

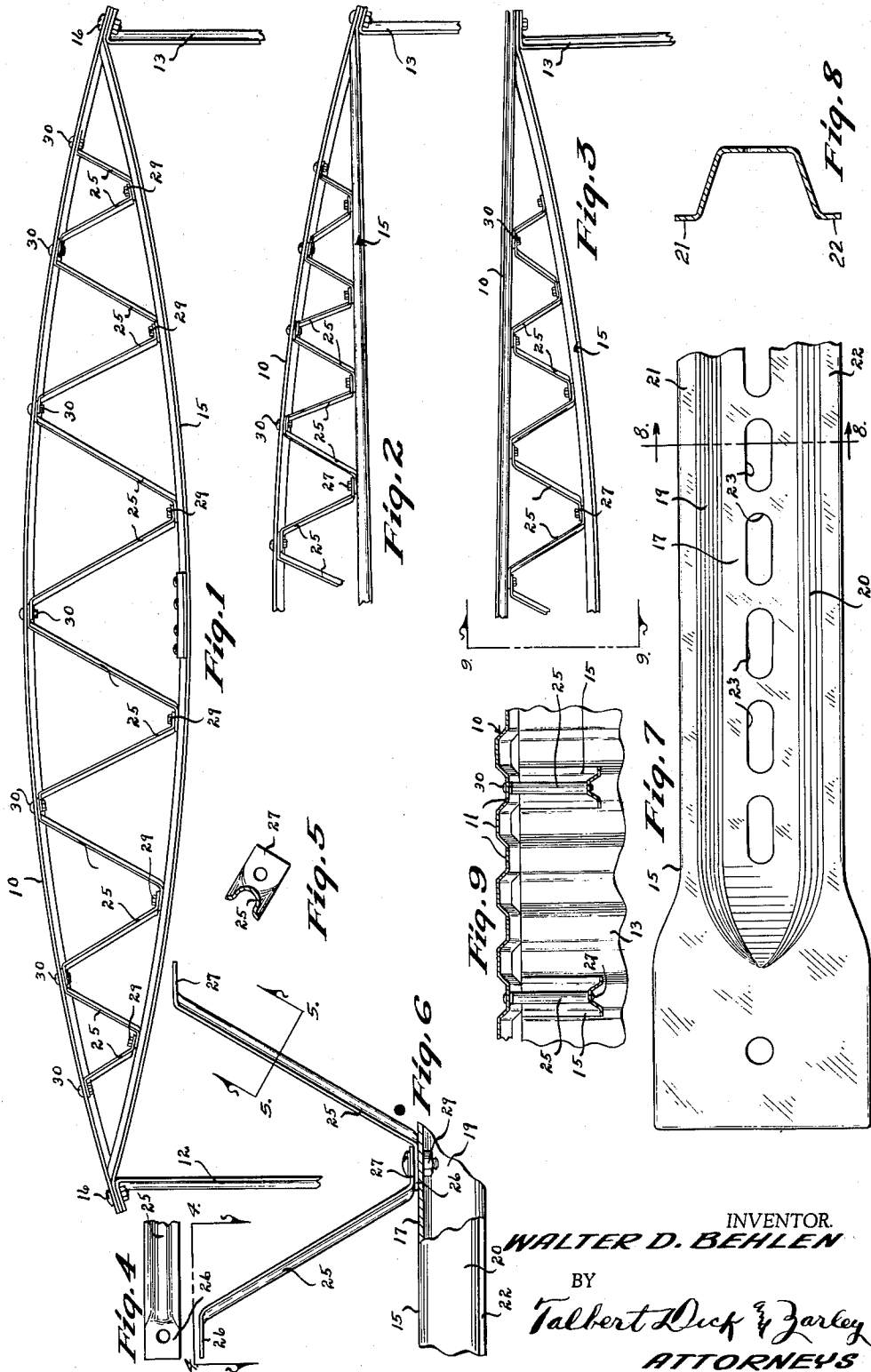
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CATENARY ROOF STRUCTURE

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CATENARY ROOF STRUCTURE

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1 Claim. (Cl. 52—86)

This invention relates to the roof structure of buildings and more particularly to a catenary roof structure.

