structure and particularly from one floor to another. The express advantages purported to redound to such rigid structures are (1) that erection and dismantling may be done by unskilled labor rather than highly skilled carpenters, thus lowering costs, and (2) that use of quick opening and closing fasteners in combination with metal structural members permits repetitiously using a structure and avoids the continual purchase of raw lumber or, alternatively, the necessity to recondition lumber for reuse.

Not usually stressed is the time factor which is of critical importance. For example, where a fireproofer progressively fireproofs structural members on each floor of a high rise building, the time required to erect and
disassemble a prior art rigid structure far surpasses that required to spraycoat the structural steel. Similarly, the time required to moisture-cure a polyurethane coating on an entire floor of a high rise parking garage is often substantially less than that required to erect and fabricate a rigid closure within the structural framework. About the only application where the time factor is roughly comparable is where a confined working zone is required for pouring concrete.

The costs associated with the use of prior art structures is still enormous. Particularly where large areas have to be enclosed, as for example an entire level of a high rise building which is to be spray-coated with fireproofing material, portable, rigid, three-dimensional assemblies are impractical. Most importantly, such assemblies provide no venting and in high wind conditions are usually scattered in fragments over the surrounding urban landscape.

Since most high rise buildings have relatively large planar surfaces, it is desirable to screen in an entire floor or more prior to working within the zone, whether it be for fireproofing or for pouring concrete.

The instant planar windbreaker provides an enclosure for at least one, and preferably a plurality of floors or levels on a high rise structure without being so heavy as to make hoisting of the screen from one level to another a major undertaking. The instant planar structure may be lashed to the face of the building to protect one or two or more floors, while it is suspended from above by a plurality of winches. The screen is raised into position either manually or by electric power winches. Similar screens are positioned in abutting relationship on each side of the building until the entire level or levels are enclosed. Spray coating of the structural members, pouring, and curing of concrete or polymeric resin within the floors enclosed then proceeds, and, after the work is completed, the screens are moved up to the succeeding floor or floors, lashed in place and the operation repeated.

Referring more particularly to the drawings, FIG. 1 shows a six-story, steel structure, shown generally at 10, which is sheathed over two floors with a plurality of the instant planar screens 11 in abutting relationship one with another so as to form the confined airspace. It will be recognized that the decks 12, demarcating the floors, will provide the bottom and the top of the confined space formed by the screens. The decks may be reinforced metal prepared for pouring concrete, preformed concrete floors, or the poured and finished concrete floor. Though the screens 11 may be formed in such a size as to enclose the space between two successive decks 12, at one time, for convenience, the screens 11 are generally formed so as to enclose two successive floors; in other words, the screens are high enough so that the decks on either side of an intermediate deck form the top and bottom surfaces of the confined airspace. The width of a unit planar screen is at least the width of the spacing of spaced apart vertical structural members of the skeleton. In high rise buildings, the vertical members are usually on 10 ft. centers. Thus, the width of a screen is at least 10 ft., and preferably 20 ft. Thus, abutting screens are in contact along a line which substantially coincides with the centerline of the vertical structural member to which the abutting screens are secured, and the vertical member performs a sealing function along the line of abutment of the screens. In this manner, it is not critical that the abutting screens be in sealing abutment with each other.

Winches 13 are demountably affixed to positions directly above the screens 11 to permit the screens to be moved vertically into any desired position. Winches for the remaining screens, which sheath the structural steel framework, are not shown. It will be recognized that it is not essential to use screens in such a manner as to entirely confine an airspace. For example, where fireproofing material is to be sprayed under relatively windless conditions in a particular section of the structural steel framework, it may be necessary to enclose only a portion of the framework, the area the screening being chosen so as to prevent the spray coating material from escaping. It will be recognized that where a sufficient number of planar screens are available, the efficiency of the operation is greatly enhanced when an entire floor, or preferably two, is enclosed and the spraying work carried out with a minimum of risk.

