

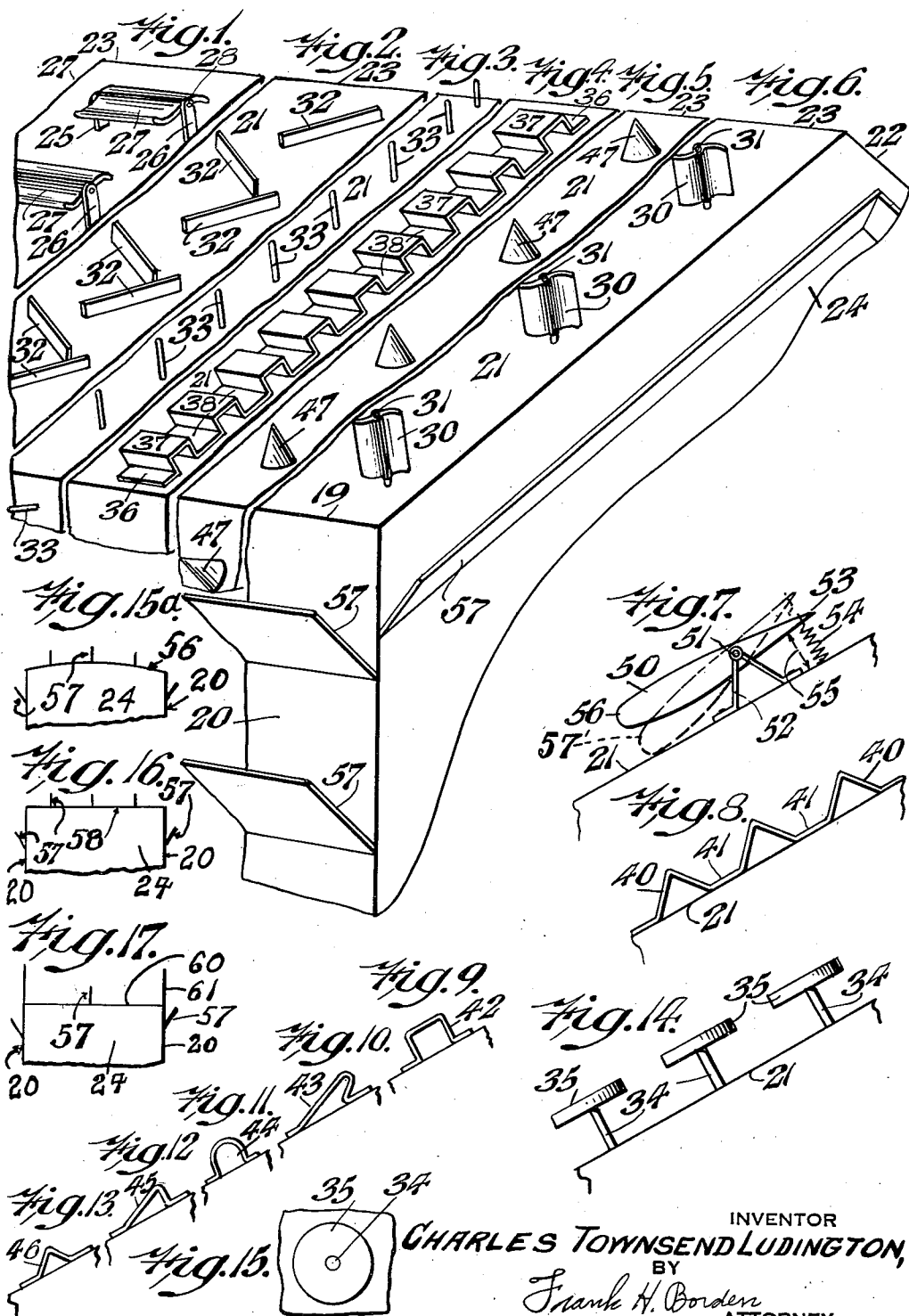
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C. T. LUDINGTON

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BUILDING

Charles Townsend Ludington, Ardmore, Pa.

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12 Claims. (Cl. 108—1)

This invention relates to buildings and particularly to improvements in exterior surfaces thereof to minimize adverse effects of high wind velocities.

In my application, Serial No. 247,333 filed December 23, 1938, I disclosed an invention in roof constructions by which the smooth flow of air over roofs could be interfered with as by the creation of turbulence with a resultant beneficial killing of the differential pressures effective on the roof that in tornados and the like might otherwise unroof the building supporting the roof.

