United States Patent [19]

Ballinger

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[45] **Feb. 13, 1973**

[54] FIRE PROTECTION APPARATUS FOR A BUILDING

[76] Inventor: **Virgil R. Ballinger,** P.O. Box 18948 Cimmaron Station, Los Angeles, Calif. 90018

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[52] **U.S. Cl.** **52/3**

[51] **Int. Cl.** **E04b 1/34**

[58] **Field of Search** .....52/3, 4; 150/52; 109/26, 1 S; 135/1 R

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Primary Examiner—John E. Murtagh

[57] **ABSTRACT**

Fire-resistant apparatus for covering and enclosing a building for protecting it from airborne firebrands, or the like, produced by a high-velocity fire storm. The enclosing apparatus includes flexible, thin-sheet cover means of fire-resistant or fire-retardant material which is usually in the form of several panel portions adapted to be edge-joined by junction means to provide a composite cover of a desired size and shape for protecting a particular building and which is then pulled into place covering the building with edges of the cover means being firmly fastened together and effectively sealed substantially completely around the building to adjacent ground surface portions by edge-fastening means so that the high-velocity winds produced by a fire storm will be substantially excluded and so that the fire-retardant character of the cover means will prevent the building from catching fire as a result of burning embers or firebrands being blown by the approaching fire storm onto the building (of course, with the protective fire-retardant cover interposed therebetween). The multi-panel cover means and the edge-fastening means and auxiliary fastening strap means provided for attachment thereof are so constructed as to be capable of being very quickly and relatively easily assembled and mounted in protective relationship over a building by a small crew of men when the building is threatened by an approaching fire storm.

16 Claims, 23 Drawing Figures

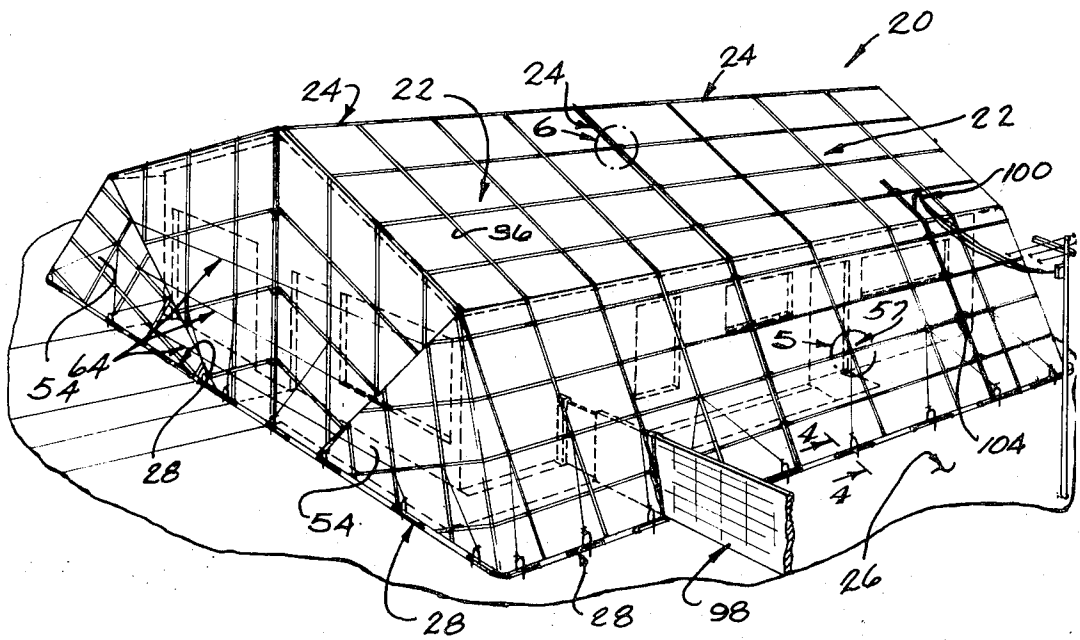
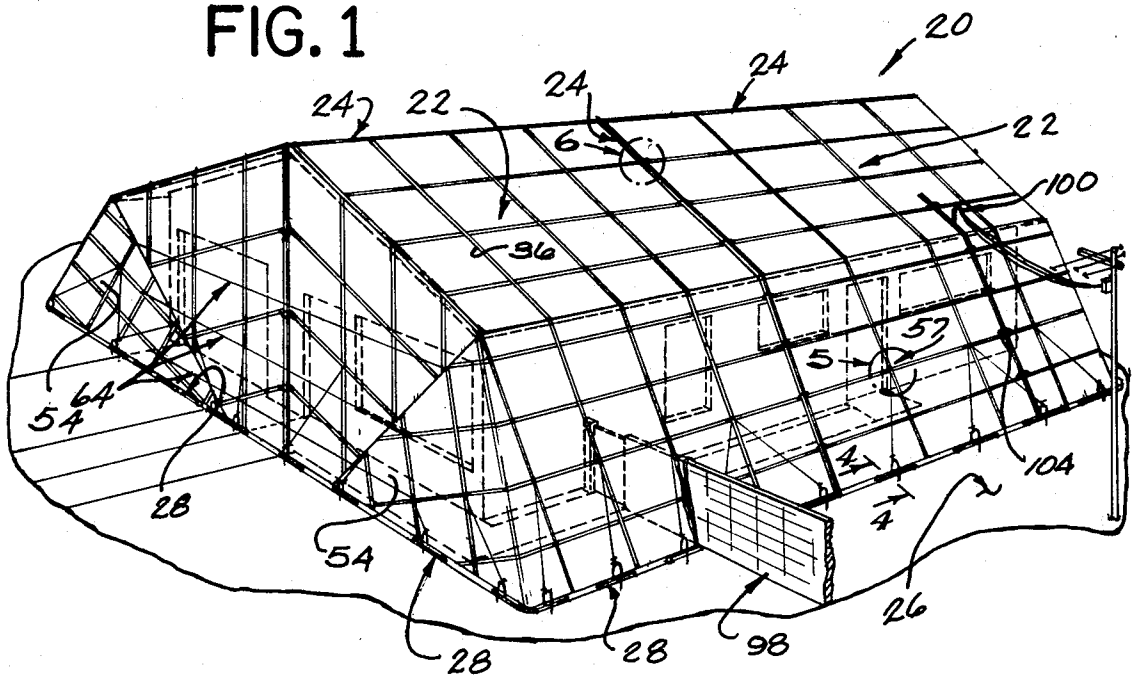


FIG. 1



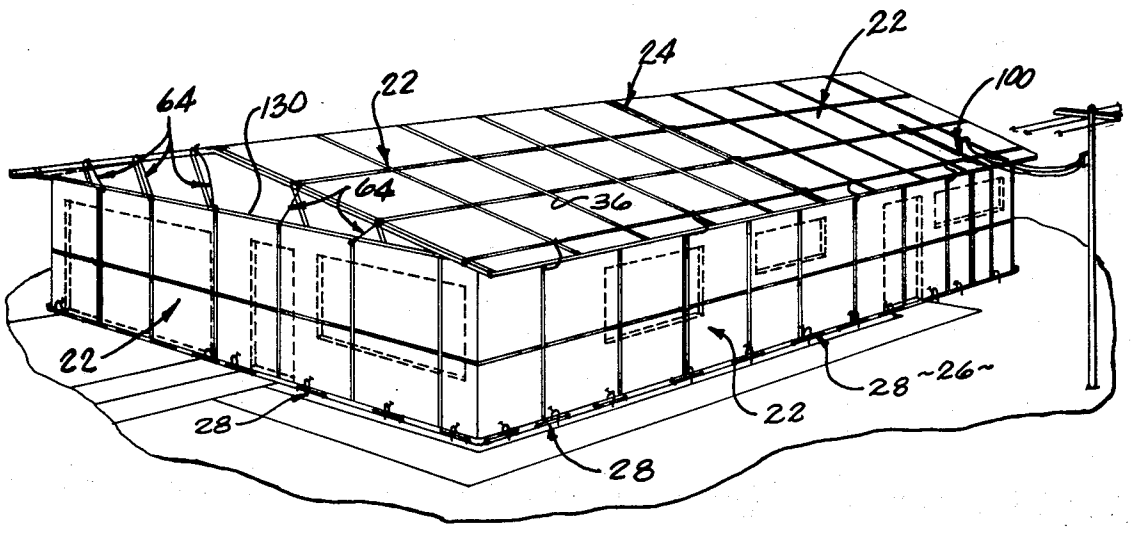


FIG. 2

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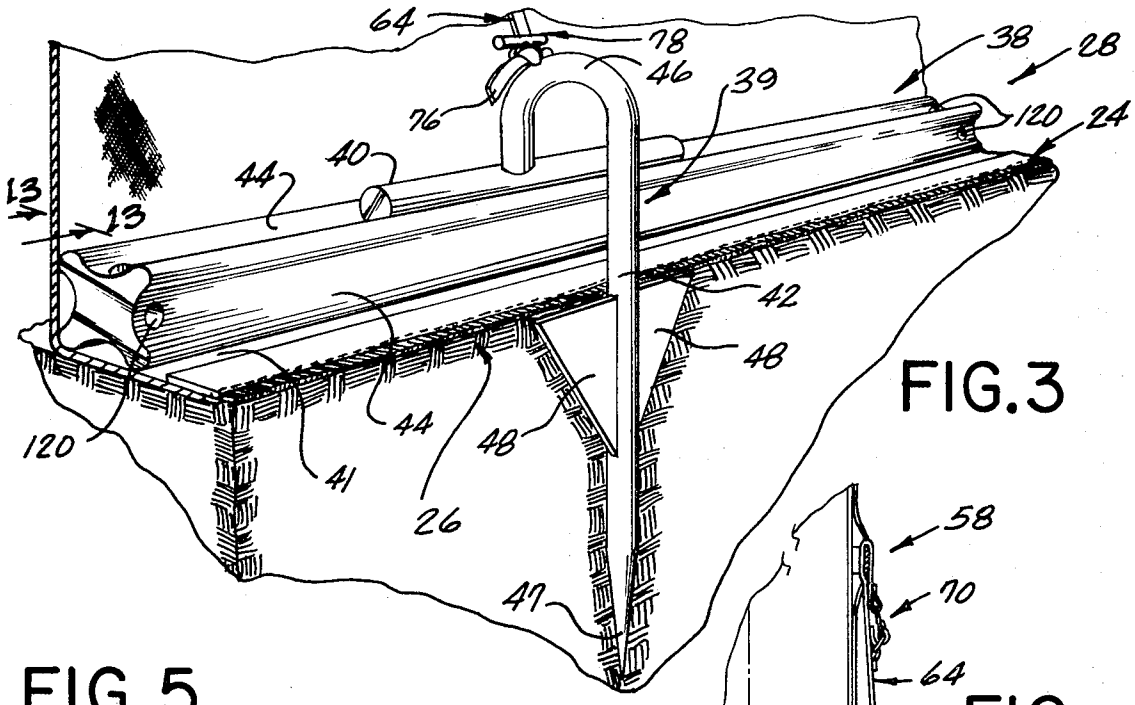


FIG.3

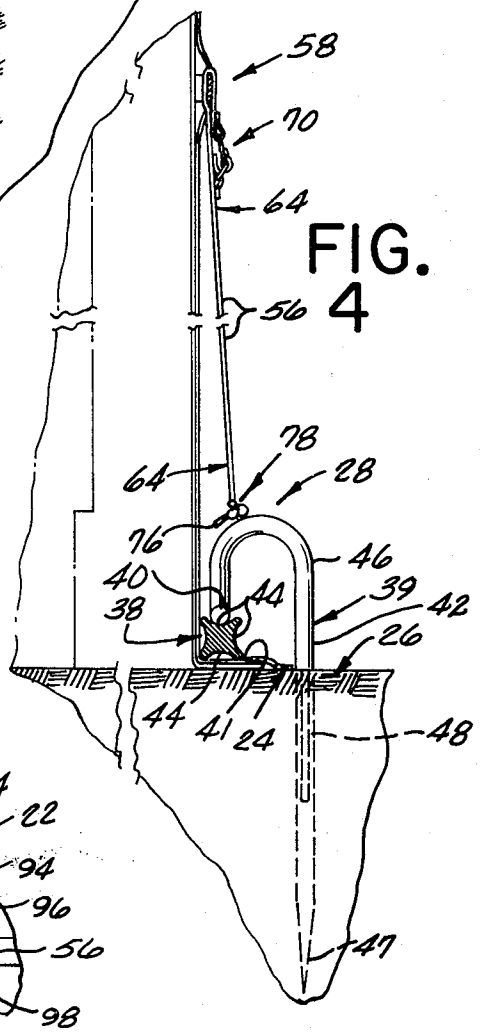
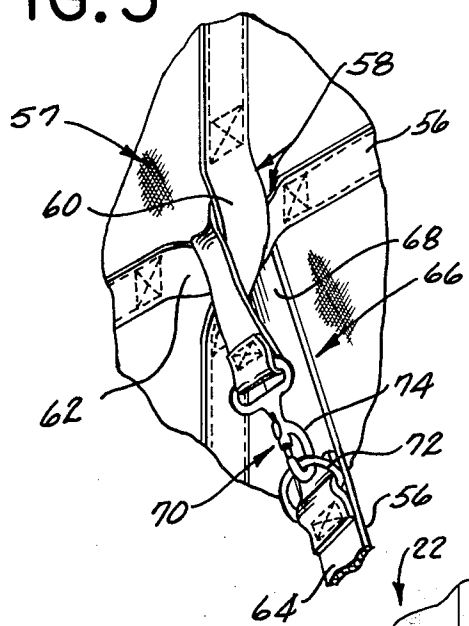