FIG. 2 shows a unit planar screen, shown generally as 11, consisting of a unit grid of elongate struts 14 conveniently formed in a size 20 ft. wide and 25 ft. high, which in turn consists of a plurality of rectangles, preferably 5-ft. squares, each of which is secured at an intersection point.

The elongate struts may be solid metallic rods of a relatively lightweight metal, such as titanium, aluminum, and the like, which rods may have a circular or a polygonal cross section; or said struts may be channel, I-beams, or other extruded cross sections of steel, aluminum, or the like, or may be tubes of any of the foregoing metals. The grid may also be formed from elongate struts of a reinforced synthetic resinous materials, such as fiber glass-reinforced polyesters, commonly termed “structural plastics.” An especially suitable and inexpensive strut is provided by bamboo, which is readily available in lengths of 20 and 25 ft. Bamboo has the advantage of being exceptionally strong on a weight-to-length basis, and can be fixedly attached at overlapping points by simple lashing with rope to form the unit grid which has excellent rigidity, yet has greater flexibility than metal struts with comparable strength. The structural advantages of a bamboo grid, coupled with the fact that it requires no painting or other maintenance for corrosion-resistance and its negligible initial cost, make it a particularly desirable choice.

The material from which said struts are formed is not critical, except that the struts, when formed into the unit screen as described, exhibit as a unit sufficient rigidity to provide an essentially confined airspace under normal operating conditions, i.e., at wind velocities below 50 miles per hour; at the same time, the unit planar screen must under abnormal, high-wind conditions above 50 miles per hour, permit spillage of wind around the edges of the grids in abutting relationship to other grids, or in overlapping relationship to those portions of the structural steel framework coextensive with the sides of a unit planar screen. Where the cross section of the struts is circular or polygonal, the anchoring at intersection points is conveniently done by a cross fitting 15, a T-fitting 16, or an L-fitting 17. Cross fittings 15 and T-fittings 16 may be offset to accommodate overlapping elongate struts, which are anchored in position by screws or other locking means. The fittings may be cast unitary fittings or stamped metal multipart fittings, as shown in FIG. 6. Where the cross section of
the strut is rectangular, channel-shaped, or an I-beam, anchoring of the struts at overlapping points may be done with bolts without the use of cross, T-, or L-fittings. Where the struts are formed of reinforced fiber glass synthetic resinous material, overlapping struts may be simply glued together. The manner in which overlapping struts are affixed to one another is immaterial, provided they are fixedly secured to provide a rigid framework under normal operating conditions over which the wind-imperious sheet material 18 is secured. The sheet 18 may be secured either interiorly or exteriorly of the unit grid. It is preferred to position it exteriorly, since it presents a smooth surface on which snow and ice will not collect, and presents the exposed struts to the vertical structural members of the framework for easy securing thereto. It will be recognized that where a unit grid is to be dismantleable into its component parts, cross fittings, T-fittings, and L-fittings will be provided with locking means; alternatively, overlapping struts may be bolted together, regardless of their cross section. However, where a multiplicity of grids will be used by a contractor on one job after another, it may be desired to form unit grids by welding overlapping portions of the metallic struts into place, or by gluing structural plastic struts permanently into position. Welding metallic struts into unit grids has the advantage of permitting the use of lighter metallic struts (which weigh less per unit foot) and thus permit the formation of unit grids relatively lighter than grids designed to be dismantled after use. Hereinafter, a grid formed of a plurality of struts, whether fixedly or dismantleably attached, will be referred to as a “unit grid.”

Over each unit grid is disposed a wind-imperious sheet 18 of a synthetic resinous material or a sheet of fibrous material, such as canvas, which is impregnated with a thermoplastic synthetic resinous material, such as a polyolefin. The sheet 18 is provided with a multiplicity of spaced grommets 19 disposed in such a manner as to provide locations for fixedly positioning the sheet 18 upon the unit grid by positioning means 20. The positioning means 20 may be a lashing means, such as a rope or a strap with a buckle. Other means for positioning the sheet material on the struts of the unit grid, as with a nut and bolt, will be apparent to those skilled in the art. A unit grid over which a wind-imperious sheet is secured is referred to as a “unit planar screen.”