It is among the objects of this invention to improve the invention set forth in said application No. 247,333; to provide "spoiling" devices of simplicity and economy which will not affect the normal drainage and the like functions of the roof; to provide means on the side walls of buildings contributing toward the prevention of differential pressures on a roof thereabove; to provide building supported elements normally permitting free flow of water and the like but which are automatically operated by the relative air stream to set up turbulence and other drag-inducing effects on the air stream; to provide hurricane-proofing for buildings at extremely small costs; to provide metal stampings for use on buildings to interfere with the free flow of air relative thereto; to provide a series of drag-creating elements formed from a single strip of metal; and many other objects and advantages will become more apparent as the description proceeds.

In the accompanying drawing forming part of this description:

Fig. 1 represents a fragmentary perspective of a roof surface containing spinning turbulence-creating devices arranged to permit free drainage therebeneath.

Fig. 2 represents a similar fragmentary perspective of a sloping roof area in which fins are arranged in staggered overlapping relation, generally upstanding relative to the roof and in their longitudinal extents being angularly divergent from both the line of the peak of the roof as well as the side edge of the roof.

Fig. 3 represents a similar fragmentary perspective of a roof section showing part of the side wall with a series of substantially perpendicular pegs as the drag-inducing elements.

Fig. 4 represents a similar fragmentary perspective of a roof section carrying a multi-ply corrugated sheet metal strip as the drag-creating element.

Fig. 5 represents a similar fragmentary perspective of a roof section and side wall section in which the spoiling or drag-inducing elements are a plurality of substantially conical members.

Fig. 6 represents a similar fragmentary perspective of a roof section and showing a side wall and end wall of the building structure, with spinnable drag creating elements on the roof and with angularly disposed laterally inclined vanes on the side wall for minimizing the adverse effects of relatively vertically moving air streams.

Fig. 7 represents a fragmentary elevation of a modified form of spoiler device comprising a pivoted airfoil spring held for clearance from the roof but arranged to contact the roof to create turbulence in response to air pressure thereon.

Fig. 8 represents a similar elevation in which the turbulence element comprises an endless metal strip corrugated with inverted V shape corrugations.

Figs. 9 to 13 inclusive represent respectively side elevations of individual modified forms of vanes or fins for the building surface.

Fig. 14 represents a fragmentary side elevation similar to Figs. 7 and 8 in which the turbulence creator comprises elevated disc-like elements.

Fig. 15 represents a plan of one of the disc-like elements of Fig. 14 and a fragmentary plan of the building structure surface upon which it is mounted.

Figs. 15a, 16 and 17 represent respectively diagrammatic fragmentary side elevations of slightly modified roof forms of building structures incorporating the invention.

For purely illustrative purposes reference may be made to Fig. 6 for a showing of the bare outlines of the surfaces to be treated and the relations they bear to each other. Thus a side wall merges into the generally sloping windward roof surface 21 as by the eave construction which is common (not shown) or in the line of intersection 19. Windward slope 21 meets the usual, illustratively only, descending companion sloping roof portion 22 in the peak or ridge 23. An end wall 24 completes the building structure so far as one end thereof is concerned.

As has been developed in said earlier filed application, the wind passing with high velocity over the building with its initial impact directed against side wall 20 and windward roof surface 21 in the normal smooth roof heretofore common, flows smoothly up and over the ridge 23 to create negative pressure or a partial vacuum over the lee roof 22. The vacuum thus created was the direct cause of unroofing the building struc-

ture in many past storms. Obviously it will be understood that each roof surface 21 or 22 will have to be treated as later described of roof surface 21 as the wind obviously may come from any direction. In this connection it is unusual for unroofing or adverse effects to follow the direct incidence of the high velocity winds against the end wall surface 24 although it is contemplated that the side wall treatment to be recited may be applied to the end wall 24 to good advantage.

I have discovered that in the present type of structure having the side walls and roof as described and either with the side wall meeting the windward roof in a projecting eave or, and most particularly, when they simply merge in the line 19, that the impact of the high velocity air stream against the side wall 20 causes such upward flow past the meeting edge 19 as to create an area of negative pressure adjacent to such meeting surface. This invention contemplates the correction of that adverse factor as will be pointed out hereinafter.

Referring to Fig. 1, the windward surface 21 supports the posts 25 and 26 upon which the curved substantially S shaped spinnable devices 27 one supported on an axis 28, so arranged as to have a clearance from the roof 21 during rotation, which illustratively may be three inches or the like and which spinners are arranged in either aligned or staggered series on the roof surface in such manner as to create turbulence in the air stream passing thereover as will be clear. The spinners 27 as illustrated in Fig. 1 have their axes substantially parallel to the roof and to the ridge 23 but if desired they may be disposed with the axes 28 parallel to the side wall 24. As shown in Fig. 6 analogous spinners 30 mounted on axes 31 may be mounted with the axes perpendicular to the roof 21 whereby to create analogous turbulence.

