

[54] **ROOF CONSTRUCTION**

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161/161; 52/404, 409, 408, 199, 515, 246

[56] **References Cited**
UNITED STATES PATENTS

3,103,042 9/1963 Martin 52/409

3,411,256 11/1968 Best 161/38 X
3,763,614 10/1973 Hyde 52/408

OTHER PUBLICATIONS

"Trocal Roofing" bulletin published by Dynamit Nobel Aktiengesellschaft, Plastic Sales Division, West Germany 1969. Publication No. 31/770 GB8. 1969.

Primary Examiner—William E. Schulz

[57] **ABSTRACT**

This invention relates to a method of constructing a roof to provide a surface which may be employed as a play, recreation or high traffic area.

4 Claims, 1 Drawing Figure

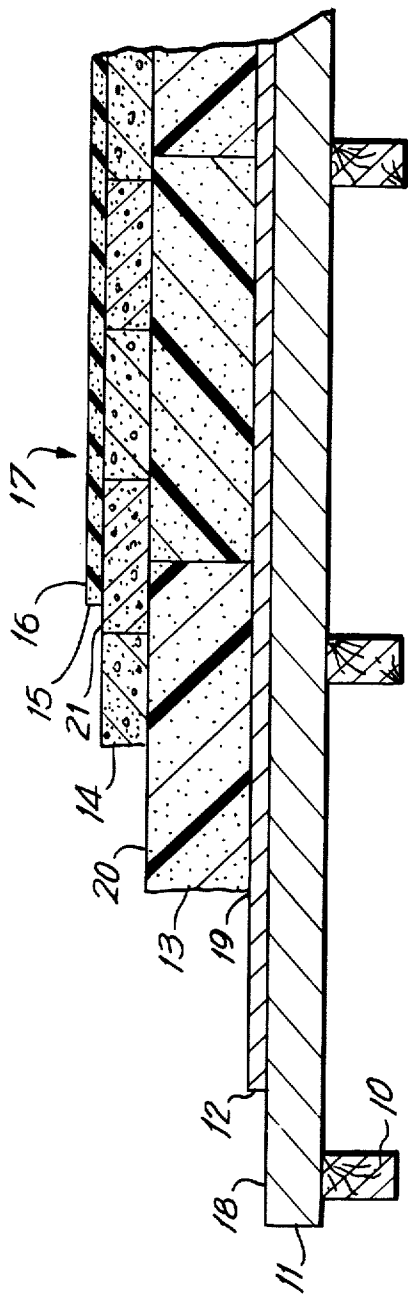


FIG. 1

ROOF CONSTRUCTION

This invention relates to and has as its objective a novel roof construction, and more particularly insulated roofs and methods for their construction.

In the past, although insulated roof constructions have been successfully employed in various roof structures, they have suffered from the inability of sustaining active and continuous foot traffic. Thus, although the methods and constructions heretofore employed have provided adequate insulation and water proofing, the thus constructed roof themselves have not been employable for any other useful purposes. In densely populated urban areas, where space is at a premium, and the need for open play or recreation areas, which are subjected to constant and active foot traffic, is especially acute, these roof areas have by their nature of construction been heretofore unavailable for use for such purposes. One type of insulated roof construction heretofore employed, and which is eminently unsuitable for the purposes of this invention, is disclosed in U.S. Pat. No. 3,411,256.

One of the objects of this invention is the provision of an insulated roof construction which is capable of being employed as a play or recreation area, and which may be subjected to constant and active foot traffic exposure without suffering any disadvantageous effect to either its insulating or water proof properties.

A further object of this invention is the provision of an adequate play or recreation area which may be easily and economically constructed and utilized.

Further features and advantages of the present invention will become more apparent from a study of the following specifications and to the said drawings to which it refers. More particularly, in reference to the said drawings, wherein FIG. 1 is a cross-section of the roof construction, generally in accordance with the present invention.

Referring to the figures setting forth the preferred embodiment of the invention, by characters of reference, the novel roof construction of this invention 17, comprises in cooperative combination, a roof deck, 11. The roof deck 11, has an upper surface 18, to which is secured a water impermeable membrane, 12. The lower surface of the roof deck, 11, may be supported by various means, for example, support beams, 10. The specific means which may be employed to support the roof deck, 11, may be any means which are known to and acceptable to the worker skilled in the art, for example, vertical pillars, reinforced concrete supports, and the like, all without detracting from the successful practice of the instant invention. To the surface of the water impermeable membrane, 12, is applied and disposed a thermal insulating layer, 13. A ballast layer, 14, is then uniformly disposed on the upper surface, 20, of the insulating layer, 13. A protective, substantially water impermeable layer 15, which is susceptible to accept constant and active foot traffic on its upper surface, 16, is then adhered in a uniform manner to the upper surface, 21, of said ballast layer, 14.

