Sept. 7, 1937. C. A. BANGERT 2,092,722

SILO ROOF

Filed Oct. 12, 1936 2 Sheets-Sheet 1

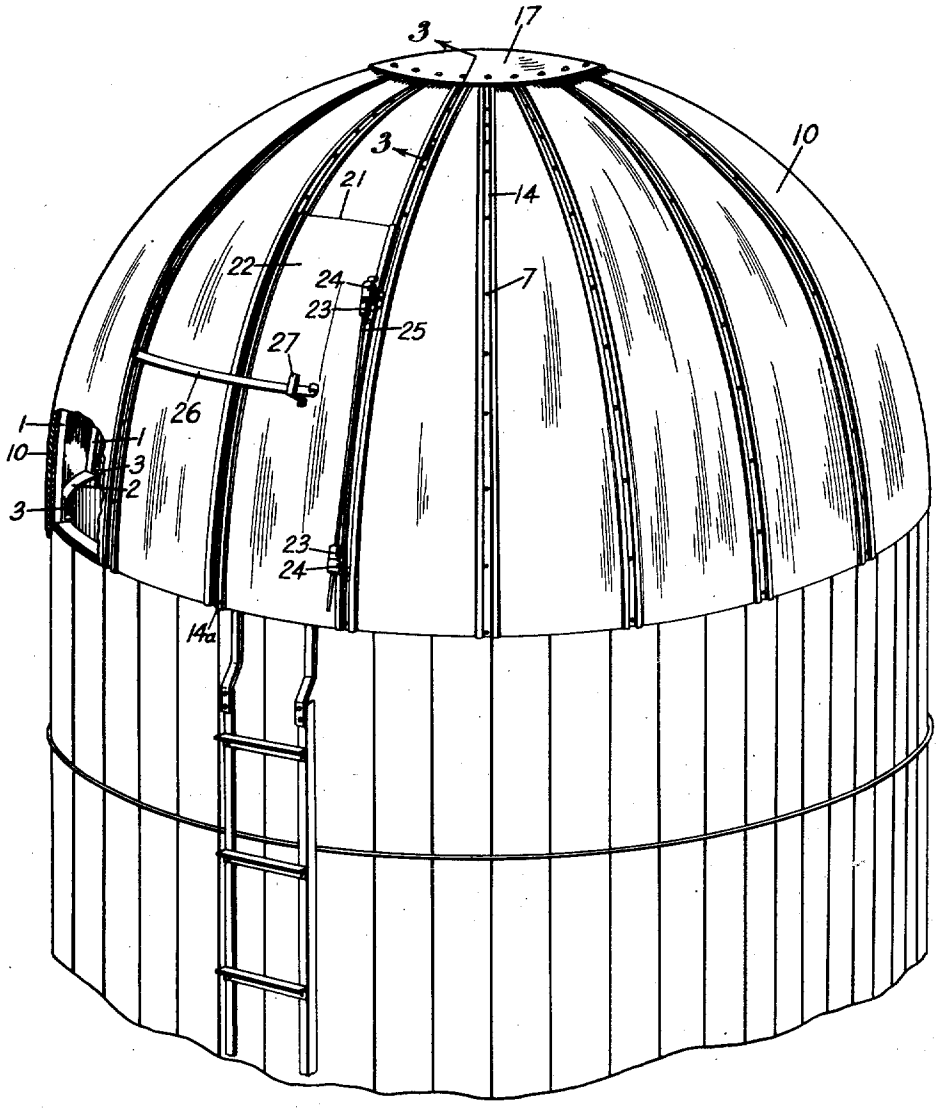


Fig. 1

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Filed Oct. 12, 1936 2 Sheets-Sheet 2