In Fig. 2 the roof has any desired number of substantially perpendicular fins 32 arranged suitably in staggered relation upon the roof surface so that drainage down the roof is not interfered with and with the respective elements 32 longitudinally disposed in angularly divergent relation to the ridge 23 and to the end wall 24. In place of the alternate staggered relation disclosed the series of fins may be disposed in substantial parallelism to each other or to ridge peak 23, and in staggered relation to facilitate drainage while producing drag to the smooth flow of air over the roof portion 21.

The device illustrated in Fig. 3 is of the utmost in simplicity and comprises a series or plurality of aligned or staggered pegs or sticks 33 preferably perpendicular to the roof 21 although obviously capable of being inclined in any desired direction. A modification of the pegs of Fig. 3 is shown in Figs. 14 and 15 in that analogous pegs 34 carry discs or the like 35 to facilitate the creation of drag in the moving air stream.

The device of Fig. 4, namely of a continuous strip 36 having the alternate upwardly and downwardly presenting corrugations 37 and 38, can be applied to the roof in narrow elongated strips extending transversely or chordwise of the roof as shown or may be disposed in aligned or staggered relations running longitudinally of the roof parallel to the eave line 19. The relatively square corrugations illustrated in Fig. 4 may be replaced by the inverted V shaped corrugations 40 of the strip 41 shown in Fig. 8.

It is contemplated that an analogous result may be accomplished by providing a plurality of the fins shown in Figs. 9 to 13 inclusive, in either aligned or staggered relation and having any desired angular relation to the ridge or end wall lines.

Specifically in Fig. 9 a sheet metal stamping of a single square corrugation 42 may be used. In Fig. 10 the asymmetrical inclined corrugation 43 is disclosed for the desired purpose. Fig. 11 shows a symmetrical substantially tubular fin 44. Fig. 12 illustrates a wedge shaped fin 45 and Fig. 13 illustrates a single inverted V shaped fin 46. It will be understood that the fins 32 shown in Fig. 2 may be single sheets of sheet metal or the like or may comprise fins as illustrated in Figs. 9 to 13 inclusive or as modified as may occur to those skilled in the art.

Referring to Fig. 5 a further highly simplified form of structure is illustrated in the mounting upon the windward roof surface of a plurality of aligned or staggered substantially conical members 47.

Referring to Fig. 7 a form of airfoil 50 is disclosed pivoted on an axis 51 on the supporting bracket 52 mounted on the roof 21. The trailing edge 53 of the airfoil is engaged by spring 54 to urge the airfoil section to substantial parallelism to the roof 21 to afford a clearance 55 permitting draining of rain, snow and the like but which is capable of responding to air pressure to push the entering edge 56 downwardly against the roof 21 as indicated in dotted lines 57' to produce a turbulence creating wind directing airfoil surface.

Mention has been made of the adverse effect sometimes attaching to the vertical flow relative to the windward wall 20. I prefer to provide a vane or angularly divergent fin 57 projecting from said wall 20 spaced below the eave line 19 so as to effect an interruption in the vertical flow to prevent the creation of negative pressure on the upper roof surfaces, whether flat, curved or the windward sloping surface 21. The preferably horizontally extending fin 57 may be a single "spoiler" element or may be one of several used on the vertical or substantially vertical walls.

It is additionally contemplated that any other individual type or series of spoilers or combinations thereof disclosed herein or of any reasonable modification thereof, may be disposed upon the substantially vertical wall 20 in place of or in augmentation of the fins 57 disclosed.

While for purely illustrative purposes, the roof disclosed is of the peaked and more or less symmetrical type, yet it will be clear that the inventions pertain to other types of roof in an analogous manner. A typical roof by which adverse differential pressures are engendered by high velocity winds is the substantially arcuate roofs 56 of hangars or similar structures as shown in Fig. 15a. Owing to the curvature the relative air passage has an effect similar to that over the upper surface of an airfoil and it is highly important that spoilers 57 such as any of those disclosed or their equivalents as will occur to those skilled in the art, will be provided both on the roof and probably also on the side walls 20, as well. Substantially similar considerations affect the treatment of Mansard types of roofs. Alternatively the structures having completely flat roofs as 58 of Fig. 16 or flat roofs such as 60 of Fig. 17 having a surrounding wall 61, are susceptible to unroofing by hurricanes and the

like and the invention contemplates treatment of the side walls, especially, either with or without spoilers 57 on the roof proper, by suitable spoilers 57 to interfere with the vertical flow up the side walls.