In the fabricating of buildings, the roof structure is of utmost importance. This is especially true of metal roofed buildings and buildings of large span areas. Herebefore the general thought has been mostly confined to roof weight support. While this is important, it is also important that the roof withstand uplift loads, such as are experienced when strong winds blow into an open doorway, or open side. When such uplifts occur, failure will result unless there are brace members or like that will serve as compression members. Roofs that are of the double spaced apart sheeting type do provide a stressed skin structure, but such combination of elements is most expensive and require a closed ceiling arrangement.

Therefore one of the principal objects of my invention is to provide a roof structure that will successfully withstand both downward and upward loads.

More specifically the object of this invention is to provide a catenary roof structure, that will withstand stresses and strains in all directions.

A further object of this invention is to provide a strong roof structure that is light of weight.

A still further object of this invention is to provide a roof structure that is easily and quickly installed on the walls of a building or like.

A still further object of this invention is to provide a roof structure wherein the catenary members are bolted to the roof cover.

Still further objects of my invention are to provide a roof structure for buildings and like that is economical in manufacture, durable in use, and refined in appearance.

These and other objects will be apparent to those skilled in the art.

My invention consists in the construction, arrangements, and combination, of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in my claim, and illustrated in the accompanying drawings, in which:

FIG. 1 is a side view of one form of structure of my catenary roof structure.

FIG. 2 is a reduced side view of still a different form of structure of the device.

FIG. 3 is a reduced side view of a portion of a different form of structure of the device.

FIG. 4 is an enlarged top view of one of the arm braces taken from line 4—4 of FIG. 6.

FIG. 5 is an enlarged cross-sectional view of one of the arm braces taken on line 5—5 of FIG. 6.

FIG. 6 is an enlarged side view of two of the installed arm braces.

FIG. 7 is an enlarged end view of one of the beams.

FIG. 8 is a cross-sectional view of one of the beams taken on line 8—8 of FIG. 7, and

FIG. 9 is a cross-sectional view of the roof structure taken from line 9—9 of FIG. 3.

If a flexible member such as a chain is secured at both ends, it will, depending on its length and tightness assume a given downward arc from its two suspension points. This arc is natural and takes into account all existing factors. In the fabricating of my ceiling, this arc prin-

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ciple is taken into account and exists either in the ceiling skin and/or catenary bracing means.

In my catenary roof structure I prefer that the top roof skin be of assembled corrugated metallic panels.

The parts that make up the ties, arms, beams and like are preferably formed from sheet metal by cutting, bending, and forming. The roof skin, if curved upwardly forms the upper cord of the structure and the brace assembly, if curved downward, forms the lower cord of the structure. This catenary brace assembly, must in any case, have compression value, with the catenary or tie arrangement being bolted to the sheet metal skin of the roof, the reaction point will be at the wall of the building.

The catenary or tie structure may be secured to a corrugation of a roof skin and in either a valley of the roof skin or a ridge of the roof skin. In the drawings, I show both locations being used. If the span of the building is relatively short, the catenary tie phase may not be rigidly connected to the roof skin, but only to the structure at the building wall area.

In the drawings I have used the numeral 10 to generally designated the top roof skin. As before indicated, it is recommended that this top roof layer be made up of a plurality of corrugated panels secured together by any suitable means such as rivets, bolts or like. Normally the corrugations 11 will run longitudinally with the catenary frame girders.

I will describe, first a structure, wherein the roof skin is slightly bowed upwardly, and the catenary beams are bowed downwardly.

The roof skin has its lower outer areas extending over the two building walls 12 and 13. Obviously, several spaced apart catenary beams and their brace members will be employed.

Inasmuch as these units are duplicates of each other, I will describe only one unit. The numeral 15 designates the lower beam of a frame unit. This beam extends at one end over the wall 12 and under the roof skin 10 and at its other end over the wall 13 and under the roof skin 10. Bolt means 16 secures each end of the beam to the building walls and roof skin 10.