FIG. 4

FIG.5



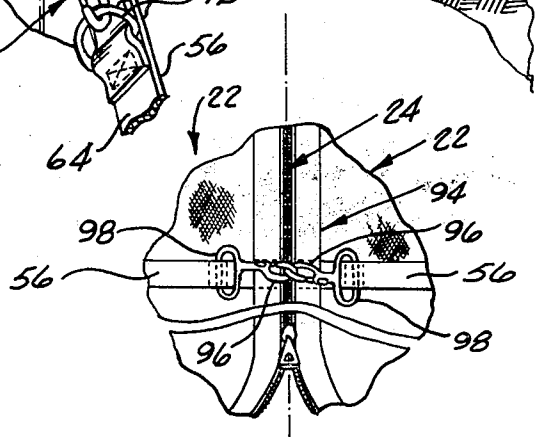
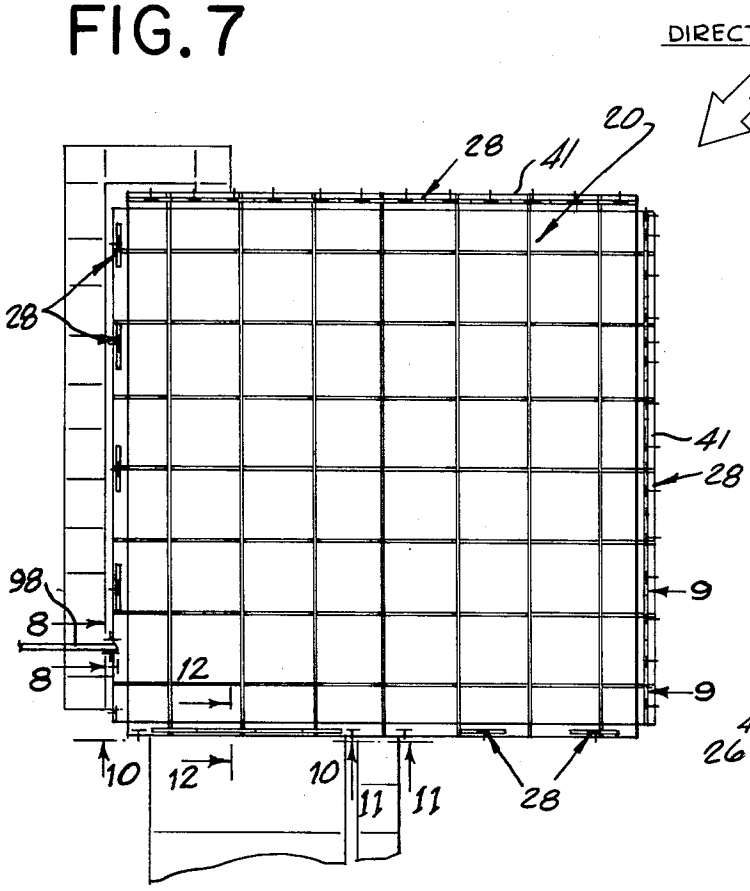


FIG.6

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FIG. 7



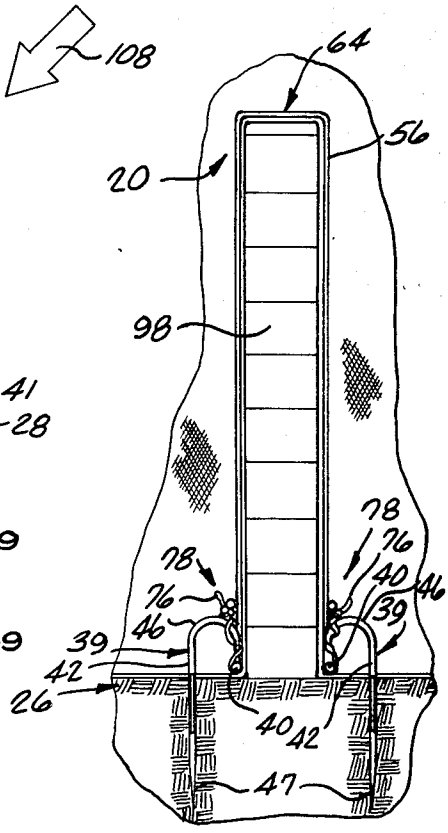


FIG. 8

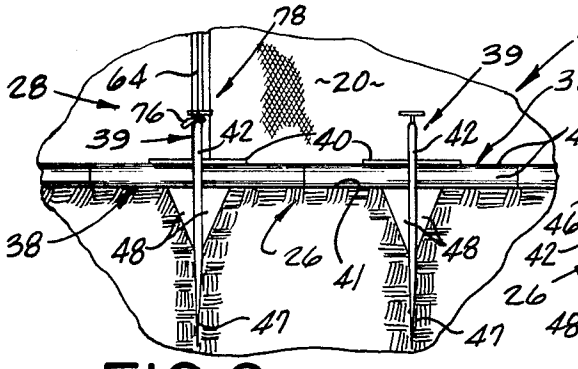


FIG. 9

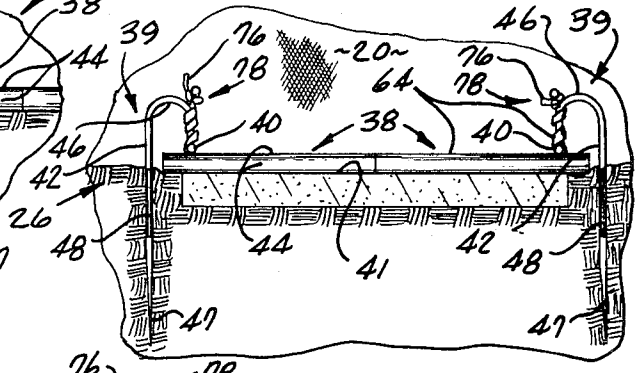


FIG. 11

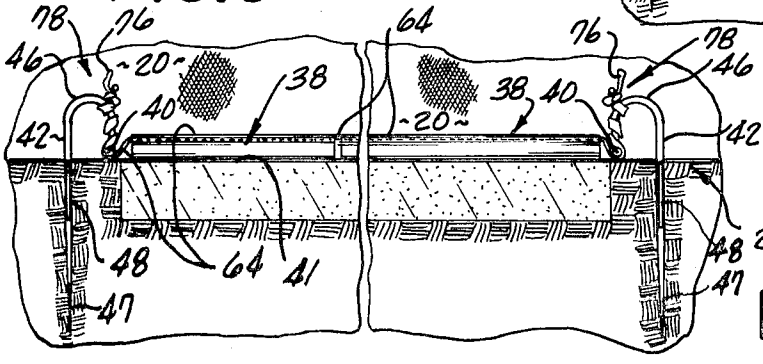


FIG. 10

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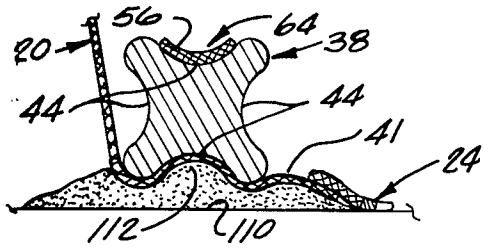