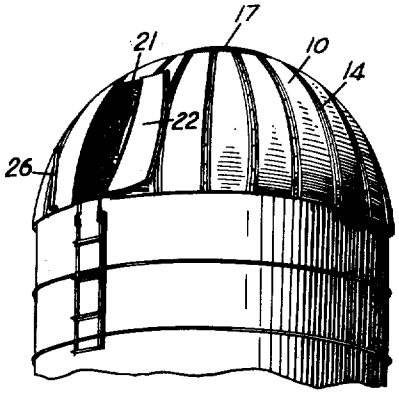


Fig. 2

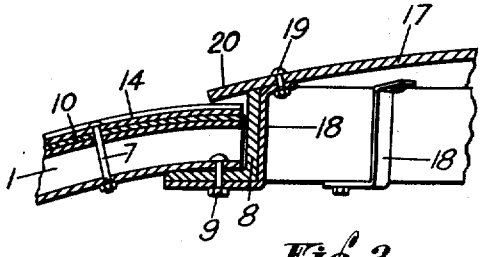


Fig. 3

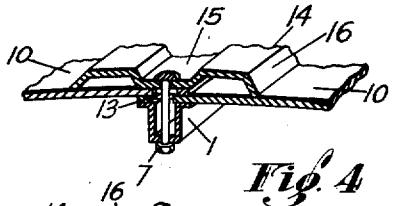


Fig. 4

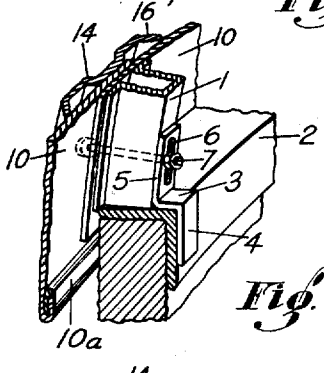


Fig. 5

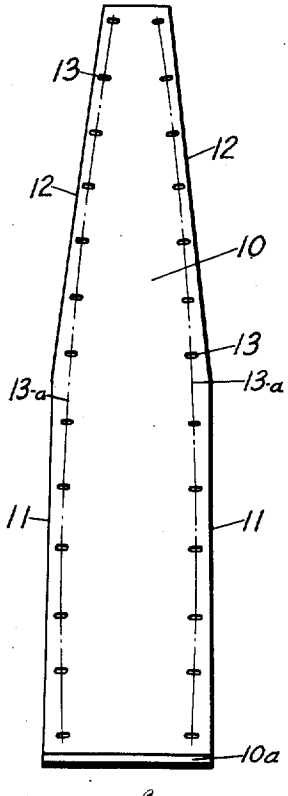


Fig. 6

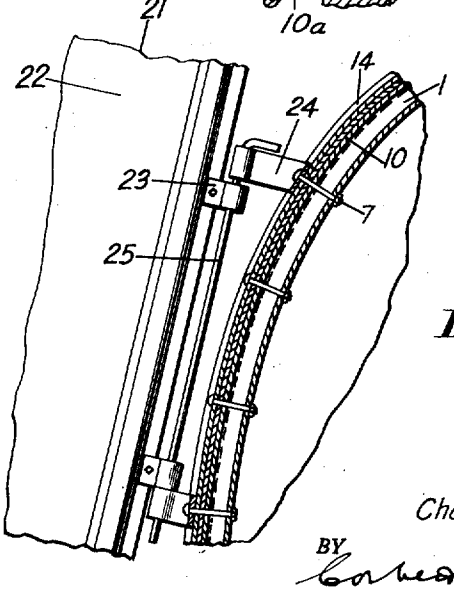


Fig. 7

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Patented Sept. 7, 1937

2,092,722

UNITED STATES PATENT OFFICE

2,092,722

SILO ROOF

Charles A. Bangert, Columbus, Ohio, assignor to Lamneck Products, Incorporated, Columbus, Ohio, a corporation of Ohio

Application October 12, 1936, Serial No. 105,193

9 Claims. (Cl. 108—32)

My invention relates to a silo roof. It has to do, more particularly, with a silo roof which is in the form of a dome and will, therefore, have the well-known advantages of dome structures.