The walls may be of metal, concrete, wood or like. The beam bows downwardly from each of its two ends. This beam may be of any suitable structure, but I recommend that in cross-section it have a central strip area 17, a downwardly extending skirt at each side of the central area 17 and which I have designated by the numerals 19 and 20, respectively. Extending laterally outwardly from the bottom edge of the skirt 19 is a flange 21. Extending laterally outwardly from the bottom edge of the skirt 20 is a flange 22. As these two lower flanges, extend in opposite horizontal directions from each other, the beam in cross-section is of a form generally referred to as a "hot" beam.

Extending the length of the beam and in the central area is a row of spaced apart longitudinally elongated bolt holes 23. This downwardly curved beam is connected to the roof skin 10 by brace members 25. Normally these brace members are arranged in pairs to provide an A-frame brace or an inverted A-frame brace between the roof skin 10 and the beam. Each brace arm is preferably a metallic strip laterally curved in cross-section and having its two ends 26 and 27 flattened. These two flattened end areas extend away from each other and at an angle to the longitudinal axis of the arm brace as shown in the drawings.

By lapping a flattened end 26 of an arm over the flattened end 27 of another arm, an A-frame brace is provided. By overlapping the flattened end 26 of the last mentioned arm on another flattened end 27 of another arm, an inverted A-frame structure results. Therefore,

if desired A-frames are alternated with inverted A-frames as shown in the drawings. This provides a triangle formation of braces. A bolt 29 is passed through the adjacent lower flattened ends of each two spaced arms 25, and through the adjacent selected hole 23 of the beam 15. Therefore, the bolts 29 will detachably rigidly secure the arm braces to the beam 15. These arms are of such lengths that they extend upwardly to engage the underside of the roof skin.

If the arm braces are arranged in A-formations, each two adjacent converging arm braces will have a flattened end 26 and a flattened end 27 overlapping, and a bolt 30 is passed through these flattened ends and the roof skin.

These bolts detachably connect the upper ends of the arm braces to the underside of the roof skin. If desired these bolts 30 may pass through the valley of a corrugated roof or through the ridge of a corrugation, as shown. By connecting the curved roof skin, the brace arms, and curved beam, a unitary catenary roof structure is produced. The beams 15 and its braces 25 should be repeated, i.e., these units should be spaced apart under the roof skin. If desired, connections may be used between the beams 15.

The holes 23 at each end of a beam are also used by the bolt means 16. The catenary structure described, provides a ceiling that is exceptionally strong, light in weight, and has compression value that will handle both uplift and down lift stresses. If desired, if the span is not too wide, the arms 25 may not be bolted to the roof skin.

Obviously, the various components of the device of this invention must be possessed of the characteristic of stiffness in order to ultimately achieve a rigid structure which is strong and safe. In this regard, the roof skin 10 is fixedly secured to the walls 12 and 13, and the various arm braces 25 are fixedly secured to both the roof skin 10 and the lower beams 15.

As the upward curvature of the corrugated roof skin increases, the curvature of the beams 15 may decrease.

In fact, if the roof skin is highly arched, as shown in FIG. 2 the beams 15 may be horizontally straight.

Some changes may be made in the construction and arrangement of my catenary roof structure without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claim, any modified

forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

- In a unitary roof structure, comprising, in combination:
- a supporting wall;
 - a second supporting wall spaced from said first wall;
 - an upwardly bowed one-piece stiff top roof skin having ends fixedly secured to said walls;
 - a stiff slender elongated beam having its two ends fixedly supported by said walls and its length between said walls bowed downwardly;
 - stiff brace arms extending upwardly from said beam to said top skin roof and being fixedly secured to said top skin roof, said arm being placed under compression by the forces of said beam and said roof skin tending to straighten them out towards each other as a result of external loads on said structure; and,
 - separate connecting means fixedly securing said brace arms to said beams and said top skin roof.

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