FIG. 12

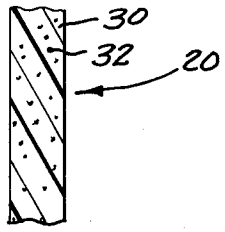


FIG. 13

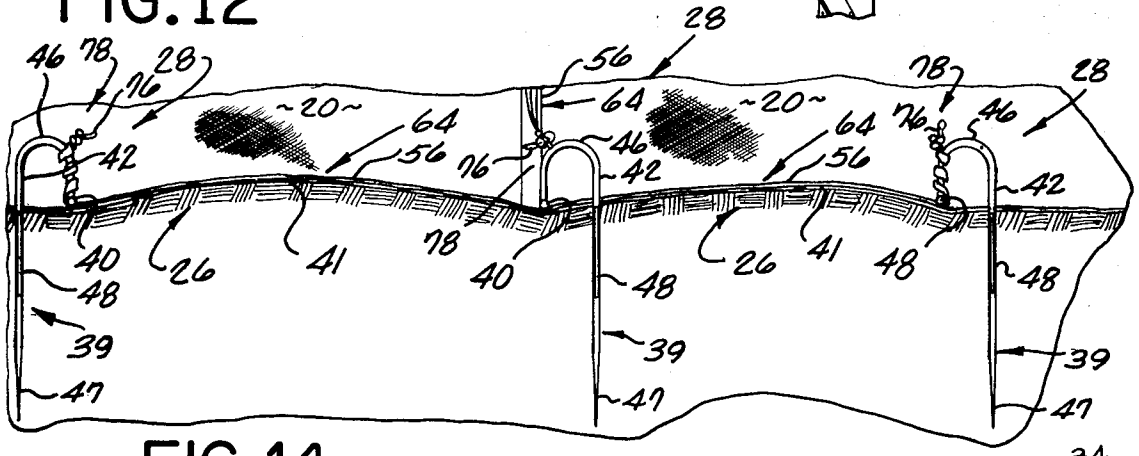


FIG. 14

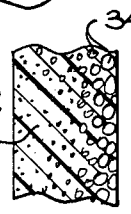


FIG. 13A

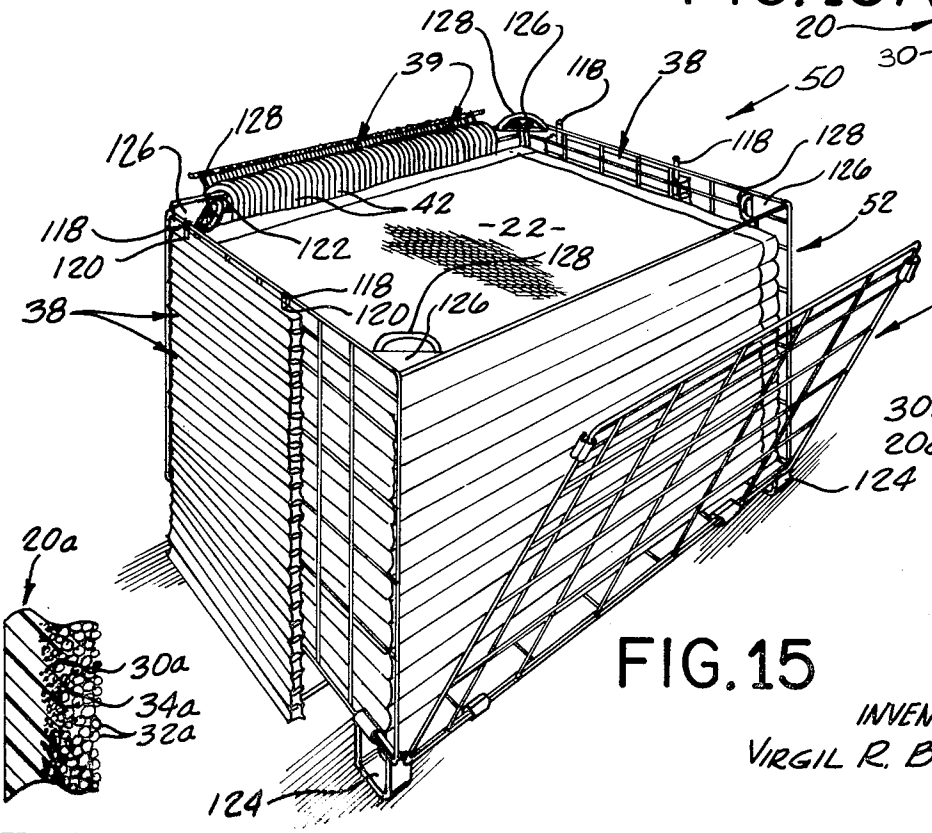


FIG. 15

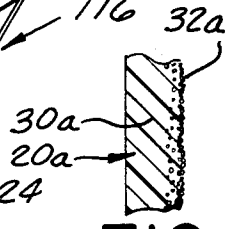


FIG. 13B

FIG. 13C

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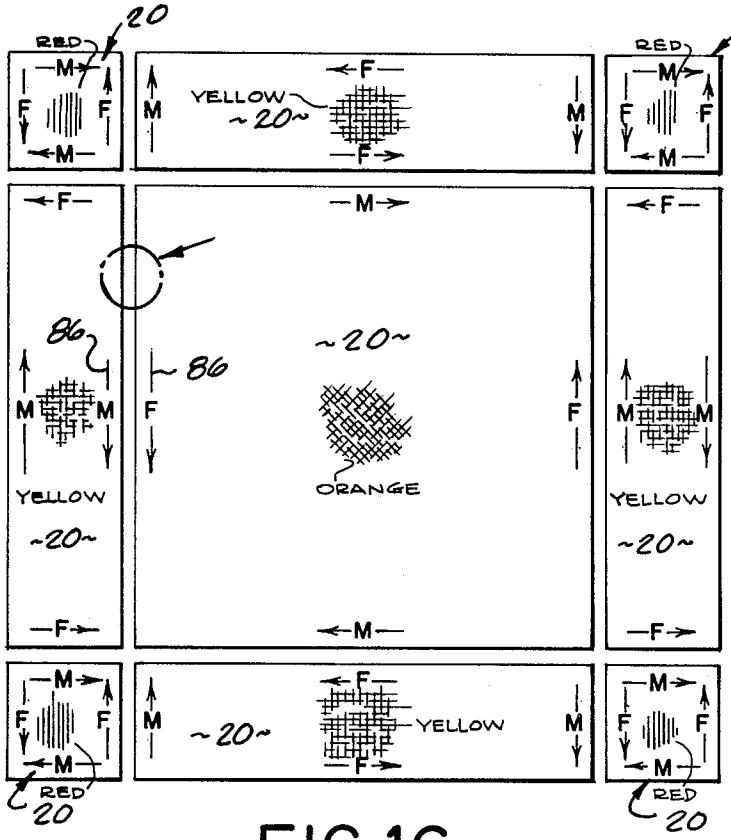


FIG. 16

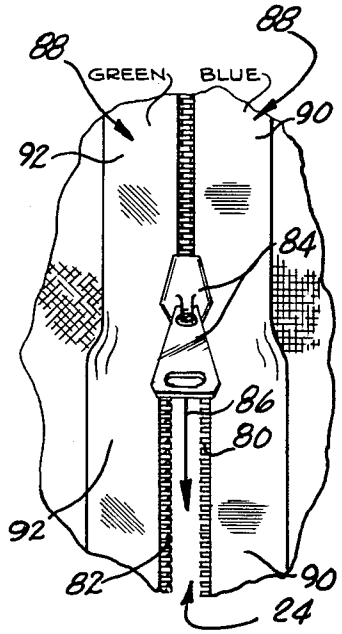


FIG. 17

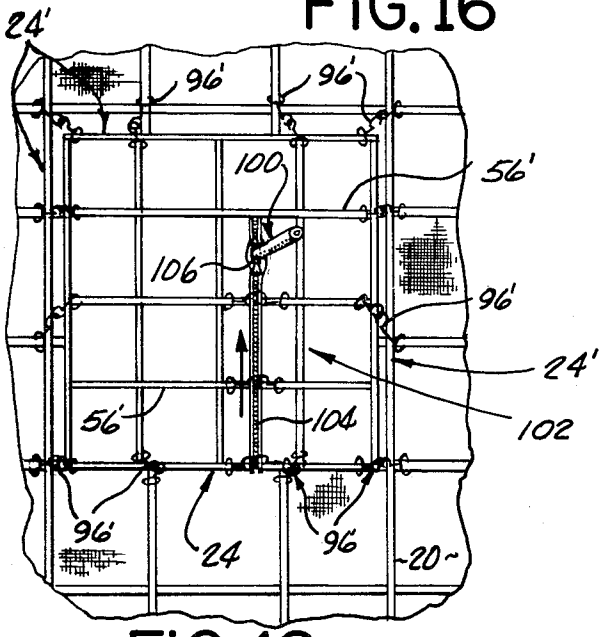


FIG. 18

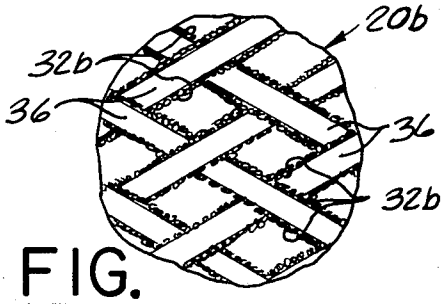


FIG. 13D

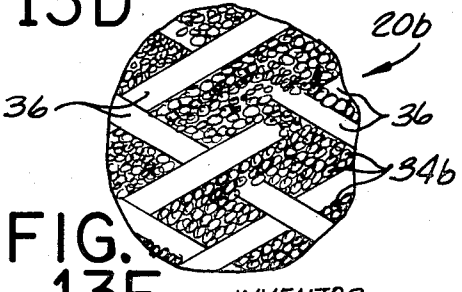


FIG. 13E

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FIRE PROTECTION APPARATUS FOR A BUILDING

SUMMARY OF THE INVENTION

When a major fire occurs, particularly in hilly or mountainous terrain which has brush and trees growing on portions thereof and which also has residential buildings in at least certain portions of the region, certain major problems in connection with controlling the rapid spreading of the fire are frequently encountered. Certain of these will be briefly detailed hereinafter.

Among the difficulties likely to be encountered under the circumstances outlined above is the fact that in such hilly terrain, very often inadequate water pressure is provided by the city, county, or other government agency in charge of the water system to allow much control of a major fire through the use of water — particularly by each individual homeowner who may be trying to protect his property from a rapidly approaching fire which may be of the type which move rapidly and generates substantial winds of its own and frequently will cause embers of the burning fire in one region to be airborne for long distances and to then be deposited on other combustible material and perhaps on the roofs of other homes. This type of fire is often called a fire storm and is extremely difficult to control because of the above-described self-spreading or self-disseminating nature of such a fire storm, which may lead to other fire storms starting at a number of different locations substantial distances away from the main or initial fire storm. One such fire was one which occurred in the 1960's in the suburb of Los Angeles known as Bel Air, where the fire spread to multiple locations by jumping large distances from one fire location to another as a consequence of the airborne travel of burning embers in the manner referred to above. In the past, efforts to prevent homes or other low-rise buildings, in regions adjacent to such a fire storm, from catching fire have consisted mainly of wetting down the entire roof of the home (which is frequently the most likely initial ignition region) with a garden hose, or the like, and also wetting down the sides of the home nearest to the fire storm. If adequate water pressure is available, this procedure is efficacious to a certain degree, but generally, under such fire storm conditions as outlined above, the water pressure will be found to be inadequate for the protective operation just described for any of several reasons. A first and major reason is the fact that many other homeowners will be attempting to do the same thing and, thus, the temporarily excessive demand for water will reduce the available water pressure to such low levels as to make such a wetting-down operation very difficult or virtually impossible to accomplish. A second major reason for the difficulty in properly using the above-mentioned prior art protective procedure is the fact that in mountainous or hilly terrain, the water-pressure situation is frequently marginal even when no fire is present and such a complete roof-wetting-down operation might be somewhat difficult to achieve even under normal, non-fire conditions and if the demand for water increases even slightly, the water pressure drops to a very low level and the water supply becomes totally inadequate for the type of wetting-down, fire protection operation described above.

The present invention is intended to solve the above-mentioned problem in a quite-different way. The method of the present invention is to send a crew in a truck, or the like, to quickly assemble and mount a complete home-enclosing fire-retardant cover over the residential building to be protected and to quickly, firmly fasten down to adjacent ground surfaces all edges of the thin-sheet, fire-retardant, protective cover means in a manner which will resist the action of high-velocity winds and will effectively prevent airborne burning embers or firebrands which might then strike the cover means enclosing the house and covering the roof thereof, from setting fire to the house. In this connection, it should be noted that such a fire-retardant cover can resist such burning embers or firebrands very much better than the material of which many residential structures are built — particularly the roofing material thereof. This is so because a great many residential structures having highly inflammable roofs, such as those made of wooden shingles, wooden shakes, and various other highly inflammable materials, will catch fire very quickly in a fire storm when a burning firebrand or ember lands on such a highly inflammable roof. The above statements are also true — although sometimes to a lesser degree — with respect to the siding and wall structure material of such a residential building which is frequently also very inflammable.

The cover means may be made of fabric, or fabric-like material, which, in certain forms, may itself be non-combustible, such as by being made of glass fibers, or the like, and may be impregnated or coated with chemicals of a fire-retardant nature such as, for example, certain fire-retardant materials which expand greatly in the presence of heat and, thus, produce what might be called a greatly enlarged or thickened layer of foam-like material with a very high percentage of hollow cells or voids which act as effective thermal insulators. This type of fire-retardant material is similar to that employed at airports by airport fire control crews for quickly smothering and choking out the flame of a burning airplane. Also, various other fire-retardant chemicals which release gasses, or the like, which inhibit combustion, may be employed for such coating or impregnating material. Such thermally responsive, volume-increasing, fire protection agents have also been employed in special-purpose fire protection coatings and paints and essentially the same theory of operation exists with respect to the protective heat shield construction employed on space vehicles to prevent them from burning up on re-entry into the earth's atmosphere, and any such fire protection agent having any of the characteristics outlined above may be employed in association with the thin-sheet protective cover means for imparting positive fire-retardant or fire-inhibiting characteristics of various different desired types thereto.

Generally speaking, the fire-resistant apparatus of the present invention comprises flexible, thin-sheet cover means of fire-resistant or fire-retardant or positive fire-inhibiting material having fasten-down edge portions and intervening or intermediate area-covering panel portions adapted to be placed over and in enclosing relationship with respect to a building (usually a residential building) which is to be protected from a high-

velocity fire. The fasten-down edge portions are effectively provided with edge-fastening means engageable with respect to adjacent ground surface portions for firmly and positively fastening down and substantially sealing the edge portion of the cover means with respect to the adjacent ground surface areas substantially completely around the building which is to be protected. In a preferred form, the edge-fastening means may comprise a plurality of longitudinal fastening bars and cooperating bar-to-ground fastening means having upper, downwardly facing, transversely extending, bar-engaging contact shoulder means adapted to be forced against corresponding receiving surface portions of corresponding parts of said fastening bars and also having substantially downwardly directed ground-penetrating (and usually pointed) stake means adapted to be driven into ground surface areas at appropriate locations spaced around a building which is to be protected so that the fastening bars will appropriately firmly hold down corresponding portions of the edges of the cover means substantially completely around the building.

In a preferred form, the protective cover is provided with a plurality of reinforcing and strengthening straps which may be jointed thereto in any suitable manner and may be spaced and directed in any desired pattern or manner, although in one particular preferred form, the reinforcing and strengthening straps are rectangularly arranged in a grid-like pattern with certain of the reinforcing straps crossing each other at predetermined, multiple, cross-over locations. The reinforcing straps are preferably provided with attachment means adapted to be fastened to corresponding ends of auxiliary fastening strap means having opposite ends adapted to be fastened to said edge-fastening means so that the entire protective cover can be firmly held down with respect to the ground surface around the building which is covered by and protected by the protective cover.

In a preferred form of the invention, the protective cover means comprises a plurality of panel portions, each provided with controllable engageable mating edge junction means for firmly fastening together adjacent edge portions of an assembly of such panel portions whereby to cause them to form a complete composite protective cover of a desired size and shape suitable for substantially completely enclosing and protecting a residential building lying within a predetermined range of sizes and shapes.

In a preferred form, the apparatus includes a plurality of edge junction bridging and reinforcing means preferably carried by opposed aligned end portions of the reinforcing strap means so that when the multiple panel portions of the protective cover means have their edge junction means joined together, unnecessary stress will be removed therefrom by the effective overriding bridging relationship of the strong edge junction bridging and reinforcing means.

A preferred form of the invention may also include edge junction coding and identification means carried by the panel portions in identifying association with the mating parts of the edge junction means carried thereby so as to provide quick identification thereof so that in assembling the multiple panels of the complete cover means, the proper edges can be placed adjacent to each other to allow for the necessary mating engagement of the separate parts of the edge junction means carried by said adjacent edges.

A preferred form of the invention may also include panel coding and identification means carried by each panel portion and corresponding to its size and/or shape (usually both its size and shape) whereby to provide quick identification of each particular type, size, and shape of panel during the initial assembly and edge-joining of same in protective relationship over a residential building which is to be protected from an approaching fire storm.

