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Jones

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[54] **METHOD OF STABILIZING A COMPARATIVELY FLAT ROOFED STRUCTURE AGAINST WIND**

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[58] **Field of Search** 52/173, 364, 23–26, 52/311, 315, 3, 389, 24

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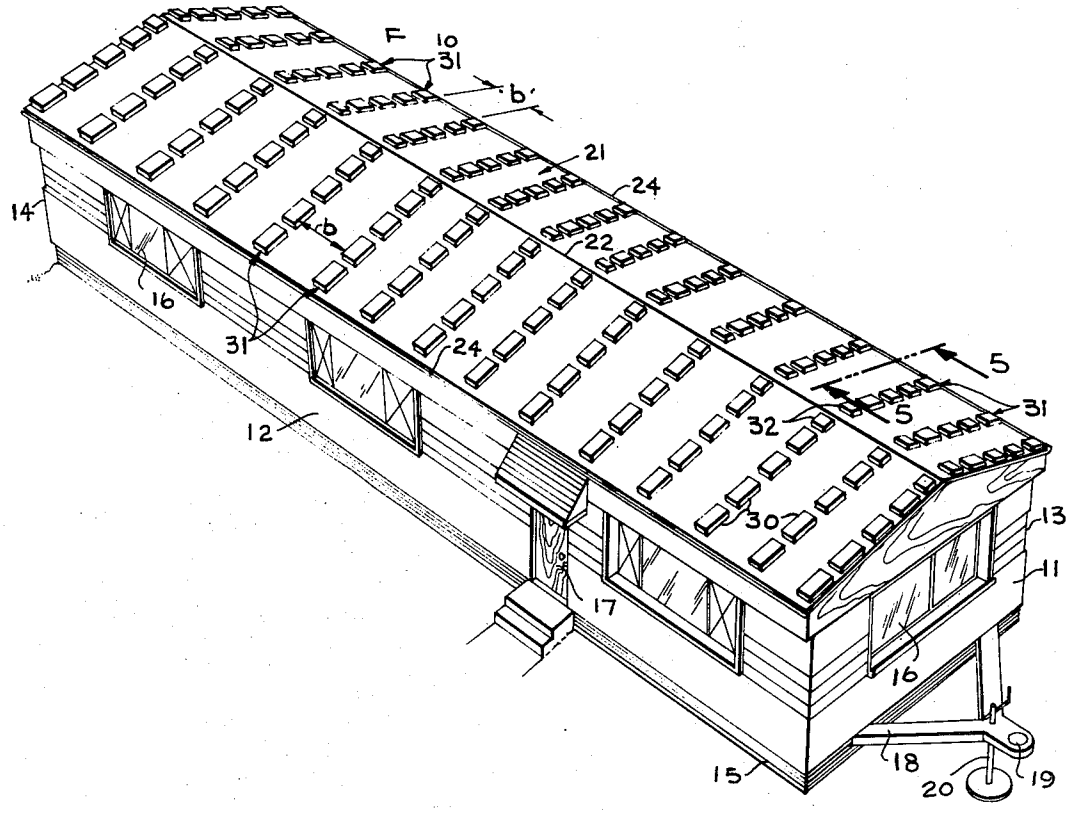
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[57] **ABSTRACT**

A method for stabilizing elongated, comparatively flat roofed structures against wind forces by affixing concrete blocks to the roof in a desired regular arrangement to disturb and break up the normal airflow pattern across the surface of the roof. The blocks are positioned to form a plurality of transverse rows across the roof surface of the structure. The individual rows are spaced in a longitudinal direction along the length of the structure. Adhesive material is used to affix the blocks to the surface to prevent movement or shifting from the desired position.

