

Feb. 16, 1971

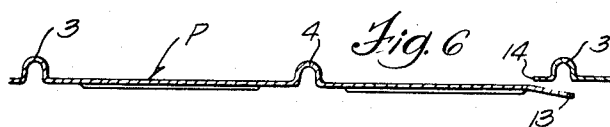
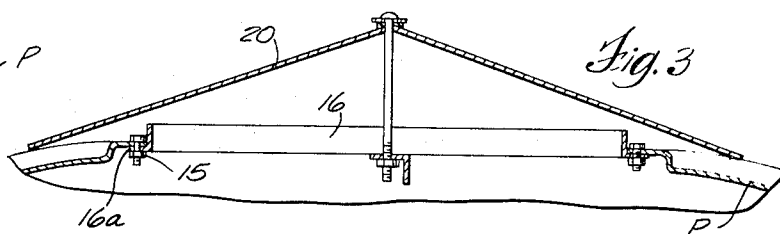
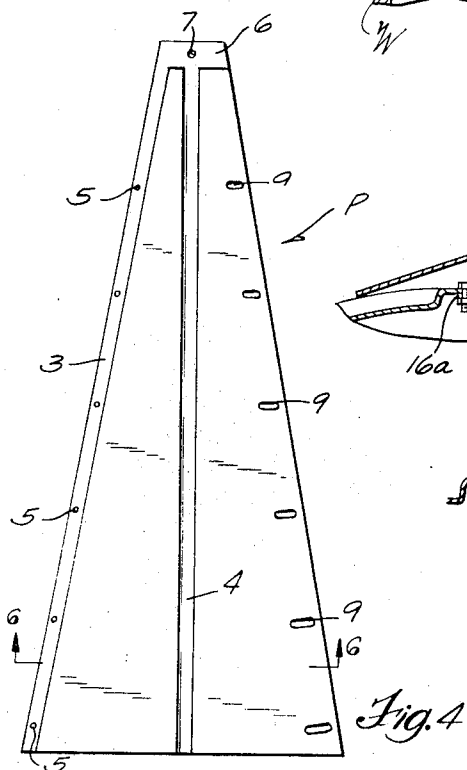
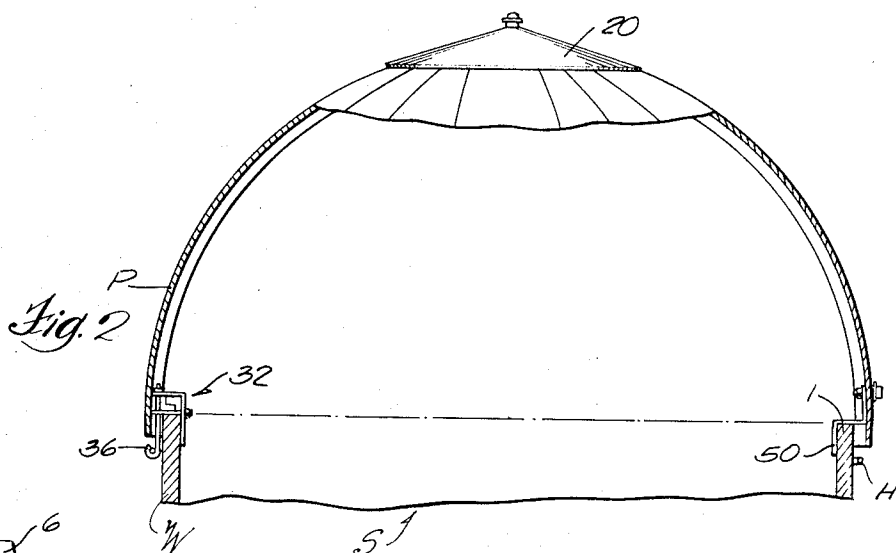
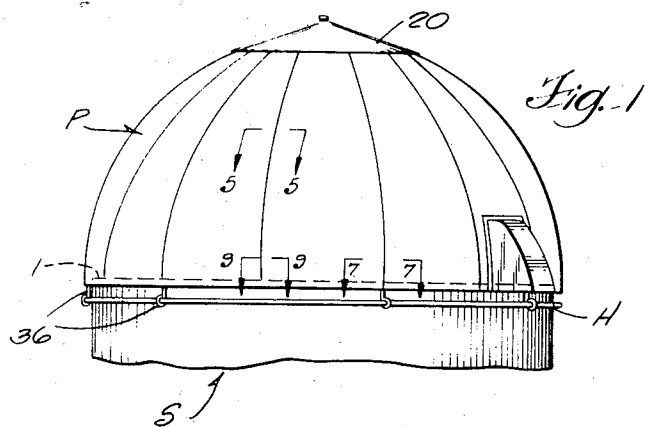
R. W. WOLLIN ET AL