The apparatus may also include one or more special panel portions of the protective cover having an apertured and usually partially slotted portion provided with multiple edge junction means for effectively joining any desired length parts of the slotted portion at virtually any locations therealong so as to permit this particular panel portion to be used over a portion of a residential building's roof which has a projecting structure, such as the electrical input fitting, or the like, from an adjacent power line, with said projecting structure extending through any part of said slotted or apertured part of the panel, after which the multiple edge junction means can be operated so as to join substantially all remaining edges of the slotted portion together; said panel having fastening straps and/or fastening hook means for attaching same to other panel portions in said desired relationship.

OBJECTS OF THE INVENTION

With the above points in mind, it is an object of the present invention to provide a fire-resistant, fire-retardant or positive fire-inhibiting apparatus for covering a building (usually a residential building) for protecting it from airborne burning embers, firebrands, hot ashes, or the like, usually produced as a consequence of a nearby high-velocity fire storm.

It is a further object of the present invention to provide apparatus of the character referred to herein generically and/or specifically and which may include any or all of the features referred to herein, either individually or in combination, and which is of relatively simple, inexpensive, easy-to-manufacture, easy-to-assemble, and easy-to-mount construction suitable for ready mass manufacture and distribution of the apparatus in any of its several different forms at relatively low cost per unit, both as to initial capital cost (including production set-up costs, etc.) and as to the subsequent per-unit manufacturing cost, whereby to be conducive to widespread production, distribution, and use of the invention for the purposes outlined herein or for any substantially equivalent or similar purposes.

Further objects are implicit in the detailed description which follows hereinafter (which is to be considered as exemplary of, but not specifically limiting, the present invention), and said objects will be apparent to persons skilled in the art after a careful study of the detailed description which follows.

For the purpose of clarifying the nature of the present invention, one exemplary embodiment of the invention (showing it in several alternative forms of use, however) is illustrated in the hereinbelow-described figures of the accompanying drawings and is described in detail hereinafter.

FIG. 1 is a greatly reduced-size perspective view of one exemplary form of the present invention shown in fully mounted, covering, enclosing, and protecting relationship with respect to a residential building (a home) and with the edges of the protective cover firmly fastened down with respect to adjacent ground surface areas.

FIG. 2 is a view generally similar to FIG. 1, but illustrates the protective cover means assembled in a somewhat different relationship from that shown in FIG. 1 and illustrates it also as being in fully mounted, protective relationship with respect to a differently shaped residential building from that illustrated in FIG. 1.

FIG. 3 is an enlarged, fragmentary, partially broken-away, partially sectional view of a representative one of the plurality of edge engagement means firmly fastening down the edge of the protective cover in both FIG. 1 and FIG. 2.

FIG. 4 is an enlarged, fragmentary, sectional view taken substantially along the plane and in the direction indicated by the arrows 4—4 of FIG. 1.

FIG. 5 is an enlarged, fragmentary, partly broken-away, perspective view of that portion of the crossed reinforcing straps and the corresponding hold-down attachment means shown at the location enclosed in the small circle designated by the arrow and the number 5 of FIG. 1 and is to be considered as representative of the many such structures of the complete apparatus.

FIG. 6 is an enlarged, fragmentary view substantially as seen in top plan view, of a representative portion of the edge junction means joining the edges of the plurality of panels of which the complete protective cover is formed and of a corresponding representative one of the plurality of edge junction bridging and reinforcing means which takes the stress off of the edge junction means. The particular portion of the apparatus shown in FIG. 6 may be considered to be that portion of FIG. 1 enclosed within the small circle designated by the arrow and the number 6 of FIG. 1 although it should be clearly understood that in FIG. 6 the edge junction means, which is shown therein as comprising a mechanical fastener of the so-called "zipper" type, is partially open at the bottom of FIG. 6 merely for the purposes of providing a more full and complete disclosure in FIG. 6. However, at the location of FIG. 6 as shown in FIG. 1, said edge junction means is actually fully closed and the slider element of the mechanical fastener would be downwardly displaced to the extreme lower end of the edge junction means rather than being in the location indicated in FIG. 6. This is done for maximizing the extent of disclosure provided by this figure.

FIG. 7 is a top plan view of a somewhat diagrammatic and schematic nature illustrating a representative and, in this case, substantially square building protected by the protective cover means of the present invention and shows that the edge engagement means is preferably increased in number along the sides of the residential building adjacent to an approaching fire storm since this is the area where the greatest tendency for the high-velocity winds produced by such a fire storm to get under the edge of the protective cover and to possible strip it away from the residential building, will exist. This tendency is minimized by using more of the edge engagement means along said adjacent sides of the residential building.

FIG. 8 is an enlarged, fragmentary, partially broken-away, cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 8—8 of FIG. 7.

FIG. 9 is an enlarged, fragmentary, cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 9—9 of FIG. 7.

FIG. 10 is an enlarged, fragmentary, cross-sectional view taken substantially along the plane an in the direction indicated by the arrows 10—10 of FIG. 7.

FIG. 11 is an enlarged, fragmentary, partially broken-away, cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 11—11 of FIG. 7.

FIG. 12 is an enlarged, fragmentary, partially broken-away, cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 12—12 of FIG. 7.

FIG. 13 is an enlarged, fragmentary, cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 13—13 of FIG. 3 and illustrates one exemplary form which the fire-retardant thin-sheet cover may take.

FIG. 13A is a view similar to FIG. 13 but illustrates the representative sample of the fire-retardant protective cover after it has been subjected to heat and has undergone a substantial degree of exfoliation and expansion on the heated surface, such as to cause the production of a greatly thickened protective coating of material characterized by extremely low thermal conductivity, by reason of the high percentage of hollow cells and voids formed by the fire-retardant material as a consequence of the heating of same.

FIG. 13B is a view generally similar to FIG. 13, but illustrates the representative piece of the fire-retardant protective cover in a slightly modified form where the fire-retardant material is not substantially evenly disseminated throughout the matrix material, but instead is concentrated along one surface of the protective cover sheet and preferably on the outside thereof which will be most likely to be subjected to great heat in a fire storm.

FIG. 13C is a view similar in most respects to FIG. 13A but illustrating the modified form of the protective cover sheet material of FIG. 13B after it has been subjected to great heat and has undergone exterior exfoliation and expansion, primarily on the outer surface thereof so as to form a number of hollow cells and voids which greatly enhance the thermal insulation characteristic of the complete protective cover.

FIG. 13D is a fragmentary, partially broken-away view illustrating a further modification of a representative piece of the protective cover wherein it is of a fabric-like form made up of a plurality of strands of a non-combustible material (such as glass fiber strands, for example, although not specifically so limited) provided with the fire-retardant material and/or any necessary carrying matrix material either in a manner impregnating the non-combustible fabric or in a layer applied and coated on the surface of the fabric (usually on the outer surface thereof).

FIG. 13E is a view illustrating the modified form of protective cover material shown in FIG. 13D after it

has been subjected to great heat during a fire storm which, consequently, has caused the fire-retardant material and carrying matrix material to be effectively exfoliated and expanded so as to form a thickened thermal insulating blanket of great fire-protecting efficiency.

FIG. **14** is an enlarged, fragmentary, partially broken-away view similar in many respects to FIGS. **10** and **11** but illustrating the use of the edge-fastening means for fastening an edge of the protective cover to an uneven ground surface.

FIG. **15** is a greatly reduced-size perspective view illustrating one exemplary and highly advantageous storage unit for storing in a very convenient, accessible, small-space-volume configuration, all of the essential elements of the apparatus in a manner which allows same to be handled by a fork lift, a helicopter, or conventional truck for speed of assembling and mounting of the protective cover means over a residential structure which is to be protected.

FIG. **16** is a greatly reduced-size, diagrammatic, top plan view illustrating certain representative different sizes and shapes of the multiple panel portions which may be assembled to form the complete protective thin-sheet cover. In this particular somewhat diagrammatic illustration, one large square panel portion is shown, four rectangular panel portions are shown, and four small square panel portions are shown. However, the particular assembly or lay-out of panel portions shown in FIG. **16** has been chosen merely because it shows all of the different types of panel portions and, when arranged as illustrated, forms a square, overall panel configuration. It should be clearly noted that the invention is not specifically limited to a composite panel including the particular numbers and types of panel portions shown in FIG. **16**, which are merely representative. Also, it should be noted that the panel portions shown in FIG. **16** are in slightly separated relationship, although normally adjacent panel portions are joined together by the edge junction means, which is shown in FIG. **17** as taking the form of mechanical fastener means of the type commonly known as "zipper" fastener means. This separation of the panel portions in FIG. **16** is provided for reasons of drawing clarity and to clearly illustrate the separate status and individuality of each panel portion. However, it should be understood that, in actuality, when forming composite panel means, all of the adjacent edge portions will be joined together, in each case, by a zipper-type edge junction means such as is illustrated in FIG. **17**. Furthermore, in this view the arrangement of the mating portions of each edge junction means and the direction of engaging or edge-joining movement of the fastener element thereof is indicated by the letters "F" and "M" and the directional arrows for each of the individual panel portions. Additionally, the panel coding and identification means which identifies the type and size of panel so that no time will be wasted when assembling same into a composite cover for protecting a residential building from an approaching fire, is clearly shown in this view.

FIG. **17** is an enlarged, fragmentary, partially broken-away view of that representative edge-joint portion of a composite panel such as would be found within the circle and arrow indicated by the number **17** in FIG. **16**. However, it should be clearly noted that the particular zipper-type mechanical fastener means, comprising one representative form of edge junction means, which is shown in FIG. **17** in actuality would be fully engaged and edge-joined rather than partly edge-joined and partly not yet edge-joined, as shown in FIG. **17**, and additionally the fastener or slider element would not be at the location shown in FIG. **17**, but would be at the extreme lower end of the joined edges and, thus, completely out of view in FIG. **17**. FIG. **17** has been purposely modified in this respect so as to show it in the act of having the edges joined together by the edge junction means for purposes of providing a better disclosure in a single figure than would otherwise be the case. This view also shows the edge junction coding and identification means in one representative form thereof for use in facilitating the placing of joinable edges adjacent to each other very quickly when assembling the various panel portions into a complete composite cover for rapidly protecting a residential building from an approaching fire storm.

FIG. **18** is a fragmentary plan view showing a portion of a protective cover sheet positioned on a roof of a building structure with a special panel portion attached in such a way as to permit the passage through the composite protective cover of a projecting structure carried by the roof structure of the building such as an electrical input or electrical weatherhead, or the like, which is usually provided adjacent to the edge of a roof of a home and which is connected to an adjacent or nearby electric power line for supplying the home with electric power.

Generally speaking, the apparatus of the present invention comprises a fire-resistant cover thin-sheet material adapted to be placed over a building structure which is to be protected from airborne burning embers, firebrands, and the like, and further includes multiple-edge fastening means for positively and firmly fastening down edges of the cover to ground surface portions around the base of the building structure which is to be protected in a manner which will prevent the high-velocity winds which accompany a fire storm from getting under the edge of the cover and ripping it loose from its protective relationship over the residential building. In the example illustrated in FIG. **1**, a building of a certain representative and non-specifically limiting size and shape is shown within such a protective cover, which is generally designated by the reference numeral **20** and which is made up of four panel portions **22**, only two of which can be seen on the near side of the building (with the other two being similarly disposed on the opposite side of the building), with all of the four panel portions **22** being joined together along adjacent edges thereof by edge junction means, indicated generally at **24**, and with three of the four sets of such edge junction means being visible in FIG. **1** on the near side of the residential building and along the front and rear ridge portions of the building. It should of course be understood that a fourth part of said edge junction means extends down the rear side of the residential building in a manner similar to that bisecting the roof and near side of the building in FIG. **1**.

All of the outer edges of the composite protective cover **20** formed of the four panel portions **24** comprise what might be termed fasten-down edge portions which

are positively firmly fastened down and substantially sealed to underlying portions of a ground surface, indicated generally at **26**, by multiple-element edge fastening means, indicated generally by the reference numeral **28**, thus providing a firmly fastened-down, enclosing, protective cover over the entire building so that airborne firebrands or burning embers which might otherwise land on a highly combustible roof of the building will now land on the protective cover **20**, which is made of a fire-resistant, fire-retardant, or, in some cases, a positive fire-inhibiting material so that said firebrands or burning embers will not set fire to the protected residential building and will burn themselves out while lying on the fire-retardant cover **20**.