More particularly, the materials and the elements which may be employed in the preparation of the novel roof construction of this invention, may be varied in accordance with the requirements of the particular needs of the specific construction in connection with which the skilled worker desires to practice the instant invention. Thus, the roof deck or roof support means which may be employed in the novel roof construction of this

invention includes such materials as steel, wood, concrete and precast planks, or a combination thereof, and other like materials. The roof deck, 11, may be supported by such means as may be convenient and may be firmly and permanently affixed thereto by such means as are usually and generally employed for such purposes, such as nails, bolts, screws, welding and other like means.

The water impermeable membrane, 12, may comprise or consist of a variety of water impermeable materials which are known in the art to be employable for such purposes. Examples of the water impermeable membrane materials so employable include conventional asphaltic and bituminous compositions employed for roofing as well as laminates of the bituminous materials with fibrous products such as roofing felt employing organic and inorganic fibers. In addition, it has been found that various liquid type water impermeable membranes may also be employed, for example, rubberized asphalts, coal tar and synthetic resinous polymeric compositions, such as polysulfides or polyurethanes, and such sheet waterproofing membrane materials as polyvinyl, butyl, neoprene and the like. Examples of some of these water impermeable membrane compositions are those which are commercially available under such trade names as, "411-M" and "411-H," from the Thiokol Chemical Company; "Vulkem-201," from the Master Mechanics Corporation; and "Keeper-Cote," from the Keeper Chemical Company. In certain applications, the water impermeable membrane, 12, may be applied in alternating layers to provide a water impermeable membrane of any desired thickness and mechanical strength. In other instances, the water impermeable membrane, 12, can be formed from the liquid type membrane materials heretofore mentioned, by uniform application thereof in the desired thickness, over the upper surface, 18, of the roof deck, 11. The synthetic sheet type water impermeable membrane material can be adhered to the upper surface, 18, of the roof deck, 11, with a suitable adhesive and one or more layers of such material may be employed to obtain a resultant membrane of suitable thickness.

The thermal insulating layer, 13, is preferably a closed cellular material which may be substantially water impermeable. Particularly preferred in the practice of this invention are cellular plastic foams of a closed cell configuration, including such materials as foam glass, styrene acrylonitrile copolymer foams, styrene methacrylate copolymer foams, polyvinyl chloride foams, polyethylene foams, polyurethane foams and other like water impermeable materials available in cellular foam forms which are well known to the skilled worker in the art. The thermal insulating layer, 13, is applied to the upper surface, 19, of the water impermeable membrane, 12, usually in a thickness of at least one and preferably two or more inches; said thermal insulating material having a density of about 1.5 to 3.0 pounds per cubic foot. As a practical necessity, the thermal insulating material is applied over said water impermeable membrane, 12, in pre-cut blocks, planks or sheets. The thermal insulating layer, 13, may be adhered to the upper surface, 19, of the water impermeable membrane, 12, by the use of various adhesive compositions which are known to be employable for such purposes.

The ballast layer, **14**, may be comprised of a multitude of precut concrete or cementitious blocks or paving squares. Most preferably, in the practice of this invention, it is desired to employ light weight concrete aggregate blocks or paving squares, such as those which are commercially available under the trade name, "Solite," from the Solite Corporation. The ballast layer, **14**, comprised of the multitude of blocks, is uniformly dry-applied to the upper surface, **20**, of the thermal insulating layer, **13**, by butting the edges of said blocks against each other, and staggering the joints thereof, care being taken to assure that the entire surface of the said thermal insulating layer, **13**, is covered by the ballast layer, **14**. The ballast layer, **14**, should, in the successful practice of the instant invention, provide sufficient weight of at least **5** and preferably at least **8**, and most preferably about **12** pounds per square foot of surface of the thermal insulating layer, **13**, to which the ballast layer, **14**, is applied. The ballast layer, **14**, is employed in the practice of this invention for the purposes of protecting the thermal insulation layer, **13**, in the presence of constant and active foot traffic or work activity on the roof wearing surface member, **16**; the prevention of the floatation, shifting or movement of the thermal insulation layer, **13**, in the event of invasion of water into or below the thermal insulation layer, **13**; and the provision of a buffer layer of uniform thickness capable of providing access to restricted areas of the roof surface without the necessity of extensive repair or excavation work, such as is necessary where a cement layer or concrete topping is employed. The ease of repairing areas of the roof construction of this invention by the employment of the particulate ballast layer, **14**, is a very advantageous attribute of the instant invention. In the event that repairs have to be made, it is a relatively simple task to merely cut through the roof wearing surface member, **16**, remove the dry-applied particulate blocks of the ballast layer, **14**, thereunder and thus have direct access to the repair area without the necessity of extensive excavation procedures.

Over the ballast layer, **14**, the successful practice of this invention requires the application of a substantially water impermeable and non-absorbent roof wearing surface member, **16**, which is capable of withstanding constant and active foot traffic and activity. The roof wearing surface member, **16**, in addition to being substantially water impermeable must be substantially nonabsorbent for water. Furthermore, the roof wearing surface member, **16**, must possess certain properties which permit its use in the practice of this invention.