3,562,976

ROOF CONSTRUCTION FOR SILOS OR THE LIKE

Filed March 3, 1969

2 Sheets-Sheet 1



Inventors:
Roger W. Wollin
Larry L. Smiley
By: James E. Nilles
Attorney

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ROOF CONSTRUCTION FOR SILOS OR THE LIKE

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2 Sheets-Sheet 2

Fig. 5

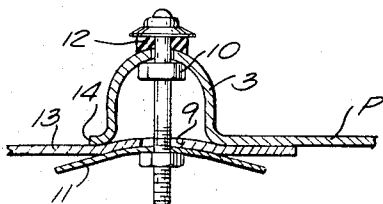


Fig. 7

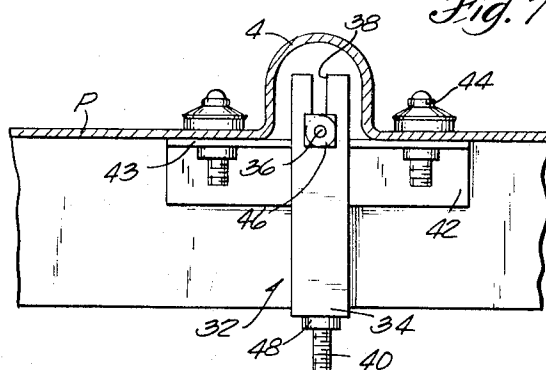


Fig. 9

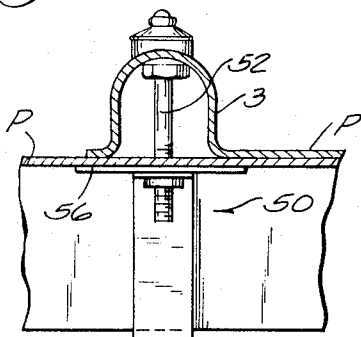


Fig. 8

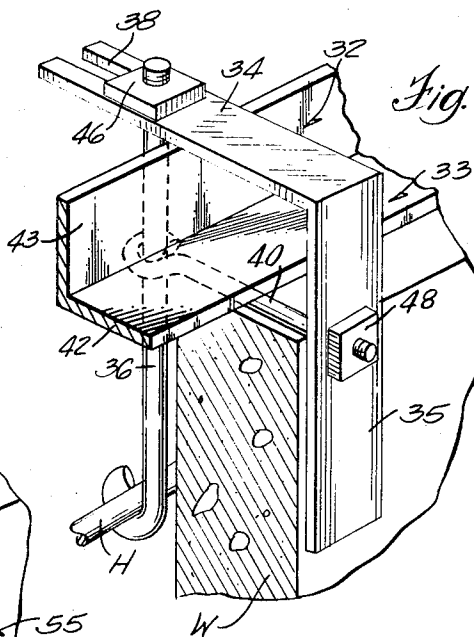
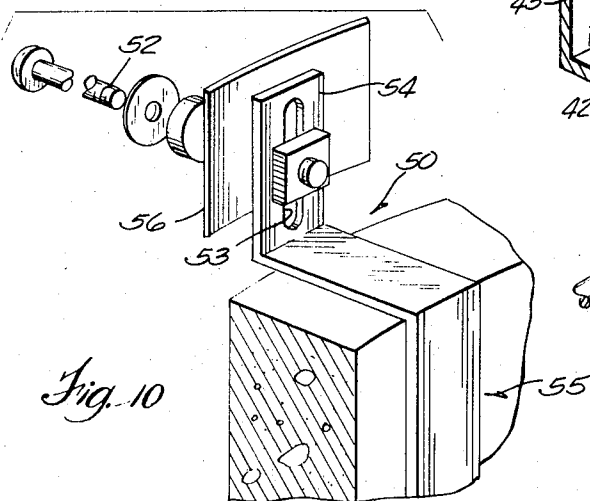