Several different types of dome roofs for silos have been devised in the past. However, all of these dome roofs have certain disadvantages. These roofs are usually made of sheet metal by providing a plurality of cooperating segments having their edges interlocking with each other. Since the segments are provided with ribs on their edges which interlock with corresponding ribs on adjacent segments, it is necessary that such segments be preformed to a definite curvature. Consequently, when shipping said segments it is necessary to crate them in such a manner that the predetermined curvature of the segments will be maintained. Obviously, this increases considerably the cost of shipping. Furthermore, since it is necessary for the ribs on the edges to be curved laterally, it is necessary to use special machinery in order to form such ribs and provide special shears for cutting the edges of the segments along curved lines. Another disadvantage of such prior art dome roof structures has decided in the fact that because the edges of the segments interlock with each other, they could not readily adjust themselves to compensate for expansion and contraction or to fit out-of-round silos.

One of the objects of my invention is to provide a dome roof for silos which is of simple structure and is inexpensive to manufacture.

Another object of my invention is to provide a silo dome roof which is of such a nature that special crating for shipping is not necessary and it can be shipped knocked-down at a relatively low cost.

Another object of my invention is to provide a dome roof for silos which is constructed in such a manner that it will automatically adjust itself to compensate for expansion and contraction and to fit out-of-round silos or silos of slightly different diameters.

Another object of my invention is to provide a dome roof for silos which is of such a nature that the ordinary machinery and shears provided at metal shops may be used in forming it.

In its preferred form my invention contemplates the provision of a silo embodying a plurality of curved inner supporting ribs having a plurality of sheet metal segmental sections secured to the outer edges thereof. The edges of these sections overlap each other and are secured together by bolt and slot connections arranged along curved lines. The segmental sheet metal sections do not have interlocking edges and, consequently, do not have ribs formed at their edges. Therefore, it is possible to make the segmental sections in the form of flat sheets which are bent to the proper curvature when they are bolted to the inner ribs which are formed of a predetermined curvature. Furthermore, it is not necessary for the edges of the sections to be curved, since the edges of adjacent sections do not interlock, and, consequently, no special shears are necessary for cutting the edges. Since the adjacent sections are connected together by bolt and slot connections, they will automatically adjust themselves to fit out-of-round silos and to compensate for expansion and contraction.

The preferred embodiment of my invention is illustrated in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a perspective view, partly broken away, showing a dome roof made in accordance with the principles of my invention in position on a silo.

Figure 2 is a similar view but on a smaller scale illustrating my dome roof with the filling door partly open.

Figure 3 is a section taken substantially along the line 3—3 of Figure 1.

Figure 4 is a section illustrating the means for connecting two adjacent segmental sections of the roof together and to a supporting rib.

Figure 5 is a detail in perspective illustrating means for securing the roof to a silo.

Figure 6 is a plan view of one of the sheet metal sections used in forming my dome roof.

Figure 7 is a view illustrating the filling door which I provide on the roof.

With reference to the drawings I have illustrated a dome roof for silos made according to the principles of my invention. This roof embodies a supporting framework which is made up of a plurality of flanged ribs 1 which are preferably formed of metal. These ribs 1 have their lower ends secured to a circular ring 2 which is adapted to be secured to the upper end of the silo in a suitable manner, for example, by means of clips or brackets 3. Each of these brackets has a lower portion 4 welded or otherwise secured to member 2 and an upper portion 5. This upper portion 5 has a vertical slot 6 therein and a bolt 7 cooperates therewith to secure the bracket adjustably to the member 1.

Each of the ribs 1 is curved inwardly from its lower end to its upper end. All of these ribs 1

are formed of such a predetermined curvature as to form a proper framework for the dome roof. The upper end of each of the members 1 is connected to a flanged ring 8 of comparatively small diameter by means of a bolt 9. Obviously, the adjacent ribs 1 are spaced farther apart at their lower ends than at their upper ends and gradually converge towards their upper ends. As previously stated, the ribs 1 are preformed to their predetermined proper curvature.

