

Jan. 16, 1940.

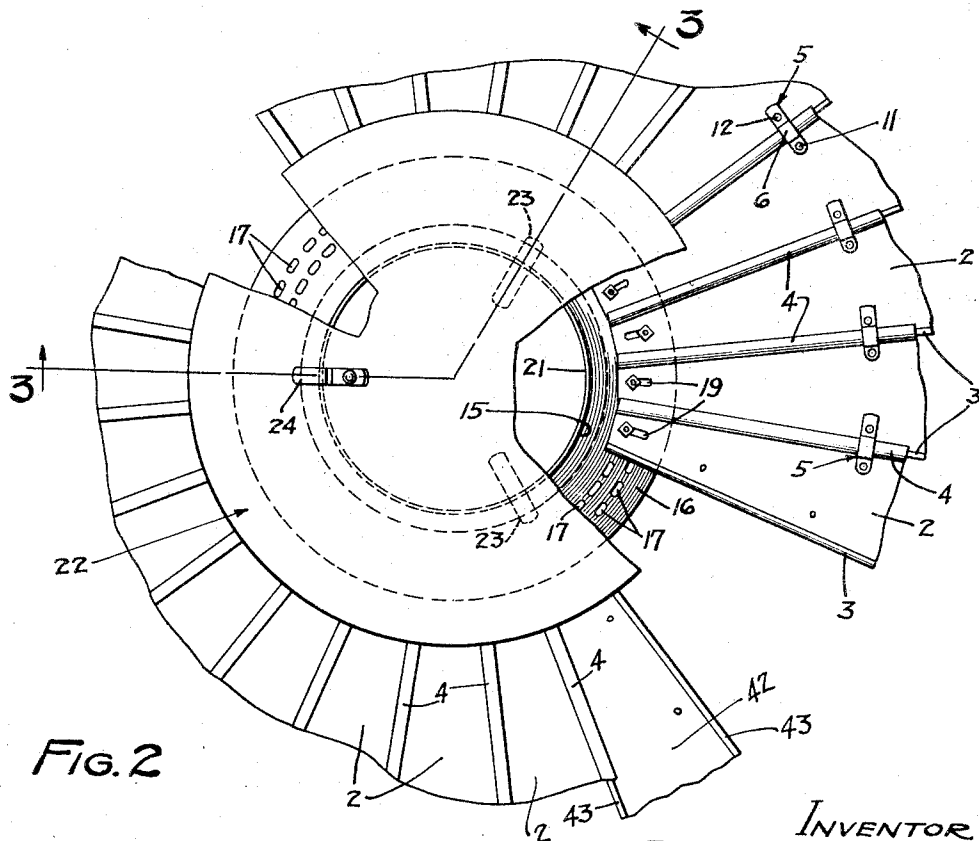
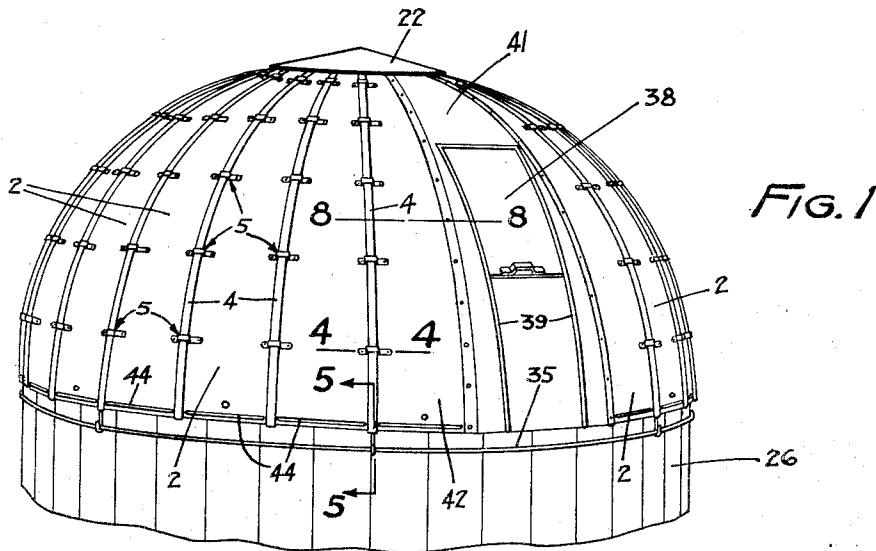
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2,187,616