At this point, a word about the nature of the fire-retardant material forming the cover **20** appears to be in order, and reference is made to FIG. **13** showing an enlarged, fragmentary, cross-sectional view of one form thereof wherein it is made of a fire-retardant or non-combustion supporting matrix material **30** which, in a preferred form, may have disseminated therethrough fire-inhibiting material indicated at **32** and which may be in the form of multiple particles or, in any other desired form, disseminated throughout or mixed in the matrix material **30** or, if desired, merely coating the exterior thereof and being of a nature such as to release gasses or vapors which inhibit combustion or which cause major exfoliation and expansion whereby to produce a vastly greater volume of material in response to the application of heat, with said material being of what might be termed a foam type having a high percentage of hollow cells or voids dispersed therethrough and, thus, providing extremely efficient thermal insulation characteristics in addition to being non-inflammable itself. The major thermal insulation characteristic just mentioned is extremely important because, even if the protective cover **20** is itself non-inflammable, the underlying roof surface of a residential building, if of highly inflammable material itself, such as wooden shingles, wooden shakes, or the like, may become heated by reason of the transmission of heat through the cover **20** thereto to a degree such as to cause it to become ignited and burn. However, the substantial thermal insulation characteristics of the cover mentioned above will, in most cases, completely prevent this from occurring.

FIG. **13A** illustrates in fragmentary, greatly enlarged, cross-sectional form the heat-caused exfoliation of the particular type of protective cover member material just described, with the multiplicity of insulating cells being designated by the reference numeral **34**.

FIG. **13B** illustrates a slight modification of the FIG. **13** form wherein the fire-retardant material, such as that shown at **32** in FIG. **13**, is not disseminated throughout the matrix material in the manner shown in FIG. **13**, but is carried largely by a surface of the matrix material, which, in this case, is designated by the reference numeral **30*a*** while the fire-retardant material is designated by the reference numeral **32*a***. It should be understood that the fire-retardant material **32*a***, while substantially carried along one surface of the cover **20*a***, may also have a certain amount of matrix material associated with it to facilitate the forming of enlarged hollow cells in response to the application of great heat in the manner indicated in FIG. **13C** wherein the enlarged hollow cells are indicated by the reference numeral **34*a***.

FIG. **13D** is a fragmentary view illustrating another slight modification of the material forming the protective cover, which, in this case, is of a woven or fabric form made of multiple strands of non-combustible material, such as glass fiber, or the like, although not so limited, with each of said strands being designated by the reference numeral **36** and with the entire protective cover being designated by the reference numeral **20*b***. The fabric of the protective cover **20*b*** is either coated or impregnated with fire-retardant material functionally similar to that shown at **32** in FIG. **13**, **32*a*** in FIG. **13B**, and **32*b*** in FIG. **13D** and may, if desired, be associated with a suitable matrix material impregnating or coating the fabric or may be independently provided in either or both of such relationships with respect to the fabric. Thus, the woven or fabric form illustrated at **20*b*** may function in either the manner of the FIG. **13** form or the FIG. **13*b*** form or both of same essentially.

It should be clearly understood that the various representative showings of different types of fire-retardant, fire-resistant, and/or positive fire-inhibiting materials illustrated are merely representative of many possible forms thereof, all of which are intended to be basically included and comprehended within the broad scope of the present invention.

Also, it should be noted that the fire-retardant material need not be limited to an exfoliation function for increasing the percentage of hollow space for increased thermal insulation characteristics, but may also be of a character such as to release gasses or vapors which positively inhibit or extinguish fire. Either or both of such arrangements of the fire-retardant material are contemplated within the scope of the present invention.

The exemplary form of the invention illustrated shows the edge-fastening means **28** as comprising, in each case, a longitudinal fastening bar, such as is generally designated by the reference numeral **38**, as best shown in FIGS. **3** and **4**, and additionally comprising a cooperating bar-to-ground fastening means, indicated generally at **39**, including an upper, downwardly facing, transversely directed bar-engaging contact shoulder means **40**, taking the form of a transversely directed length of rod, and also including a substantially vertically downwardly directed, ground-penetrating stake means **42**. Each such longitudinal fastening bar **38** of the plurality of such bars is provided with a contact portion for receiving the forceful, downwardly directed contact of the transversely directed rod **40**, comprising the contact shoulder means, so that the entire longitudinal fastening bar **38** may be forced into firm sealing engagement with respect to the fasten-down edge portions **41** of the protective cover **20** relative to the underlying ground surface portion **26**.

In the example illustrated, each of the longitudinal fastening bars **38** is cross-sectionally of a substantially rectangular shape (actually, square shape in the example illustrated) having four sides provided with four corresponding longitudinal groove means, each comprising one of the contact portions **44** referred to hereinbefore and adapted to receive the rod-shaped contact shoulder **40** therein when in the proper up-

wardly directed position. In other words, the arrangement is such that any such longitudinal fastening bar **38** may be positioned with any of the four sides thereof, and the corresponding contact groove **44**, facing upwardly so as to receive the transversely directed rod **40** therein in the manner clearly shown in FIGS. **3** and **4**, after which the entire ground-penetrating pointed stake **42** is forced downwardly into the ground surface **26** to whatever extent is deemed necessary to firmly fasten the corresponding fasten-down edge portion **41** of the protective cover **20** to the underlying ground surface portion **26**.

In the example illustrated, each rod-shaped contact shoulder means **40** is connected to the downwardly directed stake means **42** by a reversely curved, centrally positioned, neck portion **46**, and the shaft part of each ground-penetrating stake means **42** is provided with anvil means for facilitating the penetration of the pointed end **47** of the stake means **42** into the ground surface portion **26**. In the example illustrated, said anvil means comprises a pair of oppositely positioned abutment shoulders or projection members **48** having horizontally directed top edges adapted to receive a downwardly directed force thereon for driving the point **47** into the ground surface **26**. This may comprise the pressing of one's foot against the upper edges of the projection members **48** to force the stake **42** downwardly, or a sledge hammer, or the like, may be impacted against the upper edges of the projection members **48** for the same purpose. Also, the reversely curved neck portion **46** may effectively comprise such an anvil means and may be used for such force-receiving purposes to facilitate penetration of the pointed end **47** into the ground surface **26**.

In actual use, an entire kit or unit containing the various different elements of the fire protection apparatus of the present invention is delivered to a position adjacent to a house which is to be protected. Such an assembly or kit of all such elements is generally designated by the reference numeral **50** in FIG. **15** and may be carried on a truck or delivered by a helicopter equipped with cables and a lowering hoist, or the like, and after the delivery of the entire basket or kit **50**, the various panel portions of the complete protective cover **20** which it is desired to assemble and place over a residential building, such as that shown in FIG. **1**, for the purpose of protecting same from burning embers or firebrands produced by an approaching fire storm, are removed from the welded-rod basket **52** and are either edge-joined together on the ground by the edge junction means **24** or are hoisted into place with respect to the residential building and edge-joined to adjacent similarly hoisted-into-place panel portions. The best way to accomplish the above is to use a truck with a hoist or winch which can be positioned on the opposite side of the house from the protective cover or portion thereof which is to be pulled into place so that tension can be applied to a cable passed over the roof of the house and connected to the edge of the protective cover on the opposite side of the house, which will lift the cover into place, or this may be done manually. The mounting operation may be facilitated by the use of temporary rope-supporting struts, boom means and/or pulleys engageable with appropriate roof or edge portions of the house or adapted to engage the ground surface and to extend upwardly alongside of the house to an appropriate elevation for functioning as a rope-supporting pulley temporarily during the positioning operation just described in part. In any event, as soon as the entire protective cover is properly positioned over the house, the fasten-down edges **41** thereof are firmly fastened to the corresponding parts of the ground surface **26** through the use of multiple units of the edge-fastening means generally designated by the reference numeral **28**, and one of which has just been described in detail hereinbefore. Of course, any excess parts of the protective cover **20** which may be left over as a consequence of the difference in shape of the building structure to be protected and the protective cover **20** may then be folded into appropriately overlapped relationship so as to provide a relatively close-fitting engagement around the exterior of the building structure, as is clearly shown in FIG. **1**. Two such folded-back portions are indicated by the reference numeral **54** in FIG. **1** wherein two such end flaps are shown at the near end of the house and are representative of the other two which are positioned at the opposite end of the house. Said folded-back end flaps **54** may be fastened into place partly by the bottom engagement thereof by corresponding edge fastening means **28** of the type previously described in detail and/or by additional hook or strap-like fastening of inner edges thereof to each other or to other parts of the protective cover or to any other suitable fastening or attachment means.

The protective cover is provided with a plurality of reinforcing and strengthening straps, such as indicated at **56**, effectively joined thereto at a plurality of spaced locations and in a predetermined pattern which usually includes an arrangement such that certain of the reinforcing straps **56** cross each other at predetermined, multiple cross-over locations, such as indicated at **57**, for exemplary purposes and in a predetermined, corss-over, angular relationship which is a perpendicular, angular, cross-over relationship in the exemplary form illustrated, although not specifically so limited. The reinforcing strap means **56** may be effectively connected to the corresponding portions of each of the protective cover panel portions **22** by being sewn thereto or by being attached thereto by appropriate adhesive means or connected thereto in any other suitable manner.

The reinforcing strap means **56** are effectively provided with attachment means at the cross-over locations **57** (usually at all of same, although, in certain forms of the invention, certain of the cross-over locations may be excluded) with said attachment means being adapted to be connected to a first connection means or end of a corresponding auxiliary fastening strap means **64** which may have its opposite end, effectively comprising a second connection means, cooperative for taut connection thereof with respect to said bar-to-ground fastening means **39** of the edge engagement means **28**.

A typical one of said attachment means is generally designated by the reference numeral **58** as best shown in FIG. **5** and comprises a pair of crossed reinforcing strap loops **60** and **62** OF the reinforcing straps **56** at a corresponding one of the cross-over locations **57**. In fact, in a preferred form of the invention, such a hold-down attachment means **58** is located at each cross-

over region although the invention is not specifically so limited in all forms thereof.

The above-mentioned attachment means **58** is, in each case, adapted to be fastened with respect to a corresponding one of the plurality of edge-fastening means **28** by an auxiliary fastening strap means, such as is generally designated by the reference numeral **64**, which is shown as being of flat, high-tensile-strength fireproof material having a first connection means, such as is generally designated by the reference numeral **66**, at an upper end thereof and cooperative for engagement with any individual one of the plurality of first-mentioned attachment means **58**. In the example illustrated, each of said first-mentioned connection means **66** comprises an end-positioned loop portion **68** of the strap or webbing material provided with a two-element, controllably connectible fastening hook means **70** having first and second hook elements **72** and **74** carried by a corresponding end of the strap member **64** spaced apart by said end-positioned loop portion **68** and of a controllably openable and closable nature so that said manually operable hook portion **74** can be passed through the twin holddown attachment loops **60** and **62** and can then be fastened with respect to the fastening ring **72** in the manner best shown in FIG. **5** for positively connecting said first connection means **66** to said first-mentioned attachment means **58**. The arrangement is such that the connection means **66** can be readily disengaged from the attachment means **58** by merely manually opening the engagement hook **74** and disengaging it from the attachment hook member **72** and then removing the loop portion **68** from the attachment loops **60** and **62**.

A second type of attachment means is also provided for the opposite ends of the plurality of auxiliary fastening strap means **64** and, in the exemplary form of the invention illustrated, said second-mentioned attachment means is carried by the bar-to-ground fastening means **39** of each of the edge-fastening means **28** and, in general, may be said to comprise any accessible upper part of the complete bar-to-ground fastening means **39** around which the opposite or free end **76** of each such fastening strap **64** may be wound, looped, tied, or otherwise fastened. In the exemplary form illustrated, said second-mentioned attachment means includes an attachment bracket member, such as is generally designated by the reference numeral **78** and which is of substantially T-shaped configuration to facilitate the tying of the free end **76** of the attachment strap **64** thereto in a manner such as is best shown in FIG. **3**. However, it should be clearly understood that the free end **76** of the fastening strap **64** may be wrapped around the rod-shaped shoulder **40** or around the reversely curved neck **46** or attached with respect to the bar-to-ground fastening means **39** in any other suitable manner, or in any combination of the manners just indicated, and all such arrangements are intended to be included and comprehended within the scope of the present invention.

As previously mentioned, each of the panel portions **22** of the complete composite protective cover **20** shown in FIG. **1** is provided with edge junction means, such as generally designated at **24**, including mating sets of first and second junction elements of two different types (usually of what might be termed a male type or a female type) carried along corresponding joinable edges of each of the panel portions which are to be joined together to form the desired composite, complete, protective cover in any particular desired size or shape within the possible range of variation thereof provided by the number of such different sizes and shapes of panel portions initially supplied in the basket **52** of FIG. **15** (or otherwise supplied). In the diagrammatic showing of FIG. **16**, each female set of first junction elements is marked with the letter F while each male set of second junction elements of the mating sets thereof is marked with the letter M, and each of said sets of first and second junction elements (male and female) carried by each adjacent joinable edge is shown in FIG. **16** with a directional arrow indicating the direction of joining movement of a mechanical slider element of a mechanical fastener type of edge junction means of the kind commonly known as a "zipper" fastener. Such a fastener is illustrated in its actual physical appearance in FIG. **17** and is to be clearly understood as merely being representative of one type of edge junction means which may be employed.