Fig. 10



Inventors :
Roger W. Wollin
Larry L. Smiley
By: James E. Nilles
Attorney

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ROOF CONSTRUCTION FOR SILOS OR THE LIKE
Roger W. Wollin, Lake Mills, and Larry L. Smiley,
Wausau, Wis., assignors to Fiberdome Incorporated,
Lake Mills, Wis., a corporation of Wisconsin
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U.S. Cl. 52—81

10 Claims

ABSTRACT OF THE DISCLOSURE

A generally dome shaped roof for silos or the like and fabricated from individual panels which are fastened together. The panels are adjustable relative to one another to accommodate silos or buildings of various diameters. The joints between the panels are constructed so as to be waterproof. Bracket means for holding the roof down tightly on the top of the silo and also tightly against the outside of the silo.

BACKGROUND OF THE INVENTION

This invention pertains to generally circular building structures and more particularly to the domes or roofs for such buildings, for example, silos, storage bins or the like. These roofs are fabricated from individual panels which have reinforcing ribs extending along their length and which when fastened together form a generally conical, radial ribbed roof.

Roofs of this general character are well known and are shown for example in the United States patent No. 2,187,616 which issued Jan. 16, 1940, and entitled "Silo Roof." These prior art devices have attempted to use various means for facilitating assembly of the panels and for preventing leakage through the joints between the panels. These prior art devices have not proven entirely satisfactory however, because of the numerous parts, joints, and the difficulty in assembling them. They were not only complicated in construction, but costly to manufacture and furthermore, did not provide the flexibility of size which was usually required in this type of construction. They were also difficult to install properly on the top of the silo and usually required numerous parts to firmly secure the roof.

SUMMARY

The present invention provides a generally dome shaped roof comprised of a plurality of individual panels. The panels have means for fastening them together which permit a standard panel size and configuration to be used in silos or buildings of various diameters. The invention also permits the use of a common size, central upper frame ring for silos of different diameters. The arrangement is such that the panels are fastened at a pivotal point at their upper end and directly to the ring and can be adjusted relative to one another so as to vary the diameter or circumference of the lower end of the completed roof. The invention also provides a novel ribbed joint construction between the panels which is easily assembled and is waterproof throughout its length.

Another aspect of the invention provides novel bracket means for holding the roof down tightly on the top of the silo wall and also tightly against the outside of the wall, and which means can be easily installed and adjusted.

Still another aspect of the present invention relates to the use of panels made of fiberglass which are light in weight and have sufficient flexibility or deformation so as to form a particularly good seal between panels when used with other aspects of the present invention.

These and other objects and advantages of the present invention will appear hereinafter as this disclosure progresses, reference being made to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, elevational view of a silo embodying the present invention;

FIG. 2 is a vertical view, partially in section, through the silo shown in FIG. 1, but on an enlarged scale;

FIG. 3 is a fragmentary, enlarged sectional view of the uppermost portion of the roof shown in FIG. 2;

FIG. 4 is an enlarged view of one of the panels used in the roof;

FIG. 5 is an enlarged detailed cross sectional view of the joint between the panels, the view being taken generally along the line 5—5 in FIG. 1;

FIG. 6 is a sectional view, taken generally along line 6—6 in FIG. 4, but on an enlarged scale, and showing the shape of one of the panel edges before two panels are secured together;

FIG. 7 is a view taken generally along the line 7—7 in FIG. 1;

FIG. 8 is a perspective view of the bracket shown in FIG. 7;

FIG. 9 is a view taken generally along the line 9—9 in FIG. 1, but on an enlarged scale; and

FIG. 10 is a perspective, exploded view of the clamp shown in FIG. 9.