5 Claims, 5 Drawing Figures



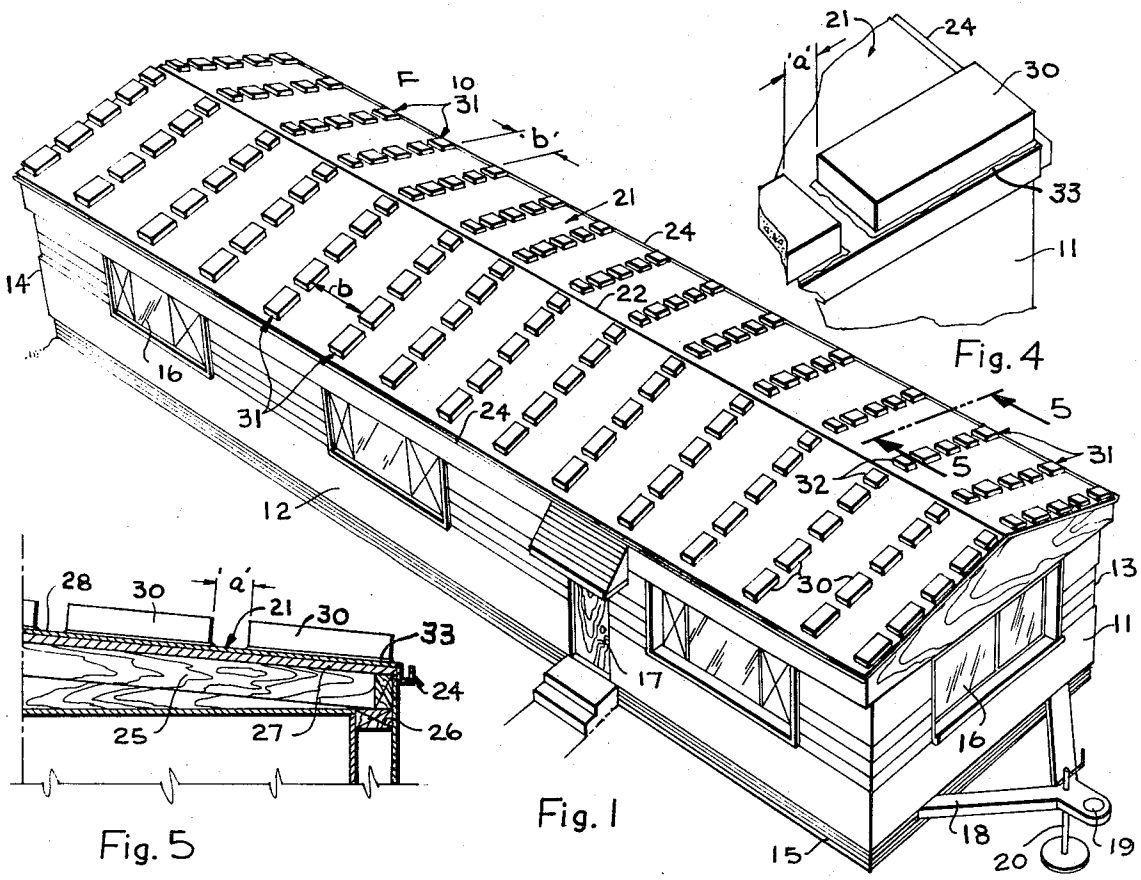


Fig. 1

Fig. 4

Fig. 5

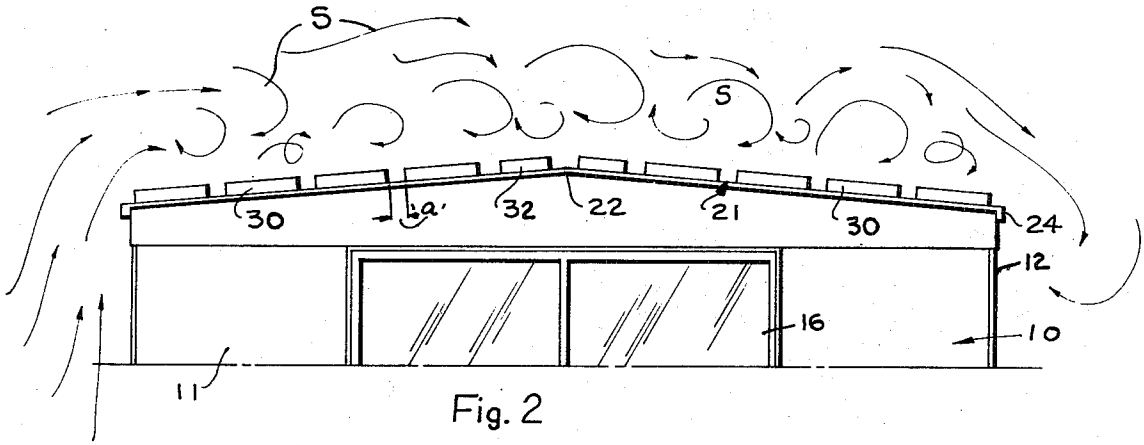


Fig. 2

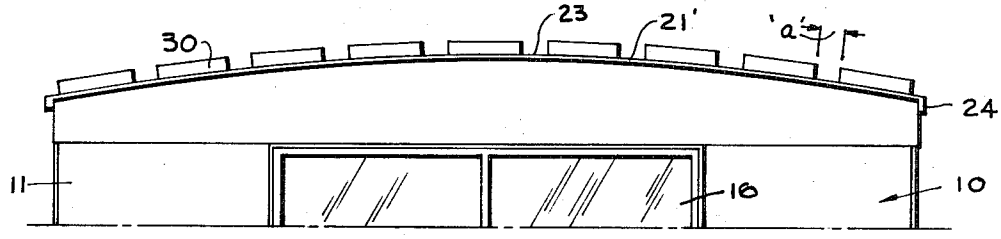


Fig. 3

METHOD OF STABILIZING A COMPARATIVELY FLAT ROOFED STRUCTURE AGAINST WIND

This invention is directed to methods for stabilizing stationary mobile homes and similar flat roofed structures when subjected to high velocity wind.

Mobile homes, the lightweight, flat roofed, elongated structures to which this invention is directed, are necessarily limited in width due to their design for highway passage. Because of this limitation and the necessity to provide a desired square footage of living area, the structures are designed with their length far exceeding their width. So proportioned, mobile homes are inherently unstable when forces are applied laterally or broadside. This problem is further accentuated since it is common in this type of construction to use lightweight materials, both from an economic standpoint as well as providing a structure which can be easily towed along the highways.

Because of these two characteristics, if a high wind strikes a mobile home broadside, disturbing or even catastrophic results can occur. The occupants of a mobile home frequently experience unpleasant shaking and vibration in the structure even with light and moderate winds, and often structural damage will result in more severe winds. Extremely high winds can cause the structure to be lifted and moved from its resting place and even overturned.

Some areas of the country, especially in the foothill regions of mountainous areas, have experienced windstorms reaching and exceeding 125 miles per hour. The wind is often funneled down and through a mountain valley or pass and the forces associated with such storms can be likened to the forces experienced in hurricanes or tornadoes. Such a severe windstorm can damage and even destroy a mobile home. In fact, high winds are a major cause of concern to any person residing in this type of dwelling.

In considering this problem, it was found that it was not so much the lateral forces created by a windstorm blowing broadside against the stationary mobile home as it was the airflow pattern across the roof surface. The roof surface functions as an airfoil to produce a substantial lift, with the wind sometimes being capable of lifting the mobile home off its foundation. Also, there will be produced a large, fluctuating turbulence roll, downwind from the structure, sometimes referred to as the "Von Karmen" effect, which will produce substantial vibrational forces against the structure.