It should be noted that various numbers, sizes, and shapes of panel portions may be provided as thought necessary for the purpose of being selectively combined into virtually any desired size and shape of composite panel for protecting virtually any size and shape of residential building. However, in FIG. **16** certain representative types of sizes and shapes of panel portions which have been found very effective and useful for forming a number of different sizes and shapes of composite cover suitable for protecting most residential buildings are shown. These comprise the four somewhat square panel portions **22** shown in FIG. **16** and each of which is, in one representative form, of a 12 feet by 12 feet size, although not specifically so limited. Lying between each of the four corner-positioned, small, square panel portions **22** are rectangular panel portions **22**, each of which, in the example illustrated, is 12 feet by 48 feet long, although not specifically so limited. The central panel portion **22** shown in FIG. **16** is a large, square panel portion 48 feet by 48 feet, although not specifically so limited. Normally, a selected number of each type of panel portion will be supplied in a kit or basket such as that shown at **52** in FIG. **14** and each of the different sizes, shapes, and/or types of panel portions will be provided with panel coding and identification means, such as being differently colored, for the purpose of making it possible to very quickly identify each different size, shape, or type of panel portion when it is being removed from the basket **52** of FIG. **15** and is being very quickly assembled and hoisted into place over a residential building which is to be protected from a rapidly approaching fire storm. As an example only, it should be noted that the central large 48 feet by 48 feet square panel portion **22** of FIG. **16** is colored orange, which comprises its particular coding and identification means, while each of the four 12 feet by 48 feet rectangular panel portions is colored yellow, which comprises its individual coding and identification means, and each of the four small square 12 feet by 12 feet corner panel portions is colored red, which comprises its individual coding and identification means. However, various other types of coding and identification means may be employed.

The zipper-type edge junction means **24** shown in detail in FIG. **17** includes a female set of junction elements **80** and a male set of junction elements **82** which are adapted to be mated and engaged together by the slider element **84** when it is moved in the engagement direction, such as indicated by the twin arrows **86** of FIG. **16** or the single arrow **86** of FIG. **17**. Conversely, when the slider element **84** is moved in the direction opposite to said arrows **86**, it disengages and separates the male and female elements **82** and **80**.

A preferred form of the invention also includes edge junction coding and identification means carried by the panel portions **22** of the protective sheet **20** in identifying association with the corresponding mating male and female junction elements, such as the male junction elements **82** shown in FIG. **17** and the female junction elements **80** shown in FIG. **17**, which are to be considered as representative of all such edge junction mating sets of elements. As illustrated in exemplary form in FIG. **17**, the edge junction coding and identification means is indicated at **88** and comprises the colored strips **90** and **92**, which are shown as being blue and green, respectively, although not specifically so limited.

The idea then is that when the initial rapid assembly of the various desired panel portions into a complete composite panel **20** and the hoisting of same into protective relationship over a residential building is to be accomplished quickly before an approaching fire storm gets too close, the persons assembling and positioning the panel portions will merely follow the rule, which is to always place a blue edge adjacent to a green edge, which will of course properly place male and female edge junction means portions adjacent to each other for quick edge joining thereof.

Also, it should be noted that, in the exemplary arrangement illustrated, all of the female edge junction element sets indicated by the letter F in FIG. **16** and physically shown at **80** in FIG. **17** are of a kind adapted to be engaged by movement of a slider, such as that shown at **84**, in a counter-clockwise direction relative to the center of the corresponding panel portion, while all of the male edge junction element sets indicated by the letter M in FIG. **16** and such as physically shown at **82** in FIG. **17** are arranged to be engaged with respect to the corresponding female junction element sets in response to movement of a slider, such as that shown at **84** in a clockwise direction relative to the center of the corresponding panel portion.

In the example illustrated in FIG. **16**, the edge junction means portions of any particular panel portion are arranged in a manner such that opposite edges have the same kind of edge junction means portions. That is, directly opposite edges will have either female junction element sets or male junction element sets, while the other pair of 90° displaced junction element sets will, in each case, both be of the other type — that is, both male junction element sets or both female junction element sets, as is clearly illustrated in FIG. **16**.

The above-described exemplary arrangement is such that irrespective of how the panel portions are assembled, provided that the blue and green edge junction coding and identification means are always positioned adjacent to each other, it will be found that the adjacent junction elements will always be of the opposite type and adapted to be closed by movement of a slider element such as that shown at **84** in the same direction so that they can be quickly and easily joined together. However, it should be noted that the invention is not specifically limited to the use of zipper-type edge junction means in all forms thereof. Hooks and eyes, buttons and buttonholes, snap fasteners, hook fasteners, and intermeshing fasteners of the type known as "Velcro" fasteners, any other type of mechanical fasteners, magnetic fasteners, electrostatic fasteners, adhesive and/or cohesive fasteners, or any other substantially functionally equivalent form of fasteners may be employed in lieu thereof. Also, various other forms of coding and identification means may be employed.

The protective cover means **20** is provided with a plurality of edge junction bridging and reinforcing means, such as the representative one shown in FIG. **6**, which is generally designated by the reference numeral **94** and which, in each case, is adapted to be placed in effective overriding, bridging, edge-junction-strengthening relationship with respect to a particular location along a particular pair of joined edges of adjacent panel portions of the protective cover **20** by passing over the corresponding part of the joined edge junction means **24** so as to remove excessive stress therefrom and to effectively transfer stress or load from one panel to a adjacent panel quite independent of the edge junction means **24**.

In a preferred form, each of said edge junction bridging and reinforcing means **94** comprises a two-element means including controllably engageable and disengageable first and second elements which are usually hook means, although not specifically so limited in all forms of the invention, and with said first and second elements being firmly attached to corresponding end portions of corresponding ones of the previously mentioned reinforcing straps **56**. One such representative arrangement is clearly shown in FIG. **6** wherein the two elements of the edge junction bridging and reinforcing means **94** comprise first and second hook members **96**, each of the controllably openable and closable type and with each having an attachment ring **98** at its rear end attached in a structurally strong manner to the end of the corresponding reinforcing strap **56** carried by the corresponding different one of the two panel portions **22** of the protective cover **20**. This provides an arrangement which allows the two hooks **96** to be very easily connected together across the zipper edge junction means **24** in a manner substantially removing stress therefrom.

It should be noted that in the exemplary form of the invention illustrated in FIG. **1** in mounted relationship over a residential building, there is such an edge junction bridging and reinforcing means in each location where transversely directed, aligned reinforcing straps **56** meet a joined edge junction means **24**, such as along the complete length of the centrally positioned edge junction means **24** of FIG. **1** containing the representative edge junction bridging and reinforcing means **94** positioned within the small portion of the apparatus enclosed within the circle designated by the arrow and numeral **6** at each location where said edge junction means **24** effectively crosses or passes between transversely aligned ends of the reinforcing straps **56**. Also, there is such an edge junction bridging and reinforcing means **94** at each location along the ridge pole portion

of the cover **20** where any of the reinforcing strap ends **56** (directed transverse to the ridge pole direction) meet each other on opposite sides of the ridge pole location. The same is true with respect to the opposite side of the protective cover **20** on the opposite, unseen side of the residential building of FIG. **1**.

Incidentally, it should be noted that the fold-back end flaps **54** may be fastened down entirely by the edge fastening means **28** or certain of the auxiliary straps **64** may be attached to the attachment means **58** thereof in a manner similar to that illustrated in FIG. **5** and described hereinbefore, and opposite ends of the straps **64** may be tied to any suitable holding member such as any other attachment loop means such as that shown at **58** in FIG. **5** or free ends of the straps **64** may be tied to each other or to any portion of the building structure or any adjacent structure. Additionally, the hook means **96** may be employed for aiding or facilitating in the fastening of the end flaps **54** in a desired taut relationship.

It should be noted that various obstacles or structures around the building need not interfere with the effective wrapping or enclosing of the building within the protective cover **20**. For example, the fence **98** shown in FIG. **1** and which effectively is the same as the diagrammatic fence **98** shown in FIGS. **7** and **8**, may have the edge of the protective cover **20** passed vertically thereover and may then pass under abutment shoulders **40** of two of the bar-to-ground fastener means **39** positioned on each side of the fence **98** and a fastener strap **64** may be drawn over the fence **98** and the edge of the cover **20** and tied to the attachment means **78** of each of the two bar-to-ground fastener means **39**, usually after having been wrapped around the corresponding rod-shaped shoulder **40** a few times before similar wrapping around a part of the curved neck **46** and then being tied to the attachment means **78**. When this is done and each of the two bar-to-ground fastening means **39** is driven downwardly into the upper surface of the ground **26**, it will be found that a very effective sealing of the edge of the cover **20** relative to the fence **98** has been achieved.

Also, wherever the roof of the building has a necessary projecting structure which cannot be temporarily removed to facilitate the placing of the protective cover **20** over the building, special panel portions to allow such a structure to pass therethrough while maintaining a tight seal therearound are provided. One such arrangement for allowing an electrical input from a nearby electric power line to remain in position with respect to the roof of a building and to not interfere with the placement of the protective cover of the present invention is shown in FIG. **18** in detail although it should be understood that such an arrangement is adapted to be positioned at the corresponding location of the arrangement illustrated in FIG. **2** where the electrical input **100** is shown as being located. As best shown in FIG. **18**, said special panel portion is designated by the reference numeral **102** and has reinforcing straps **56'** similar to those previously described. It also has edge junction means portions around all or several of the edges thereof such as indicated at **24'** and additionally has the hook-type fasteners **96'** similar to those shown at **96** in FIG. **6** and, thus, through the use of various of these means can normally be quickly and easily engaged with respect to other adjacent panel portions of the protective cover **20** at an appropriate location with respect to the electrical input structure **100**. The special panel portion **102** has slot means **104** usually provided with a double-zipper closure arrangement so that it can be placed around the electrical input **100**, or other projecting structure, and the multiple zipper fasteners can be closed along desired portions of the slot **104** until only a small portion, such as that shown at **106**, is not closed, and it effectively defines a through-aperture for the projection **100** irrespective of its location along the slot **104**. In using the special cover portion **102**, it should be noted that it may be placed over a portion of a roof which does not have an underlying, completely sealed cover panel portion or which has had same either perforated or partially cut away to allow the passage therethrough of the projection **100**, after which the special panel **102** is fastened thereover and has the slot **104** closed to the maximum possible extent around the projection **100**, thus providing an effectively closed and sealed and effectively patched top cover portion. Also, if desired, a slot similar to that shown at **104** in FIG. **18** may be provided in a large panel in a way such as to extend clear to the lower or foot edge thereof in the manner shown in FIG. **1** so that an extra auxiliary patching panel may not be needed.

The same type of arrangement may be provided for closely encircling most any type of projecting roof structure — even relatively large projecting roof structures such as chimneys, and the like — although in certain extremely hazardous situations it may be found that, in the case of many different types of roof projections, it is more desirable to actually remove the roof projection (even if subsequent substantial repairs will be required) in order to facilitate the proper close sealing, covering, and protecting of the complete house so that it will not be destroyed by a rapidly approaching fire storm.

A typical fastening relationship of the edge fastening means **28** with respect to the fasten-down edge means **41** of the protective cover **20** is most clearly shown in FIGS. **3** and **4**, which are views of corresponding parts of the protective cover of FIG. **1** fastened over the corresponding residential structure. However, in describing the various different modes of use of the apparatus of the invention under various different environmental conditions and with respect to various different types of structures carried by ground surface portions adjacent to a covered building structure, the simplified arrangement shown in FIG. **7** and various sectional views taken on parts thereof are employed purely for purposes of simplification. Therefore, the same reference numerals are used in this view.

It will be noted that on the side (or sides) of the building structure closest to an approaching fire storm, which might, for example, be approaching from the direction indicated by the directional arrow **108** of FIG. **7**, for example, although not specifically so limited, the fasten-down edges **41** of the protective cover **20** are provided with more of the edge-fastening means **28** than are provided along the other two sides of the building (such as shown at the left and bottom of FIG. **7**) where said edge-fastening means **28** are fewer in number. This is merely indicative of the fact that on

the side (or sides) closest to an approaching fire storm, the fastenedown edges 41 of the protective cover 20 should be sealed with respect to adjacent ground surface portions 26 to the greatest possible extent since these will be the edges of the protective cover 20 which would be most susceptible to being ripped loose from the residential building being protected by the cover, as a consequence of high-velocity winds from a rapidly approaching fire storm's getting under the near fasten-down edges 41 of the cover 20 and then effectively tearing it away from the building. This is much less likely to occur on the other two sides of the building and that is the reason for the distribution of edge-fastening means 28 illustrated in FIG. 7. However, the invention is not limited to any particular distribution of said edge-fastening means and they may be distributed as thought necessary in any of a variety of different conditions of use.