DESCRIPTION OF A PREFERRED EMBODIMENT

The silo S or other structure with which the invention has been shown is generally circular in plan view. A series of steel hoops H are wrapped around the silo at spaced vertical intervals and act to strengthen the silo and prevent it from "exploding" or being pushed outwardly due to the pressure of the material stored therein. One such hoop has been shown adjacent the top edge 1 of the silo and further reference will be made to this particular hoop.

These silos are generally of various diameters and heretofore it has been a difficult problem for manufacturers of roofs to be able to fabricate and stock panels and other parts which are used to make up these roofs.

The roof provided by the present invention is comprised of a series of arcuate, sector-shaped panels P fabricated from fiberglass. These fiberglass panels have a certain amount of resiliency, are light in weight, and exceptionally strong. A rib 3 is formed along the length of one edge of the panel while another central rib 4 is formed along the center of the panel. As shown clearly in FIG. 4, a series of holes 5 are formed in the rib 3 at spaced intervals along the length of the raised rib. Adjacent the top, flattened end 6 of the panel, an aperture 7 is formed for purposes that will appear. Along the other side or length of the panel is a series of recesses, apertures, or slots 9 of elongated shape and these elongated apertures 9 may be formed as slots or the like which provide adjustability between the panels in a circumferential direction as will appear. Inasmuch as the panels are pivoted at their upper end at the apertures 7 and must swing circumferentially at their lower end relative to one another, the apertures 9 located towards the lower end of the panel are of greater length than the apertures 9 at the upper end of the panel. In other words, the apertures increase in length, in a horizontal or circumferential direction around the roof, as they progress downwardly along the length of the panel.

As shown in FIG. 5, the edges of adjacent panels are overlapped and fastening means in the form of bolt means 10 extend therethrough and have a washer 11 located at its

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lower end which is of sufficient size so as to completely cover the apertures 9. A rubber gasket 12 is provided under the head of the bolt means and when the bolt means are tightened, the flat edge 13 of the lower fiberglass panel deforms sufficiently to be drawn up to a certain extent within the rib 3 of the upper panel. Furthermore, as shown in FIG. 6, the one edge of a panel is formed as an inwardly turned edge 13 which lies under the adjoining rib 3. Due to the flexibility of the fiberglass, when the bolt means 10 are tightened to draw the edge 13 outwardly so that it is drawn slightly into the rib, the edge also deforms along the outermost edge 14 of the upper sheet.

The resulting joint forms a very effective seal against moisture for the entire length of the resulting panel joint.

The upper end of each panel is fastened by bolt means 15 to a center ring 16. The ring 16 is fabricated from an angle iron and has a horizontal flange 16a through which the bolt means 15 extends and on which the upper end of the panel rests.

It should be noted that with the present invention a ring 16 of a given diameter can be used for silos having various diameters within limits, as will appear.

With the panels pivotally attached at their upper end to the ring 16, and with the elongated apertures 9 along one side of the panels, the panels can be adjusted relative to one another. As a considerable number of these panels are used in any roof, if the elongated apertures 9, for example, are two inches in length, a considerable variation in silo diameters or circumferences can be accommodated with panels of any given size or configuration.

Thus, a considerable savings in costs for labor and dies in making the panel, in stocking the panels, and in handling and assembling these panels is made possible.

The entire roof is easy to assemble, light in weight, waterproof in construction, and particularly rigid.

A dome cap 20 as shown in FIG. 3 can then be used to close the top, central opening in the roof.

Bracket means are provided for securely anchoring the above described roof to both the previously mentioned silo hoop H which surrounds the upper end of the silo, and to the silo wall itself.