It is a practice to anchor or tie down a mobile home whenever it is located in an established park. Intricate arrangements of cable tiedowns and cross anchoring have been used to prevent the structure from moving and to stabilize it against excessive wind forces. However, such anchoring will not stop the undesirable vibration and often it is insufficient to protect the mobile home from the lifting and tipping forces encountered.

Other devices have been proposed to supplement the anchors or tiedowns of a mobile home. For example, sandbags, tires, stones and the like have been loaded on the roof of a mobile home, but the results have been generally unsatisfactory. In the past few years, unusually severe windstorms in the vicinity of Boulder, Colorado, have damaged and destroyed many mobile homes, and the same problem exists in many other areas throughout the country. It follows that there is a

real and definite need for an improved and reliable method and system for stabilizing a mobile home against high winds.

The present invention was conceived and developed with the above considerations in view, and comprises, in essence, an arrangement of flat, moderately heavy, block-shaped members in desirable, regular, spaced patterns across the roof surface of a mobile home. When these blocks are properly arranged, as hereinafter described, a surprising stabilizing and quieting effect is achieved in the mobile home. A mobile home having such block arrangement was observed to quietly withstand a severe windstorm, while adjacent mobile homes are damaged. Apparently, the roof block pattern does far more than add weight to the mobile home. The blocks effectively break up the lift effect of the airflow over the roof of the mobile home and at the same time, produce many small eddies of turbulence rather than a single, large, fluctuating, turbulent roll at the downwind side of the structure. This eliminates the forces which cause the walls and roof of the mobile home to vibrate and also eliminates a substantial portion of the forces which tend to tip the mobile home and/or lift it off its foundation.

Accordingly, an object of this invention is to stabilize a generally flat roof structure such as a stationary mobile home, so as to eliminate and prevent the damaging effects caused by high wind forces.

Another object of the invention is to provide a novel and improved mobile home structure which will not vibrate to any significant extent in a windstorm.

Another object of this invention is to provide a method of stabilizing a mobile home type structure which is both economical and easy to apply.

A further object of the invention is to provide a method for stabilizing the elongated structure of a mobile home by applying block members to the roof of the structure in a manner which is simple and easy and which does not require the penetration of the roof surface so as to maintain its weatherproof characteristics.