The covering for the framework is made up of a plurality of sheet metal sections 10. These sheet metal segmental sections can be made in the form of flat sheets as illustrated in Figure 6. Furthermore, it is not necessary to cut the edges along a curved line. On the other hand, it is possible to cut the edges with straight shears. To do this, it is merely necessary to cut each edge along two lines 11 and 12 which are at an obtuse angle to each other but each line is straight so that it can be cut with a straight shears. The lower edges 11 are substantially parallel with each other but taper slightly towards each other, as indicated, while the upper edges 12 converge towards the upper end of the sheet. Each edge of the sheet is provided with a plurality of transverse slots 13 which are arranged along a curved line indicated by the line 13a and are substantially perpendicular thereto. The slots are so arranged that when the adjacent sections are bolted together, they cooperate to form a dome surface.

The sheet metal sections 10 are bolted to the rib members 1. Each of the sections 10 bridges the space between two adjacent rib members. The edges of the adjacent sections 10 overlap each other as indicated best in Figure 4. The bolts 7 pass through the members 1 and through the slots 13 in order to secure the sections 10 to the members 1 and the overlapping edges of the sections 10 together. Obviously, the edges of the adjacent sections 10 overlap each other in such a manner that the slots 13 in one section coincide with the slots 13 in the other section. The lower end of each section 10 overlaps the outer surface of the silo wall at the upper edge thereof, as indicated in Figure 5. The lower edge of each section is rolled as indicated at 10a to reinforce the section transversely and enhance its appearance. The upper end of each section 10 terminates at the ring 8, as illustrated in Figure 3. Obviously, when the sections 10 are bolted to the ribs 1, they assume the curvature of the ribs 1. Because of the bolt-and-slot connections between the adjacent edges of the sections 10, they may automatically adjust themselves relative to each other so that the roof will fit on a silo which is out-of-round or of slightly different diameter from the diameter of the lower end of the roof. Furthermore, this connection permits adjustment of the sections relative to each other to compensate for expansion and contraction.

In order to seal the joint between adjacent sections 10 and to cover the slots 13, I provide strips 14. These strips may also be made in substantially flat form although they are curved transversely slightly to correspond to the curvature of the roof. This strip is bent transversely to provide a U-shaped center portion 15 which rests directly over the joint between the two adjacent sections. The outer edges of the members 14 are turned downwardly at 16 so that the downturned edge will contact with the outer surface of the section 10 in such a manner that moisture will not be permitted to reach the joint between the adjacent sections. The strip 14 is bolted in overlapping relation to the joint between the adjacent sections by the same bolts 7 which secure the sections 10 to the ribs 1. These bolts pass through openings of a corresponding size formed in the U-shaped portion 15 of member 14. Obviously, when the member 14 is bolted in position it will assume the curvature of the outer surface of the sections 10. The member 14 extends from the extreme lower end of the sections 10 to the extreme upper end thereof.

In order to cover the opening provided within the ring 8 at the upper end of the roof, I provide a cap 17 of upwardly convex form. This cap is secured to the ring 8 by means of brackets 18 secured to the cap by bolts 19 and to the ring by the bolts 9. The cap 17 is provided with a portion 20 which extends outwardly a sufficient distance to overlap the upper ends of members 14, sections 10, and rib members 1, in order to prevent leakage at this point. Since the portion 20 is inclined outwardly the water will tend to flow away from this joint rather than enter at such joint.