Where the elongate struts are angle or channel-shaped, as for example commonly available UNISTRUT or DEXION brand sections with perforations at fixed intervals, the grommets may be placed in the sheet material so as to be directy above a perforation. Thus, the sheet material may be fastened to the unit grid by simply bolting the material to the foraminous strut. It will be recognized that where the grommets are so bolted to the foraminous strut, there is no leakage through the grommet. Thus, most of the leakage and wind-spillage in high wind conditions will occur around the periphery of the unit grid. When a planar screen is so constructed, with no grommet means for leakage it will generally require stronger sheet material, since the entire force of the wind is borne by the sheet anchored to the grid, and no leakage occurs through the grommet holes. Since heavy sheet materials are more expensive, it may be preferable to use the standard sheet material and provide grommet “escapes” within the sheet wherein the grommets are deliberately left open. As used herein, the term “grommet” refers to an eyelet of metal, plastic, or other material set into a perforation of the wind-imperious sheet material so as to strengthen and protect the inner circumference of the perforation and the immediately surrounding area. The grommets preferably used herein are reinforced on either side of the sheet material with plural thicknesses thereof so as to strengthen the material and protect it from abrasion of the lashing means or bolt which is passed therethrough. A flap of wind-imperious material may be provided on the sides of each screen with spaced grommets which permit the flap to be secured in overlapping relationship to the abutting screen. Use of flaps permits a more airtight enclosure in normal wind conditions.

It will be apparent from the foregoing that the instant weather-sealing enclosure is relatively airtight under normal weather conditions, namely, with wind velocities less than about 50 miles per hour. However, at abnormal wind conditions, namely in excess of about 50 miles per hour, the unit planar screen must permit escape of high velocity wind and prevent fragmentation of the screens. Where a unit planar screen is made of a relatively lightweight material, such as bamboo or titanium tubing, the screen is sufficiently flexible so that it may be lashed to the vertical members 21 very tightly. However, where the struts are of a relatively rigid material, such as 1.5 inch diameter aluminum pipe forming a unit grid as described herein, the chain 23 secures the unit planar screen 11 to the vertical structural steel member 21 so as to permit sufficient “give,” that is, to permit displacement of the screen or distortion thereof relative to the structural steel framework under abnormal wind conditions. Manually securing a strut of the instant screen with a chain to the vertical structural steel member 21 is found to provide the necessary amount of “give” for a unit planar screen which is relatively rigid, that is, not sufficiently flexible to permit the escape of air during high velocity winds. A typical unit grid formed of 1.5 inch diameter No. 6063-T6 aluminum structural pipe, clad with an 18 mil. reinforced vinyl wind-imperious sheet having overall dimensions of 20 ft. width and 25 ft. height, weighs approximately 300 pounds, and is suspended by 1/4-inch diameter steel cable reeved on winches positioned one or two floors above the confined airspace.

FIG. 3 is a cross sectional plan view of a unit planar screen secured to a vertical structural steel member 21 by a chain 23. As shown in FIGS. 1 and 3, the vertical structural steel member 21 is at the midpoint of a unit screen, the width of which screen corresponds to twice the spacing of the vertical structural steel members. Where screens abut, the side members are preferably in abutting relationship directly above a vertical structural member.

FIG. 4 is a cross sectional plan view of the unit planar screen, which in the phantom position is shown abutting the bulkhead of a floor in its normal position. In the other position, the unit screen is shown displaced in spaced-apart relationship to the bulkhead under abnormally high wind conditions where the grid is so rigid that flexure in the struts under such conditions is not visually apparent. Where the struts 14 are relatively flexible, such as of bamboo, flexure under gale conditions would be readily visible. The instant screens have been successfully used without being shredded at winds in excess of 80 miles per hour.
FIG. 5 is an exploded, detailed view of the unit grid showing cross fittings, T-fittings, and L-fittings used to assemble relatively rigid metal tubing to form the unit grid. It will be noted that in the particular embodiments shown herein, the cross fittings, T- and L-fittings are offset, since the rigidity of the struts 14 requires offset fittings. Where the struts are quite flexible, i.e., flexible enough so as to permit the use of planar L- and T-fittings at the ends of the struts, these planar fittings may be used.