With the foregoing and other objects in view, my present invention comprises certain constructions, combinations and arrangements of materials, and sequences, operations and steps, all as hereinafter described in detail, defined in the appended claims, and supplemented by the accompanying drawings in which:

FIG. **1** is a perspective view of a stationary mobile home which is stabilized against wind by roof blocks according to the principles of this invention.

FIG. **2** is an end view of the upper portion of a mobile home such as shown at FIG. **1**, but on an enlarged scale to illustrate a preferred arrangement of roof blocks and with arrows indicating, diagrammatically, a wind pattern over the roof.

FIG. **3** is an end view similar to FIG. **2**, but showing a mobile home having an arched roof.

FIG. **4** is a fragmentary perspective view of one corner of a mobile home upon which the roof blocks have been installed; and

FIG. **5** is a fragmentary sectional view taken along the line **5—5** of FIG. **1**, but on an enlarged scale.

Referring more particularly to the drawing, FIG. **1** shows a mobile home, a lightweight, flat roofed, elongated structure **10** which is capable of being towed on a highway when it is to be moved. However, mobile

homes such as illustrated, and like structures with which the present invention is concerned, are usually set upon pads in a trailer court and are used as permanent dwellings. As such, even though mobile homes and like structures are not positioned on permanent foundations such as found in conventional house construction, they may be secured in place by various anchoring devices.

The mobile home **10,** shown in FIG. **1,** includes a front wall **11,** sidewalls **12** and **13** and a rear wall **14.** This structure is supported on an undercarriage frame **15** which, in normal use, is mounted upon suitable base members such as blocks, not shown. The typical mobile home will have various facilities within it for living purposes and will include windows **16** and a suitable entrance, as a door **17.** It will also include means to permit it to be towed. A wheeled carriage, not shown, is mounted below the frame **15.** A trailer tongue **18** and a hitch means **19** extends forwardly from the front wall **11** and at times, the front end of the trailer may be temporarily supported by a suitable lifting jack **20** at the tongue.

The roof **21** of a mobile home is comparatively flat, although it may be formed with a slight slope at each side to define a longitudinal central ridge **22,** as shown at FIGS. **1** and **2.** The roof may also be formed with a slight slope at each side which arches to define a longitudinal, central crown **23** as shown on the roof **21'** illustrated at FIG. **3.** The roof structure will terminate close to the sidewalls **12** and **13** and a gutter **24** may be provided.

The manner in which the roof structure of a mobile home is built is essentially conventional. One type of construction is shown at FIG. **5.** Suitable rafter trusses **25** fit with top wall plates **26** to form the framework of the roof and plywood sheeting **27** is secured to the rafters. The plywood is ordinarily covered with a protective, waterproof layer **28** such as galvanized sheet metal. This sheet metal is commonly applied as 48-inch transverse strips overlaying the roof and extending from the gutter **24** at one side of the mobile home to the gutter at the other side, with transverse lapping edges of the sheet metal being soldered together.

Whenever a strong wind strikes the mobile home broadside, the airflow against the side of the mobile home will be deflected upwardly to deflect the airflow over the roof upwardly and create a reduced pressure across the roof and at the opposite side of the mobile home. Beyond the other side of the mobile home, the downwind side, the airflow deflects downwardly in large, turbulent swirls which causes the reduced pressures against the roof and the downwind side of the mobile home, and will fluctuate resulting in undesirable vibration of the mobile homes such as is commonly experienced in a windstorm.

The purpose of the present invention is to disrupt this airflow pattern across the roof of a mobile home, to thus eliminate the undesirable effects of large, turbulent swirls downwind from the mobile home and to reduce the tipping and uplift forces on the mobile home to the point where they are not objectionable.

In the present invention, simple, rectangular blocks **30** are affixed to the roof as an array of transversely disposed rows **31.** The blocks **30** in each row extend from the edge of one eave of the roof to the edge of the opposite eave of the roof, and the blocks in the row are spaced apart in a regular pattern. The spacing, indicated as '*a*,' is preferably the same between the blocks of the row although such is not essential. A suitable spacing '*a*' was found to be in the same range as the thickness of the blocks as hereinafter set forth. It is desirable that the spacing be such as to create turbulent eddies or swirling air currents whenever a wind is blowing across the roof.

The number of individual rows **31** of the blocks can also be varied. The row spacing, indicated as '*b*,' is preferably the same across the length of the roof **21** although such is not essential. Preferably, there will be a row **31** adjacent to each end of the roof. It was found that this spacing between individual rows could vary from four to eight times the width of the block, although such limits of spacing are only approximate.