As shown in FIGS. 7 and 8, the bracket means 32 comprises an L-shaped, steel member 33 which has a horizontal portion 34 that extends over the top of the silo wall W and outwardly thereof. The member 33 also has a vertical portion 35 which extends downwardly along and against the inside of the wall W.

The steel hoop H is located adjacent the upper edge of the silo wall and a J-bolt 36 is readily connected at its lower end to the hoop and then extends upwardly where it passes through an open ended slot 38 in the free end of the horizontal portion 34 of the L-shaped member 33. An eyebolt 40 is slipped over and thus secured at one end around the J-bolt and then extends over the top of the silo wall and through the vertical portion 35 of the bracket means.

An intermediate brace 42 rests on top of the silo wall and has a vertical flange 43 which is secured by bolt means 44 (FIG. 7) to the inside of the roof and adjacent the lower end thereof. It will be noted from FIG. 8 the horizontal portion 34 of the bracket means rests firmly against the top of the brace 42 and when the nut 46 of the J-bolt is tightened, the bracket means is held tightly downwardly against brace 42 and against the top of the silo wall, thus holding the roof down securely. Furthermore, when the nut 48 on the eye-bolt is tightened, the J-bolt and the roof are held tightly against the outside of the silo wall.

The open ended slot 38 in the end of horizontal portion 34 permits easy assembly of the J-bolt in the bracket and radical adjustment of the J-bolt in slot 38. The J-bolt can also be easily assembled on the hoop at any location along the length of the hoop.

These bracket means 32 are spaced around the circumference of the silo wall and act to securely hold the

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roof downwardly and also inwardly against the outside of the silo.

Other brackets 50, as shown in FIGS. 2, 9 and 10 are spaced circumferentially around the silo at locations between bracket means 32, and are for the purpose of joining two panels securely together and then to the silo wall. A bolt means 52 is adjustable in slot 53 in the upper leg 54 of the L-shaped bracket 55. Bracket 55 sets on top of the silo wall. The washer 56 is also considerably larger than the slots 9.

What is claimed is:

1. A dome-shaped fiberglass roof for a circular wall, said roof being made up of a plurality of arcuate sector-shaped fiberglass roof panels and a center, upper ring attached to the upper end of said panels; said panels being secured at their upper end to said ring for limited pivotal movement in respect thereto, said panels each having a raised rib formed along one side and extending along the height thereof, a series of holes in said rib and spaced therealong, said panels having their adjacent edges overlapped, and said panels also each having a series of horizontally elongated apertures along their other side and spaced along the height thereof and aligned with said holes in said rib to form a joint, and fastening means extending through said holes and the elongated apertures of an adjacent panel, whereby said panels can be pivoted relative to one another to vary the circumference of the lower end of the roof formed by assembled panels, and when said fastening means are tightened to rigidly secure said panels together, the lower panel of a joint is pulled up slightly into the rib of the upper panel to form a watertight connection between said panels along the entire joint, means adjacent the lower edge of said panel for securing said panels to said wall, said means including brace elements secured to said panels and also including first bolt members holding said panels in a downward direction and other bolt members connected to said first bolt members and holding said first bolt members radially inwardly.

2. The combination with a dome-shaped roof of the type made up of a plurality of arcuate sector-shaped roof panels, an upper, center ring attached to the upper end of said panels, and a circular hoop surrounding a silo adjacent the upper edge thereof and to which said roof is anchored; a bracket means for securing said roof to said hoop and tightly around said upper edge of said silo; said bracket means comprising, an L-shaped member having a horizontal portion extending over said silo edge and extending outwardly therefrom, said member also having a vertical portion along and against the inner side of said silo, adjustable bolt means secured to and extending between said hoop and said horizontal portion forcing said member in a downward direction, other adjustable bolt means secured to and between said first bolt means and said vertical portion forcing said first bolt means against said silo, and an intermediate brace secured to the inside of said roof adjacent the lower edge thereof and set on the top of said silo edge and also located beneath and against said horizontal portion whereby the latter holds said roof tightly against the top of said silo wall.