It is to be understood that although each of the normal flow obstructing projections disposed on buildings for conventional ornamentation or utilitarian purposes, such as window projections, ledges, friezes, cornices or the like, may have a small unintended turbulence-creating function, it is generally so minute that even in the aggregate they exert no appreciable drag, so that at critical velocities the unroofing may still take place. It is the province of this invention when used on buildings free from such normal projections to create such positive substantially predetermined degree of turbulence and retardation of flow as will prevent unroofing at critical velocities. When used on buildings having some or all of such normal projections, it is the province of the invention to create such positive substantially predetermined degree of turbulence and retardation of flow as will prevent unroofing at critical velocities at which such normal projections alone would be ineffective to prevent unroofing.

It is thought that the invention will be clear as will the fact that the exact dimensions will vary in accordance with the conditions governing the local problem and that many modifications of the spoiler devices disclosed may be resorted to by those skilled in the art without departing from the spirit of the invention.

I claim as my invention:

1. In building constructions, an external surface, means operatively supported to extend from said surface to a point such as to create turbulence in air flowing along the surface, said means being movable responsive to air movement to enhance the turbulence creation.

2. In building constructions, an external surface, means operatively supported to extend from said surface to a point such as to create turbulence in air flowing along the surface, said means comprising pivoted means having an edge movable relative to the surface in response to differential air velocities to modify the turbulence creation.

3. In building constructions, an external surface, means operatively supported to extend from said surface to a point such as to create turbulence in air flowing along the surface, said means comprising a plurality of fins extending across the line of air movement and of such area and numbers as to create substantially predetermined drag in said air flowing along said surface.

4. In building constructions, an external surface exposed to passing air streams, a plurality of spaced substantially perpendicularly extending abutments of such area and distribution as to be arranged to create substantially predetermined turbulence in such passing air stream, the abutments comprising pegs.

5. In building constructions, an external surface exposed to passing air streams, a plurality of spaced substantially perpendicularly extending abutments of such area and distribution as to be arranged to create substantially predetermined turbulence in such passing air stream, the

abutments comprising pegs, a plurality of disc like terminals mounted on the respective pegs.

6. In building constructions, an external surface exposed to passing air streams, a plurality of spaced substantially perpendicularly extending abutments of such area and distribution as to be arranged to create substantially predetermined turbulence in such passing air stream, said abutments comprising conical members.

7. In building constructions, a corrugated strip of metal, an exposed structural surface supporting said strip, said corrugations being of such size and number and supported in such manner relative to said surface as to create substantially predetermined turbulence in air streams flowing thereover.

8. In building constructions, an exposed external surface, bracket supports in spaced relation on said surface, a substantially airfoil section extending between the brackets and pivoted thereto on an axis longitudinal of the section, resilient means normally urging the section to a position and attitude relative to the surface that a clearance is provided between the section and the surface, said section so arranged as to be susceptible to deflection downwardly on its axis to form a drag creating fin arising from the surface.

9. In building constructions, an exposed external surface, a plurality of staggered mutually angularly divergent upstanding fins mounted on said surface in such manner as to create turbulence in a passing air stream while permitting drainage between the adjacent fins.

10. A turbulence creating mechanism for the wall and roof of a building independent of normal projections if any disposed on said wall, comprising means operably associated with said wall and so disposed, arranged and proportioned with respect to the wall area and to the flowing air stream moving relative thereto and to the roof as to create flow retarding turbulence in said air stream to prevent unroofing airflow over said roof at critical velocities at which such normal projections would be ineffective.

11. A turbulence creating mechanism for the wall and roof of a building independent of normal projections if any disposed on said wall, comprising means operably associated with said wall and so disposed, arranged and proportioned with respect to the wall area and to the flowing air stream moving relative thereto and to the roof as to create flow retarding turbulence in said air stream to prevent unroofing airflow over said roof at critical velocities at which such normal projections would be ineffective, and supplemental turbulence-creating means associated operably with the roof for enhancing the creation of turbulence in air flowing over said roof.

12. In building constructions, an external substantially vertical wall surface exposed to passing air streams of critical velocities, a plurality of spaced substantially perpendicularly extending abutments of greater turbulence creating value than any normal projections if any on said surface and of such area and distribution as to be arranged to create substantially predetermined turbulence in such passing air stream at critical velocities.

CHARLES TOWNSEND LUDINGTON.