Normally, the windows on the side of the building closest to the approaching fire storm will be closed by one of the crew of men who subsequently place the protective cover over the building, while windows on the other two sides of the building may be opened if this is thought desirable for purposes of heated air pressure equalization, etc., although the invention is not so limited.

FIG. 9 illustrates a typical enlarged view of portions of four of the edge-fastening means' individual units with one of them shown firmly fastened down but not connected to any of the auxiliary fastening straps and with a second one firmly fastened down over a fasten-down edge of the protective cover and additionally acting as an anchor or attachment for the lower end of one of the auxiliary fastening strap means which has its upper end attached to one of the attachment means of the protective cover in a manner such as is shown in greater detail in FIGS. 4 and 5.

FIG. 10 is a view illustrating a modified use of the edge-fastening means when a substantial portion of the ground surface 26 takes the form of a driveway, or the like, such as that shown at 110. When this occurs, it obviously is not possible to hold down each longitudinal bar 38 in the manner best shown in FIGS. 3 and 4 because the ground-penetrating stake 42 obviously cannot be driven through the hardened concrete of the driveway 110. Thus in this modification, each of the two bar-to-ground fastening means 39 is positioned just beyond the side edge of the concrete driveway 110 and is rotated 90 degrees from the normal engaging position with respect to the longitudinal fastening bars 39 best shown in FIGS. 3 and 4. In this case, the actual fastening of one or more of the longitudinal bars 38 and the downward pressing of same against the fasten-down edge 41 of the protective cover is provided by extending one or more auxiliary fastening straps 64, or two auxiliary fastening straps 64, fastened together at their ends and then stretching same along one or more of the aligned longitudinal grooves, such as shown at 44 in FIG. 3, for example, and then wrapping said auxiliary straps 64 around the transverse contact shoulder 40 of each of the two bar-to-ground fastening means 39 and then wrapping said straps around at least a portion of the reversely curved neck 46 of each of the two bar-to-ground fastening means 39 and then tying same to the T-shaped second attachment bracket 78 of each of same. Of course, the pointed stake portions 42 are driven downwardly into the adjacent ground surface portions 26 as shown in FIG. 9 until the auxiliary fastening straps 64 are drawn very taut along the top groove (or grooves) 44 so that one or more of the longitudinal fastening bars 38 will firmly hold the fasten-down edge portion 41 of the protective cover in sealed relationship on the top surface of the driveway 110, as is clearly shown in FIG. 10.

FIG. 12 illustrates one means for providing an enhanced seal between the fasten-down edge 41 of the protective cover 20 and the surface 110 of the driveway, which is accomplished by shoveling a quantity of dirt, sand, gravel, or the like, over what amounts to the threshold of the driveway 110 at the location where the longitudinal bar (or bars) 38 of the edge-fastening means 28 will be placed. This makes it possible to force the bar (or bars) 38 downwardly in a manner which correspondingly displaces and shapes the loose gravel or dirt 112 so that a very effective seal is provided, as is clearly shown in FIG. 12. However, the invention is not specifically limited to the FIG. 12 arrangement for providing such an effective seal.

FIG. 11 is a view generally similar to FIG. 10 and illustrates a slightly different mode of use of the edge-fastening means 28 over a sidewalk portion of the ground surface 26. In this case, the major difference in the engagement of the two bar-to-ground fastening means 39 with respect to the pair of longitudinal bars 38 is to have their top surfaces actually engaged by each of the two contact shoulders 40 which lie transversely across the top surfaces of end portions of the two bars 38, as is clearly shown in FIG. 11. One or more of the auxiliary fastening straps 64 lie along the top grooves 44 in the manner previously described in connection with the FIG. 10 showing, and outer ends thereof are fastened to the bar-to-ground fastening means 39 in the same manner as previously described in connection with FIG. 10. The sidewalk which is illustrated as being made of concrete is designated by the reference numeral 114.

FIG. 14 is a view similar to FIGS. 10 and 11 and illustrates how the edge-fastening means 28 can be used very effectively for sealing a fasten-down edge portion 41 of the protective cover 20 to ground surface portions 26 which are of irregular (non-planar) contour, such as is illustrated in FIG. 14. The mode of use of the edge-fastening means 28, as shown in FIG. 14, is very similar to that shown in both FIGS. 10 and 11, with the major difference being the fact that more than two of the bar-to-ground fastening means 39 are employed in FIG. 14 and each is driven into the ground surface 26 at a low point, with higher ground surface elevations being positioned therebetween. Also, the extended or multiple, linked, auxiliary strap means 64 is differently engaged with respect to the middle bar-to-ground fastening means 39 than it is with respect to the two end bar-to-ground fastening means 39 in that the linked, auxiliary strap means 64 is wrapped around the contact shoulder rod 40 of the middle bar-to-ground fastening means 39 and is not wound around the reversely curved neck portion 46 thereof and tied thereto as it is to each of the two end bar-to-ground fastening means 39. This arrangement, with all of the lowest attachment points of the linked fastening strap means 64

to each of the three contact shoulders **40** being at the lowest portions of the ground surface **26**, causes the linked fastening strap means **64** at all intervening regions to be pulled downwardly into taut relationship over the fasten-down edge **41** of the protective cover **20** and the underlying elevated portions of the ground surface **26** whereby to provide a very effective seal therebetween.

The basket **52** shown in FIG. **15** is one form of structure well suited to storing the entire apparatus in disassembled form for quick and easy movement to a location adjacent to a residential building which is to be protected in the manner shown in FIG. **1** or FIG. **2**. Said movement may be by truck, helicopter, or in any suitable manner, and it should be noted that the basket **52** is made of welded rod construction in the exemplary form illustrated and includes one or more swing-down gates, such as shown at **116**, to facilitate easy access to the items stored therein comprising the various panel portions of the protective cover in folded up, stacked relationship. Such panel portions are generally designated by the reference numeral **22** in FIG. **15** and may comprise any of the various different types, sizes, and shapes of panel portions previously referred to. Each of the plurality of longitudinal fastening bars **38** of each of the bar-to-ground fastening means is stored on a plurality of upwardly directed rods **118** adapted to be inserted through the receiving holes or storage mounting apertures **120** carried adjacent to each end of each of the longitudinal bars **38**, as is perhaps best shown in FIG. **3**, so that all of the fastening bars **38** will be stored in the vertically stacked relationship on the two storage rods **118** clearly shown at the left or near end of the basket **52** illustrated in FIG. **15**. The plurality of bar-to-ground fastening means **39**, including the ground-penetrating stakes **42**, is adapted to be stored on a storage rack or rod (or plurality of rods) **122**. The plurality of auxiliary fastening straps may be stored in between the various cover portions **22**, on top thereof, or at any other convenient location within or with respect to the basket **52**.

It should be noted that the entire basket **52** is mounted on a plurality of similar foot portions **124** providing sufficient bottom spacing to allow the fork of a fork-lift power-lifting machine to be inserted under the complete basket, thus making it possible to facilitate the easy lifting, transport, and setting down of the basket anywhere in loaded or unloaded condition by such powered fork-lift machines in a manner similar to the conventional handling of what is commonly known as pallets by such powered fork-lift machines. Also, it should be noted that the downwardly projecting feet **124** are set inwardly to an extent sufficient to allow the vertical stacking of such baskets by allowing the inset feet **124** to extend downwardly through the open top of the next underlying basket and into supported contact with four corner-positioned brace members **126** thereof.

The basket **52** is also provided with a plurality of (four, in the example illustrated) engagement loop, hook, or eye portions **128** which are intended to be engaged by corresponding hook portions of a helicopter hoist cable having corresponding multiple cable attachment portions at the bottom thereof so that the entire basket **52** can be lifted, transported, and placed at any desired location by a helicopter, preferably of the type having a controllably operable power winch and hoist.

The number, types, and sizes of protective cover sheet panel portions **22** to be carried in the basket **52** are somewhat variable, depending to some extent upon the anticipated size and/or shape of a residential building which is to be protected thereby, and can, correspondingly, be varied to meet the requirements of particular projected building sizes and shapes.

However, I have found that one representative, generally adequate arrangement is to provide five of the large square sheets (or panel portions), such as the center sheet **22** of FIG. **16**, for example, which may be approximately 48 feet by 48 feet in one form thereof, to provide five of the rectangular sheets (or panel portions), such as the four rectangular sheets **22** shown in FIG. **16**, which in one representative form may be 12 feet by 48 feet, to provide five of the small square sheets (or panel portions) **22**, such as shown at the four corners of the representative lay-out of FIG. **16**, and with each of said small square sheets or panel portions **22**, in one representative form, being 12 feet by 12 feet, and to provide one large square sheet, such as that shown at **102** in FIG. **18**, which may be of the same size as the other large square sheets or, in certain cases, of a somewhat lesser size, and to provide an adequate number of the auxiliary fastening straps of the type shown fragmentarily in FIGS. **4** and **5** and, in certain cases, also of a type having the hooks at each end.

It should be noted that, as previously mentioned, the panel portions **22** of the composite protective cover sheet **20** are provided with the reinforcing straps or tapes which, in a preferred form, lie in a rectangularly arranged, grid-like pattern with the straps of a first group thereof being substantially parallel and being spaced from each other by a predetermined first type of spacing, and with the other straps of a second group thereof being substantially perpendicular to the first group of straps and being spaced (by a second type of spacing) from each other in a second direction perpendicular to the first spacing direction of the first group of parallel straps. This of course causes the straps of each of the two different groups or sets to cross each other at regular, predetermined, cross-over locations such as the representative cross-over locations shown at **57** in FIG. **1**, for example, where each of the attachment means **58** is formed by the crossed loops **60** and **62**, such as is best shown with respect to a representative single attachment means **58** in FIG. **5**.

In the preferred rectangular, grid-like arrangement of the reinforcing straps **56**, they may be positioned at various predetermined spacing intervals, such as 4 feet apart, 6 feet apart, 8 feet apart, or even 12 feet apart, and, in certain cases, the spacing may vary in the two different directions. However, I have found one very effective arrangement to be a 4 foot spacing between reinforcing straps or tapes **56**, with tapes along edges of the panel portions very close to said edges, although they may be spaced inwardly a short distance therefrom, up to the order of approximately 6 inches or so, in certain forms of the invention. I have also found that ends of the tapes should be provided with hooks of the type shown at **96** in FIG. **6** (or any other substantially functionally equivalent means) in virtually all lo-

cations, although there are certain sides of some of the panel portions where said hooks may remain inoperative if they lie at a terminus not adjacent to another panel portion or to some fastening structure. In general, it is simpler to have the hooks at virtually all tape ends on the premise that it is better to have certain hooks which may not be used than to require hooks and find that they are not present.

The remarks advanced above with respect to the hooks **96** are equally applicable with respect to the zipper-type edge junction means **24** — that is, certain edges of certain panel portions may end up with free zipper portions not engaged to mating zipper portions, and it would appear that such zipper portions might be eliminated and, in certain cases, they can be. In general it is preferable to have excess zipper portions so that, no matter how the panel portions are assembled, there will always be a zipper portion where it is needed. However, wherever it does not appear that zipper portions will be engaged, they can be eliminated, and, also, it should be noted that other types of edge junction means may be employed in lieu thereof, such as various kinds of mechanical fasteners of the hook and eye type, of the button or snap fastener type, of the so-called "-Velcro" type, or even various kinds of adhesive fastener means or edge junction means may be employed in lieu of the zipper type edge junction means illustrated and described hereinbefore, and all such arrangements are intended to be included and comprehended within the broad scope of the invention. For example, the sheet **102** of FIG. **18** may have certain or all of the zippers eliminated and may rely upon hooks of the type shown at **96** in FIG. **6**, or any other equivalent type of mechanical fastener, for fastening said sheet or panel **102** in place.

It should also be noted that the cover sheet **20**, and/or the panel portions thereof, may be made of an elastic or stretch-type material so as to be capable of assuming the shape of a residential building enclosed within the composite sheet in certain forms of the invention. It should also be noted that cover flaps may be provided to cover edge junctions if desired, particularly where the edge junctions are of a type other than zipper fasteners.