I provide a filling door 21 in my roof adjacent the lower edge thereof. This filling door is of such a type that when it is swung open it will lie against the roof and will be out of the way. It comprises a section 22 which is hinged at its outer edge to the roof by means of hinge straps 23 secured to the door section 22 and straps or lugs 24 secured to the roof at a joint between two sections, the members 23 and 24 being pivoted together by a vertically extending rod or pintle 25. The door section 22 is curved in such a manner that when closed it is of proper contour to form a continuation of the dome roof. The hinge structure is so arranged as to permit this. Each edge of the door sections 22 is provided with a portion 14a of substantially the same structure as member 14 but slightly greater in dimensions so it can fit over member 14. Each edge 14a of the door overlaps the member 14 disposed at the edge of the doorway, when the door is closed, in order to provide a seal. In order to lock the door I provide a latch member embodying a curved bar 26 which is pivoted to the roof at a joint spaced the width of one section from the edge of the doorway. This bar may be swung behind a lug 27 secured to the door section to lock the door in position or it may be swung into inoperative position where it will hang out of the way of the doorway.

It will be apparent from the above that I have provided a roof structure for silos having many desirable features. This silo is of such a nature that it may be readily shipped in a knocked-down condition. The members 10 are in the form of flat sheets which facilitates shipment. The only members of the roof which are of a predetermined curvature and must be preformed to such curvature are the ribs 1. Obviously, these ribs could be bundled and shipped inexpensively.

My roof structure is of such a nature that it may be manufactured at a relatively low cost. No special machinery is required in order to provide curved ribs on the edges of the segments as is necessary with prior art roofs. Furthermore, ordinary straight shears may be provided for cutting the edges of the sections because it is not necessary that they be curved. My roof is much more simple to assemble and erect because the edges of the sections do not interlock with each other. The bolt-and-slot connections provided

between the edges of the adjacent sections will permit the sections to automatically adjust themselves relative to each other in order to compensate for expansion and contraction, so that the roof will fit out-of-round silos, or so that the roof will fit silos of slightly different diameter.

My roof structure is of pleasing appearance and will have all of the well known advantages of dome structures.

Having thus described my invention, what I claim is:

1. A silo roof comprising a plurality of segmental sections joined together to form a roof of dome-like form, the edges of the adjacent sections overlapping each other, said edges being cut along straight lines, means for securing the overlapping edges together, said means comprising a plurality of bolts passing through corresponding slots formed in the overlapping edges of the adjacent sections, said slots being disposed along a curved line.

2. A silo roof comprising a supporting frame made up of a plurality of curved ribs having their lower ends secured to a lower ring at circumferentially spaced intervals and their upper ends secured to a smaller ring at circumferentially spaced intervals, said ribs being preformed to a predetermined curvature, the adjacent ribs gradually converging towards their upper ends, a covering for said frame, said covering being composed of a plurality of segmental sections, each of said sections being made of a flat sheet having straight line edges, each edge of said sheet being provided with transverse slots arranged along a curved line, said sheets being disposed on said frame in such a manner that the edges of the sheets overlap each other, means for securing the sheets to the frame so that the sheets will assume the curvature of the ribs of the frame, said means comprising bolts passing through the ribs and through the slots formed in the overlapping edges of said sheets, means for sealing the joints at the adjacent edges of the sheets, said means comprising strips disposed in covering relation to said joints, and means for closing the opening formed within the smaller ring at the upper end of the roof, said means comprising a cap which is disposed over said opening.

3. A silo roof comprising a supporting frame made up of a plurality of curved ribs having their lower ends secured to a lower ring at circumferentially spaced intervals and their upper ends secured to a smaller ring at circumferentially spaced intervals, said ribs being preformed to a predetermined curvature, the adjacent ribs gradually converging towards their upper ends, a covering for said frame, said covering being composed of a plurality of segmental sections, each of said sections being made of a flat sheet having straight line edges, each edge of said sheet being provided with transverse slots arranged along a curved line, said sheets being disposed on said frame in such a manner that the edges of the sheets overlap each other, means for securing the sheets to the frame so that the sheets will assume the curvature of the ribs of the frame, said means comprising bolts passing through the ribs and through the slots formed in the overlapping edges of the sheets, and means for sealing the joint at the adjacent edges of the sheets, said means comprising strips disposed in covering relation to said joints.