The novel roof construction of this invention provides a unique roof surfacing construction which operates as a total system which, in addition to providing the structure to which this system is applied with a sound water proof and thermal insulation system, also provides the structure with a roof surface area which is capable of sustaining constant and active foot traffic. Especially of interest in the utilization of this invention is the creation of roof surfaces which are capable of being employed as play or recreation areas in popular urban areas. Examples of the play or recreation purposes to which this invention may be put contemplate the conduct of such activities as sports activities, such as tennis, volley ball, basketball, track events, areas contiguous to swimming pools, and the like; and children's play activities, for example, playground activi-

ties and games engaged in by children especially as an integral part of children's day care centers in urban areas. In view of the uses to which this invention are contemplated to be employed, it has been found to be essential for its successful practice that the novel roof construction hereof be constructed and employed as a total and self contained system, each integral element thereof interacting and cooperating with the other elements thereof. Thus, the roof wearing surface member, **16**, employed herein must provide a surface suitable for withstanding the constant and active traffic contemplated; must provide a wearing surface which is resilient and soft enough to prevent injury to the persons employing the area in the event of falls; must be capable of providing a smooth and relatively uniform surface as required in the activities to be engaged in thereon; must be capable of withstanding wide temperature and humidity variations to avoid swelling or buckling of the roof surface; must be of such a permanent nature as to prevent easy removal of the underlying materials employed in connection with the construction hereof; and must be of such a nature as to substantially prevent seepage of moisture below the exterior surface of the roof construction of the instant invention.

It has now been found that certain materials are eminently satisfactory for employment as the roof wearing surface member, **16**, in the successful practice of this invention. Among the materials which have been found to be satisfactory in connection herewith, may be included such materials as neoprene or latex based emulsions such as those commercially available under the trade name, "Elastaturf," from the Borden Chemical Company; urethane based surfacing compositions, such as those commercially available under the trade names, "Tartan" and "Weatherdeck," from the 3M Company; rubberized deck surfacing materials commercially available from the Chevron Asphalt Company under the trade name "G-29"; polymeric surfacing materials, such as polyvinyl, for example, polyvinyl commercially available from the Monsanto Chemical Company under the trade name, "Astroturf," polyethylene and other like materials, depending on the character and quality of the surface desired. It has been found that satisfactory results are generally obtained when the roof wearing surface member, **16**, is applied to the upper surface, **21**, of the ballast member, **14**, in a thickness of about one-quarter inch or more, the thickness depending upon the nature of the surface required and the uses to which it is to be put. However, for most purposes contemplated by the practice of this invention it has been found that application of the roof wearing surface in a thickness of from one-quarter to one-half inch provides very satisfactory results. The upper traffic bearing surface of the roof wearing surface member, **16**, should be uniform and level to the extent required by the end use to which the roof construction of this invention is to be put.

In addition to the foregoing embodiment, the instant invention may also be satisfactorily practiced by the use of a single combined thermally insulated and ballast member in lieu of the individual insulation member, **13**, and the ballast member, **14**. It has been found that the instant invention may be satisfactorily practiced by employing combination insulated concrete blocks or planks such as those commercially available under the trade names, "Doxplank" and "Insulrock" from the

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Flintrote Company, in substitution of the thermal insulation member, 13, and ballast member, 14, without detracting from the satisfactory results obtained herewith.

Further to the foregoing, the instant invention may also be satisfactorily practiced with a combined ballast member and roof wearing surface member in substitution for the individual ballast and wearing surface members. Thus, where a plastic encased ballast member, having pre-applied to the upper surface thereof a roof wearing surface material of the type contemplated herein, and where said plastic encased ballast members have an interlocking joining means whereby the joined upper surface is rendered substantially water impermeable, the satisfactory practice of the instant invention may still be had.

From the foregoing, it will be understood that the embodiments of the present invention described above are well suited to provide the advantages set forth, and since many possible embodiments may be made of the various features of this invention and as the construction herein described may be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and that in certain instances some of the features of the invention may be used without a corresponding use of other features all without departing from the scope of the invention.

What is claimed is:

1. A roof construction capable of withstanding con-

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stant and active foot traffic, which comprises, in combination:

- a. A roof deck;
- b. A water impermeable membrane affixed to the upper surface of said roof deck;
- c. A thermal insulating member disposed on the upper surface of said water impermeable membrane;
- d. A ballast member comprised of a multitude of pre-cut concrete or cementitious blocks or paving squares disposed on the upper surface of said thermal insulating member; and
- e. A substantially water impermeable and non-absorbent wearing surface member affixed on the upper surface of said ballast member, to provide a relatively smooth, resilient and uniform upper surface to said wearing surface member.

2. The roof construction of claim 1, wherein the ballast member is comprised of a multitude of concrete blocks having a density of at least 5 pounds per square foot.

3. The roof construction of claim 1, wherein the wearing surface member is affixed on the upper surface of the said ballast member in a thickness of about one-quarter inch.

4. The roof construction of claim 1, wherein the thermal insulating member is a plastic cellular foam material.

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