At one installation, conventional cinder or concrete blocks **30,** having a width of 8 inches, a length of 16 inches and a thickness of 2¼ inches, were arranged in rows with their length dimension extending transversely across the roof surface **21.** The space '*a*' between the blocks was approximately 4 inches, but, as was found in other installations, good results could be obtained by spacing the blocks approximately 2 inches apart, suggesting a reasonable spacing pattern where the space '*a*' could vary from approximately the thickness to twice the thickness of the block.

The spacing '*b*' between the rows of the blocks was sugested by the roof pattern, where galvanized sheets four feet wide are used. Thus, the 8 inch wide blocks were set on 48-inch centers, with the space '*b*' thus being 40 inches, or five times the width of the block. Other installations suggested that the spacing of rows could be as close as 24 inches on centers with the space '*b*' thus being 16 inches or two times the width of the block.

With the installations above described, using conventional cinder or scoria blocks as above described which weigh approximately 12 pounds each, the total loading applied to the roof **21** of a mobile home was in the range of approximately 2.4 to 5.8 pounds per square foot, which is well within the allowable load limits for the mobile home structures. This is true even with an allowance for snow and ice loading such as can occur in northern regions.

A moderately flat roof **21,** having a ridge **22** as shown in FIG. **2,** may have the blocks **30** arranged in rows **31** as described, but with half-blocks **32** arranged on each side of the ridge line **22.** The arched roof **21'**, shown at FIG. **3,** may use a row **31** of blocks which does not include broken blocks.

As shown in FIGS. **4** and **5,** the blocks **22** are arranged across the surface of the mobile home roof **21,** as described, and are secured to the surface of the roof to prevent their shifting or moving from their proper location as by accident or otherwise. A simple securing means is a layer **33** of asphalt mastic which is spread upon the roof sheet **28** and also upon the blocks to give a good bond when the mastic cures or sets. After hardening, the mastic layer **33** retains the blocks permanently in proper position. While asphalt mastic is a preferred material simply because of cost, other types of mastic or adhesive material, such as synthetic epoxy resins, can be used. Although mechanical fasteners are useable, adhesive materials are more desirable since the roof surface need not be ruptured, thereby maintaining its weatherproof characteristic.

With the present method of stabilization, somewhat diagrammatically illustrated at FIG. **2,** the air currents against the side of a mobile home are deflected upwardly and over the roof surface **21.** However, these currents are disrupted by blocks **30** which produce a number of turbulent swirls S, as indicated. Such swirls negate and destroy a lifting action which would be otherwise produced. Also, such swirls apparently break up, at least to a substantial extent, the large vibration inducing swirls downwind of the mobile home.

The efficiency of the present invention in producing these desired results is well demonstrated by actual field results. Several mobile homes at Boulder, Colorado, having blocks arranged upon the roof, as herein set forth, have been observed to remain quiet, vibration-free and stable in windstorms so severe that the residents of adjacent mobile homes, not so protected, fled because of the severe vibration and shaking of the homes.

I have now described my invention in considerable detail. However, it is obvious that others skilled in the art can build and devise alternate and equivalent constructions which are nevertheless within the spirit and scope of my invention. Hence, I desire that my protection be limited not by the constructions illustrated and described, but only by the proper scope of the appended claims.

What is claimed is:

1. In combination with a relatively narrow, elongated, enclosed, light weight stationary structure such as a mobile home, a wind stabilizing and anchoring means comprising:

a. a plurality of rectangular building blocks disposed upon the roof as an array of transverse rows of blocks spaced apart extending longitudinally over the reach of the roof;

b. the spacing between the blocks in each row being about one to two times the thickness of the block;

c. the spacing between the rows of blocks being approximately two to eight times the width of the blocks;

d. said blocks being of a weight such that, when spaced as aforesaid, said roof is loaded to about 2.4 to 5.8 pounds per square foot; and

e. adhesive means for securing the blocks to the roof to prevent them from shifting out of position.

2. In the structure defined in claim **1,** wherein:

said means for securing the blocks to the roof is a mastic to adhere the blocks in position without penetrating the roof cover.

3. In the structure defined in claim **1,** wherein:

the blocks in each row are spaced apart and the block at each end of each row is adjacent to an edge of the roof.

4. In the structure defined in claim **3,** wherein:

the transverse rows of blocks includes a row of blocks adjacent to each end of the roof.

5. In the structure defined in claim **4,** wherein:

said blocks weigh approximately 12 pounds each.

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