FIG. 6 is a detail of an offset cross fitting, depicting locking means for removably securing tubular struts 14 into a unit grid.

Though it will be apparent that various modifications of the invention should be limited by the advance by which the invention has promoted the art, and described herein will be possible, the scope of the invention is defined by the claims appended hereto.

I claim:

1. In combination with a structural framework and movably disposed exteriorly thereof, a rectangular unit grid of elongate rigid struts of substantially uniform transverse cross section, said unit grid having side struts, upper and lower struts and plural horizontal and vertical struts fixedly attached at their ends to said side, upper and lower struts and additionally fixedly attached at points intermediate said their ends to form plural rectangles within said unit grid; a wind-im pervious non-metallic sheet coextensive with said unit grid having a multiplicity of spaced grommet means adjacent to said struts; first fastening means to secure said sheet through said grommet means to said unit grid to form a unit planar windbreaker on said structural framework; means positioned above said unit windbreaker to move it vertically contiguous to said framework; and second fastening means to secure said unit planar windbreaker to structural framework so as to form a rigid weather-sealing enclosure for normal wind conditions under 50 miles per hour to permit the maintenance of a suitable working temperature, moisture content or confined zone of operation.

2. The apparatus of claim 1, wherein said wind-im pervious non-metallic sheet is a fabric of fibrous material bonded with thermoplastic synthetic resinous material, the overall thickness of the laminate being at least 10 mil, and wherein said sheet is translucent.

3. The combination of claim 1 wherein said wind-im pervious non-metallic sheet comprises a synthetic resinous material.

4. The combination of claim 1 wherein said wind-impervious non-metallic sheet is a canvas sheet impregnated with a polyolefin.

5. In an enclosure which provides a relatively confined working zone within a structural framework of a building, the combination comprising a rectangular unit grid at least as wide as the center-to-center distance of vertical structural members of said framework and at least as high as the spacing between decks or floors thereof, said unit grid being formed of elongate, rigid struts of substantially uniform transverse cross section, said unit grid having side struts, upper and lower struts, and plural horizontal and vertical struts fixedly attached at their ends to said side, upper, and lower struts and additionally fixedly attached at points intermediate said their ends to form plural rectangles within said unit grid; a wind-im pervious, non-metallic sheet coextensive with and disposed exteriorly of said unit grid, said sheet having a multiplicity of spaced grommet means adjacent to said struts; first fastening means to secure said sheet through said grommet means to said unit grid to form a unit planar windbreaker or screen on said structural framework; winch means positioned above said unit screen to move it vertically contiguous to said framework; and second fastening means to secure said unit planar screen to said structural framework so as to form a rigid weather-sealing enclosure for normal wind conditions under 50 miles per hour to permit the maintenance of a suitable working temperature, moisture content or confined zone of operation.

6. The enclosure of claim 5, wherein a plurality of unit grids are used in abutting relationship, said side struts are in abutting relationship over a vertical column of said structural framework, said wind-im pervious, nonmetallic sheet is sufficiently wider than said unit grid to provide flaps on each side of said unit grid to permit securing of said flaps over abutting side members so as to form an essentially confined airspace and relatively leakproof enclosure under said normal wind conditions.

7. The enclosure of claim 5, wherein said winch means are adapted to position a plurality of abuttingly secured unit grids simultaneously.

8. The combination of claim 5 wherein said wind-im pervious non-metallic sheet comprises a synthetic resinous material.

9. The combination of claim 5 wherein said wind-im pervious non-metallic sheet is a canvas sheet impregnated with a polyolefin.

* * * * *