3. The bracket means set forth in claim 2 further characterized in that said first adjustable means comprises a J-bolt which can be readily attached to said hoop.

4. The bracket means of claim 3 further characterized in that said horizontal portion has an open-ended slot where it extends outwardly from said silo wall, and said J-bolt is inserted in said slot.

5. The combination with a dome-shaped roof of the type made up of a plurality of arcuate sector-shaped roof panels, an upper, center ring attached to the upper end of said panels, said panels being secured at their upper end to said ring for limited pivotal movement in respect thereto, said panels each having a raised rib formed along one side and extending along the height thereof, a series of holes in said rib and spaced therealong, said panels

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also each having a series of horizontally elongated apertures along their other side and spaced along the height thereof and alignable with said holes in said rib when adjacent panels overlap to form a joint, and fastening means extending through said holes and the elongated apertures of an adjacent panel, whereby said panels can be pivoted relative to one another to vary the circumference of the lower end of the roof formed by assembled panels; and a circular hoop surrounding a silo adjacent the upper edge thereof and to which said roof is anchored; a bracket means for securing said roof to said hoop and tightly around said upper edge of said silo; said bracket means comprising, an L-shaped member having a horizontal portion extending over said silo edge and extending outwardly therefrom, said member also having a vertical portion along and against the inner side of said silo, adjustable bolt means secured to and extending between said hoop and said horizontal portion forcing said member in a downward direction, other adjustable bolt means secured to and between said first bolt means and said vertical portion forcing said first bolt means against said silo, and an intermediate brace secured to the inside of said roof adjacent the lower edge thereof and set on the top of said silo edge and also located beneath and against said horizontal portion whereby the latter holds said roof tightly against the top of said silo wall.

6. The combination set forth in claim 5 further characterized in that said first adjustable means comprises a J-bolt which can be readily attached to said hoop.

7. The combination of claim 7 further characterized in that said horizontal portion has an open-ended slot where it extends outwardly from said silo wall, and said J-bolt is inserted in said slot.

8. The combination with a dome-shaped fiberglass roof of the type made up of a plurality of arcuate sector-shaped fiberglass roof panels, an upper, center ring attached to the upper end of said panels, said panels being secured at their upper end to said ring for limited pivotal movement in respect thereto, said panels each having a raised rib formed along one side and extending along the height thereof, a series of holes in said rib and spaced therealong, said panels also each having a series of horizontally elongated apertures along their other side and spaced along the height thereof and alignable with said holes in said rib when adjacent panels overlap to form a joint, and fastening means extending through said holes and the elongated apertures of an adjacent panel, whereby

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said panels can be pivoted relative to one another to vary the circumference of the lower end of the roof formed by assembled panels, and when said fastening means are tightened to rigidly secure said panels together, the lower panel of a joint is pulled up slightly into the rib of the upper panel to form a watertight connection between said panels along the entire joint; and a circular hoop surrounding a silo adjacent the upper edge thereof and to which said roof is anchored; a bracket means for securing said roof to said hoop and tightly around said upper edge of said silo; said bracket means comprising, an L-shaped member having a horizontal portion extending over said silo edge and extending outwardly therefrom, said member also having a vertical portion along and against the inner side of said silo, adjustable bolt means secured to and extending between said hoop and said horizontal portion for forcing said member in a downward direction, other adjustable bolt means secured to and between said first bolt means and said vertical portion for forcing said first bolt means against said silo, and an intermediate brace secured to the inside of said roof adjacent the lower edge thereof and set on the top of said silo edge and also located beneath and against said horizontal portion whereby the latter holds said roof tightly against the top of said silo wall.

9. The combination set forth in claim 8 further characterized in that said first adjustable means comprises a J-bolt which can be readily attached to said hoop.

10. The combination of claim 9 further characterized in that said horizontal portion has an open-ended slot where it extends outwardly from said silo wall, and said J-bolt is inserted in said slot.

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HENRY C. SUTHERLAND, Primary Examiner

U.S. Cl. X.R.

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