4. A silo roof comprising a supporting frame made up of a plurality of curved ribs having their lower ends secured to a lower ring at circumferentially spaced intervals and their upper ends secured to a smaller ring at circumferentially spaced intervals, said ribs having a predetermined curvature, the adjacent ribs gradually converging towards their upper ends, a covering for said frame, said covering being composed of a plurality of segmental sections, each of said sections being made of a flat sheet, each edge of said sheet being provided with slots arranged along a curved line, said sheets being disposed on said frame in such a manner that the edges of the sheets overlap each other, and means for securing the sheets to the frame so that the sheets will assume the curvature of the ribs of the frame, said means comprising bolts passing through the ribs and through the slots formed in the overlapping edges of the sheet.

5. A silo roof comprising a supporting frame made up of a plurality of curved ribs arranged to form a dome-like structure, a covering for said frame, said covering being composed of a plurality of segmental sections, each of said sections being made of a flat sheet having straight-line edges, said sheets being secured to said frame in such a manner that the edges of the sheets will overlap each other and the sheets will assume the curvature of the ribs of the frame.

6. A silo roof of dome form comprising a supporting frame of dome-like structure made up of a plurality of curved ribs having their lower ends arranged at circumferentially spaced intervals around a circle, said ribs being preformed to a predetermined curvature, the adjacent ribs gradually converging towards their upper ends, the upper ends of the ribs being connected together, a covering for said frame, said covering being composed of a plurality of sections adapted to form segments of the dome, each of said sections being made of a flat sheet, said sheets being disposed on said frame in such a manner that the edges of the sheets overlap said ribs, and means for securing the edges of said adjacent sheets to the ribs of said frame in such a manner that the sheets will assume the curvature of said ribs, the edges of adjacent sheets being free from each other, said means comprising pin-and-slot connections which permit limited transverse movement of the sheets relative to the ribs.

7. A silo roof of dome form comprising a supporting frame of dome-like structure made up of a plurality of curved ribs having their lower ends arranged at circumferentially spaced intervals around a circle, said ribs being preformed to a predetermined curvature, the adjacent ribs gradually converging towards their upper ends, a covering for said frame, said covering being composed of a plurality of sections adapted to form segments of the dome, said sections being formed of flat sheets, and means for securing the sheets to the frame so that the sheets will assume the curvature of the ribs of the frame, the edges of adjacent sheets being free from each other, said means permitting limited transverse movement of the sheets relative to the frame and to each other.

8. A silo roof of dome form comprising a supporting frame of dome-like structure made up of a plurality of curved ribs having their lower ends arranged at circumferentially spaced intervals around a circle, said ribs being preformed to a predetermined curvature, the adjacent ribs gradually converging towards their upper ends, a covering for said frame, said covering being composed of a plurality of sheet metal sections adapt-

ed to form segments of the dome, said sections being formed of flat sheets, and means for securing the sheets to the frame so that the sheets will assume the curvature of the ribs of the frame, the edges of the adjacent sheets being free from each other.

9. A silo roof of dome form comprising a supporting frame of dome-like structure, a covering for said frame, said covering being composed of a plurality of sheet metal sections adapted to form segments of the dome, said segments being formed of flat sheets, and means for securing the sheets to the frame in such a manner that the sheets will assume the curvature of the frame, the edges of adjacent sheets being non-interlocking.

CHARLES A. BANGERT.

DISCLAIMER

2,092,722.—*Charles A. Bangert*, Columbus, Ohio. SILO ROOF. Patent dated September 7, 1937. Disclaimer filed February 4, 1939, by the assignee, *Lamneck Products, Incorporated.*

Hereby enters this disclaimer to claims 7, 8, and 9 in said specification.

[*Official Gazette March 14, 1939.*]

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