The arrangement illustrated in FIG. **2** shows a somewhat differently shaped residential building from that of FIG. **1** protected by a somewhat different composite protective cover **20** made up of the cover panel portions **22** assembled a little differently than in FIG. **1**. As shown in FIG. **2**, two large cover panel portions **22** are placed over the top of the building and are joined at the center by the junction means **24** and have opposite ends and side portions thereof folded under the eaves of the building and then have a plurality of the end-joined rectangular panel portions of the type shown at the sides in FIG. **16** effectively wrapped around all side walls of the building and over the folded-down end portions of the cover panels **22** positioned over the roof of the building, thus completely enclosing same within the wrapped-around, end-positioned, rectangular panel portions **22** completely enclosing all side walls of the residential building of FIG. **2**. The top edge **130** of the end-joined rectangular panel portions **22** wrapped around the side walls of the residential building of FIG. **2** may be attached and supported by connection of hooks of the type shown at **96** in FIG. **6** (or any effective functional equivalent) to corresponding hooks, or attachment means **58**, of the panel portions **22** positioned over the roof of the residential building, or may have certain of the auxiliary fastening straps **64** upwardly directed and fastened to corresponding hooks, or attachment means **58**, carried by any of the reinforcing straps **56** of the panel portions **22** mounted on the roof of the residential structure, or one or more of such auxiliary straps **64** may be thrown over any upper building portion or projection so as to support the upper edge **130** of the effective protective continuous-sheet side wall formed by the end-joined rectangular panel portions **22** completely wrapped around the side wall of the residential building. Bottom edges of said rectangular, continuous, side wall panel portion **22**, comprising part of the complete protective cover **20**, are fastened down through the use of edge engagement means **28** which is of the same type as that previously fully described in connection with the FIG. **1** protected-building disclosure. A protective sheet of the type shown at **102** in FIG. **18** will normally be positioned around the electrical inlet **100** near the right corner of FIG. **2**, but is not shown in detail in FIG. **2** for reasons of drawing clarity and simplification since such a showing is illustrated in FIG. **18** and has already been fully described.

All of the edge engagement means are preferably made of relatively lightweight material, such as aluminum, or the like, having a high strength-to-weight ratio. Also, all of the material is of a fireproof nature including all of the auxiliary fastening straps **64**, all or reinforcing straps **56**, and all panel portions **22**.

A brief description of one typical installation operation follows. A truck carrying a fully loaded basket, such as that shown at **52** in FIG. **15**, and having a crew of five men will drive to the house which is to be protected, and the first man will proceed to unload the fireproof panel portions **22** of the protective cover from the basket **52**, along with the various fastening straps and various other parts, so as to facilitate a fast assembly operation. It is estimated that this will require about 3 minutes' time of the first man.

The second man will select appropriate tools such as a pipe wrench, a pair of pliers, a Crescent wrench, and a small asbestos sheet, or other heat-insulating sheet, for protecting the gas meter, as described hereinafter, and will then proceed to the house and turn off the gas meter and then cover the gas meter and pipes and adjacent ground area with the asbestos sheeting for the purpose of preventing a gas explosion from excessive heat. Then man No. 2 proceeds to the available gas outlets and bleeds all of the lines throughout the house of all gas and then, if possible, closes the valves thereafter. Man No. 2 then proceeds to the electrical circuit-breaker or fuse box and opens all circuits and then returns to the truck. This has been estimated to require about 3 minutes' time of man No. 2.

The third man picks up a pipe cutter, a wire cutter, a pair of pliers, an adjustable wrench, a short length of light rope, and a ladder, and then places the ladder against a convenient portion of the roof of the house, climbs to the roof, unbolts the television antenna from the roof at the anchor point, if convenient, and, if not convenient, cuts the television antenna mounting post a

short distance (such as two inches, for example) above the anchor point with the pipe cutter. He then cuts or unfastens the television antenna guy wires and lowers the television antenna and mounting post or mast to the ground with the short length of rope. Man No. 3 stays on the roof ready to assist with the subsequent installation of the protective cover over the house. It has been estimated that the foregoing operations of man No. 3 to this point will require about 3 minutes' time of man No. 3.

The fourth man proceeds through the house, opening all inside doors, cupboard doors, kitchen doors, bedroom doors, and doors connected to stairwells and the like. He also opens as many windows as possible on the side (or sides) of the house opposite or away from the wind produced by the approaching fire storm. He then examines all available water faucets to see that they are closed and, if not, closes same. These operations are primarily to prevent flooding and heated-air explosions. Man No. 4 then returns to the truck. It has been estimated that the foregoing operations will require about 3 minutes' time of man No. 4.

Man No. **5** proceeds to distribute all of the anchor bars and stakes (the edge engagement means), all of the ropes (the fastening straps), and several sledge hammers to the various needed locations around the house which is to be protected. A solid line of the anchor bars or edge-fastening means will be needed on the side (or sides) of the house nearest to the approaching fire storm. The foregoing operations have been estimated to require approximately 3 minutes' time of man No. 5.

Now all five men proceed to assemble and move the panel sections **22**, and complete composite protective cover sheet **20**, into the proper position over the house, using power equipment such as winches, auxiliary overhead pulleys and booms, or the like (or doing it manually) — said operations being arranged so as to facilitate the complete assembling of the composite cover and the proper positioning thereof completely over the house in whatever manner experimental testing proves to be most expeditious. It is estimated that this will take approximately 10 minutes' time of all five men.

All five men then proceed to place the anchor bars and stakes (the edge engagement means), the various tie ropes (fastening straps) in the proper relationship so as to encompass any auxiliary objects around the building, such as fences, driveways, walks, and the like, and such as to firmly fasten them over the complete exterior edge of the composite protective cover to adjacent underlying ground surface portions in an effectively sealed manner such as has been described in greater detail hereinbefore. It is estimated that the foregoing operations will require approximately 7 minutes' time of the complete five-man crew.

Thus it will be seen that the exemplary installation operation described above will require 20 minutes per house for the five-man crew, and normally each truck would carry at least two complete units for sequential installation requiring a nominal total installation time of 40 minutes. Thus it can be seen that a relatively small number of trucks and crews could protect a substantial number of homes along the edge of a residential tract toward which a fire storm is approaching, so that none of said edge-positioned homes will catch fire and there will be no effective airborne spreading of the fire storm in the undesirable manner referred to hereinbefore. Homes positioned further back in such a residential tract will, in certain cases, have only their roofs protected since their side walls will be in part protected by the fully protected, edge-positioned, homes mentioned above. This should make it possible, within a matter of several hours when a fire storm is moving toward a given residential region, to protect a sufficient number of homes to prevent the airborne spreading of the fire in such residential, high fire hazard areas of the type referred to hereinbefore.

It should be noted that the various fasteners and engagement means, and the materials thereof, described hereinbefore are exemplary of one of the many possible forms of the invention lying withing the broad scope hereof.

It should be understood that the figures and the specific description thereof set forth in this application are for the purpose of illustrating the present invention and are not to be construed as limiting the present invention to the precise and detailed specific structure shown in the figures and specifically described hereinbefore. Rather, the real invention is intended to include substantially equivalent constructions embodying the basic teachings and inventive concept of the present invention.

What is claimed is:

1. Fire protection apparatus for a building, comprising: flexible, thin-sheet, protective cover means of fire-retardant material having fasten-down edge portions and intervening area-covering, building-enclosing panel portions adapted to be placed over and in enclosing relationship with respect to a building which is to be protected from a high-velocity fire, with said area-covering, building-enclosing panel portions enveloping, protecting, and exteriorly covering and isolating substantially the entire surface of such a building from any exterior firebrands, flaming material, or burning embers which may come into contact therewith from an approaching high-velocity fire, and with said fasten-down edge portions being effectively provided with edge fastening and edge engagement means and being adapted to be effectively fastened down and sealed by same with respect to adjacent ground surface areas around edge portions of such a building, said panel portions of said protective cover means being provided with multiple spaced first attachment means; said edge fastening means being provided with multiple spaced second attachment means; and multiple auxiliary fastening strap means, each having first connection means at one end thereof cooperable for connection to any corresponding one of said multiple spaced first attachment means provided at said multiple locations of said panel portions of said protective cover means and having second connection means of a controllably adjustable, longitudinal spacing from said first connection means cooperable for taut connection to any corresponding one of said multiple spaced second attachment means carried by corresponding ones of said edge fastening means.

2. Apparatus as defined in claim **1**, wherein said edge fastening means comprises a plurality of longitudinal fastening bars and cooperating bar-to-ground fastening

means having upper, downwardly facing, transversely directed, barnengaging contact shoulder means and having substantially vertically, downwardly directed ground-penetrating stake means, with said plurality of bar means being adapted to be placed over different parts of said fasten-down edge portions of said protective cover means which are superimposed upon corresponding underlying ground surface portions and with said bar-engaging contact shoulder being forced downwardly into firm retaining contact with each of said bar means by forcing the downwardly directed stake means into an adjacent portion of such a ground surface.

3. Apparatus as defined in claim 2, wherein each of said second attachment means takes the form of an attachment bracket member carried by a corresponding portion of said edge fastening means.

4. Apparatus as defined in claim 2, wherein said protective cover means is provided with a plurality of reinforcing and strengthening straps effectively joined thereto at a plurality of spaced locations and in a predetermined pattern and with certain of said reinforcing straps crossing each other at predetermined, multiple, cross-over locations at predetermined angles, each of said first attachment means comprising a pair of crossed, reinforcing strap loops formed of said reinforcing straps at said cross-over locations, each of said second attachment means comprising an attachment bracket member carried by a corresponding portion of said edge fastening means.

5. Apparatus as defined in claim 2, wherein said protective cover means is provided with a plurality of reinforcing and strengthening straps effectively joined thereto at a plurality of spaced locations and in a predetermined, rectangularly-arranged, grid-like pattern and with certain of said reinforcing straps crossing each other at predetermined, multiple, cross-over locations at predetermined, substantially perpendicular angles, each of said first attachment means comprising a pair of crossed, reinforcing strap loops formed of said reinforcing straps at said cross-over locations, each of said second attachment means comprising an attachment bracket member carried by a corresponding portion of a corresponding bar-to-ground fastening means of said edge fastening means.

6. Apparatus as defined in claim 2, wherein each of said longitudinal fastening bars cross-sectionally is of substantially rectangular shape having four sides provided with four corresponding longitudinal groove means for the reception therein of the corresponding transversely directed contact shoulder of one or more of said bar-to-ground fastening means.

7. Apparatus as defined in claim 2, wherein each of said longitudinal bars is provided at predetermined locations with transversely directed storage-mounting apertures for conveniently storing a plurality of same on correspondingly spaced storage bars.

8. Apparatus as defined in claim 1, wherein said first connection means comprises an end-positioned loop portion of each of said auxiliary fastening straps having controllably connectible fastening hook means carried at locations spaced apart by said end-positioned loop portion.

9. Apparatus as defined in claim 1, wherein said protective cover means comprises a plurality of panel portions, each provided with controllably engageable mating edge junction means for firmly fastening together adjacent edge portions of an assembly of such panel portions whereby to together form a complete composite protective cover means of a desired size and shape suitable for substantially completely enclosing, enveloping, and protecting any of various different-sized buildings within a predetermined range of sizes and shapes.

10. Apparatus as defined in claim 9, wherein said edge junction means comprises mating sets of first and second junction elements of two different types carried along corresponding joinable edges of said panel portions which are to be joined together to form said desired complete composite protective cover means of a desired size and shape.

11. Apparatus as defined in claim 9, including multiple edge junction bridging and reinforcing means carried by opposed parts of said joined panel portions in a manner perpendicular to an intervening part of said edge junction means and fastenable with respect to each other in effective overriding bridging edge-junction-strengthening relationship whereby to substantially remove excessive stress from said edge junction means.

12. Apparatus as defined in claim 5, wherein said protective cover means comprises a plurality of substantially rectangular panel portions, each provided with controllably engageable mating edge junction means for firmly fastening together adjacent edge portions of an assembly of such panel portions whereby to together form a complete composite protective cover means of a desired size and shape suitable for substantially completely enclosing, enveloping, and protecting any of various different-sized buildings within a predetermined range of sizes and shapes; and including multiple edge junction bridging and reinforcing means carried by opposed aligned end portions of said reinforcing strap means of adjacent ones of said panel portions fastened together by said edge junction means and fastenable with respect to each other in effective overriding bridging edge-junction-strengthening relationship whereby to substantially remove excessive stress from said edge junction means.

13. Apparatus as defined in claim 12, wherein said edge junction bridging and reinforcing means comprises controllably engageable and disengageable bridging hook means.

14. Apparatus as defined in claim 10, including edge junction coding and identification means carried by said panel portions in identifying association with said corresponding mating junction element sets for quick identification and corresponding proper placement in adjacent relationship of such junction element sets when initially assembling said panel portions to form said complete protective cover means over a building for protecting same from a rapidly approaching high-velocity fire storm.

15. Apparatus as defined in claim 9, including panel coding and identification means carried by each panel portion and corresponding to its size and shape whereby to provide quick identification of each particular type, size, and shape of panel during the initial assembly and edge-joining of same in protective relationship over a building which is to be protected from a rapidly approaching fire storm.

16. Apparatus as defined in claim 9, wherein one of said panel portions of said protective cover means comprises a partially slotted portion having multiple edge junction means for joining the slotted edges after said panel portion has been placed over a roof with a part of said slotted portion positioned around and allowing the vertical passage therethrough of a projecting structure carried by a roof portion of a building which is to be protected, such as an electrical weatherhead input from an adjacent power line.

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