SILLO ROOF

Filed Sept. 26, 1938

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

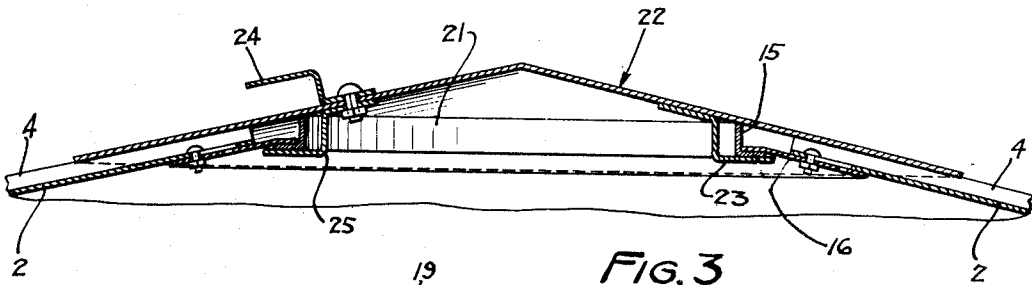


FIG. 3

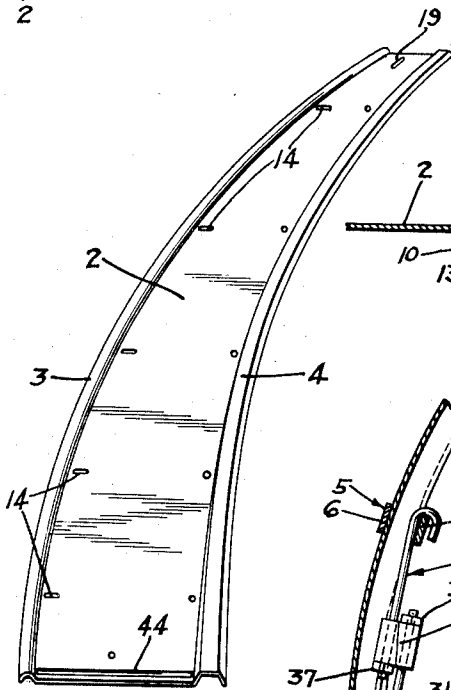


FIG. 6

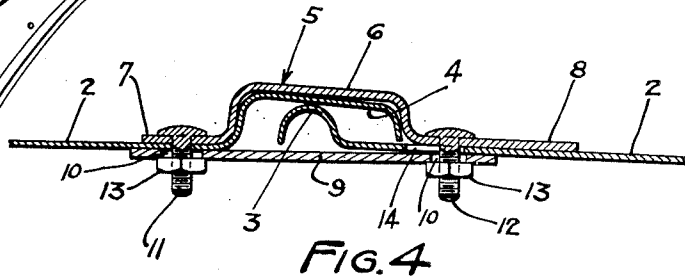


FIG. 4

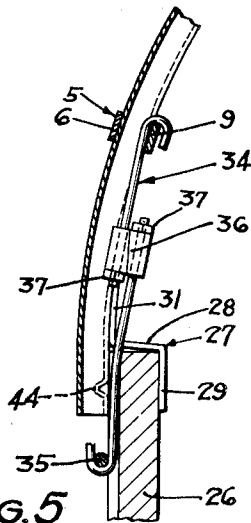


FIG. 5

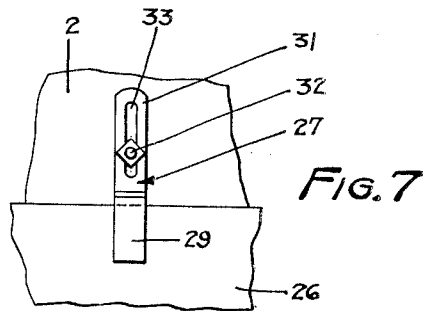


FIG. 7

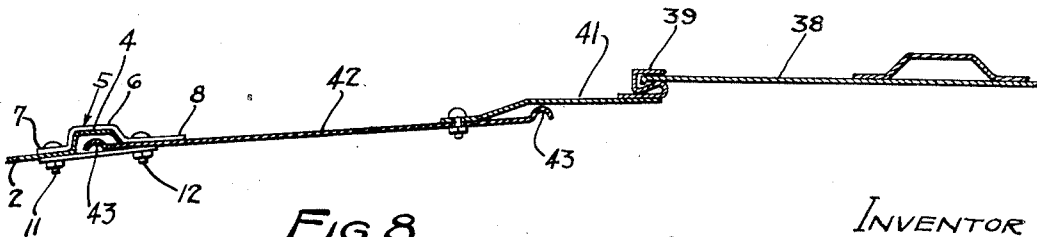


FIG. 8

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2,187,616

SILO ROOF

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Application September 26, 1938, Serial No. 231,742

11 Claims. (Cl. 108—32)

This invention relates to new and useful im-
provements in silo roofs, and more particularly to
such roofs constructed of metal.

5 An object of the present invention is to pro-
vide a simple and inexpensive silo roof which
readily lends itself to manufacture in quantity
production, and which is so constructed that it
may be supported entirely upon the upper edge
of the silo, without the use of rafters.

10 A further object is to provide a dome-shaped
silo roof comprising a plurality of segmental sec-
tions having channels formed in their longitudi-
nal edges adapted to overlap or interlock to
form the joints between adjacent sheets, said
15 channels greatly strengthening the sections and
preventing water or moisture from entering the
silo between the roof sections.

A further object is to provide a dome-shaped
20 roof composed of a plurality of segmental sec-
tions having their longitudinal edges suitably
channeled, and the adjacent channel edges of
contiguous sections being adapted for interlock-
ing or overlapping engagement to provide suit-
able joints between sections, and the upper ends
25 of said sections being supported by an annular
member or collar having a plurality of elongated
apertures therein adapted to receive bolts inserted
through apertures provided in the upper ends of
the sections, said channels and apertures being
30 so fashioned and arranged as to permit the sec-
tions to be relatively moved with respect to one
another and to said annular member, whereby
the diameter of the roof at its base may be varied
within certain limits, to allow for variations in
35 the diameter of the silo or the cylindrical struc-
ture upon which the roof is to be mounted. The
shapes of the channels provided on the longitu-
dinal edges of the sections and the arrangement
of the apertures in the annular member and said
40 sections also permitting the number of sections
in the circumference of the roof to be varied, if
necessary.

A further object is to provide a dome-shaped
45 silo roof composed of a plurality of segmental
sections, having their longitudinal edges formed
with suitable channels, one of said channels
being relatively larger than the other and adapt-
ed to overlie the smaller channel of an adjacent
sheet, and suitable clamping elements being ar-
50 ranged at intervals along the joints between sec-
tions to secure the sections together, said clamp-
ing elements permitting free expansion and/or
contraction of the segments circumferentially.

Other objects of the invention reside in the
55 unique construction of the clamping elements

which secure together adjacent roof sections; in
the means for seating and supporting the lower
ends of the sections upon the upper edge of the
silo wall; in the means provided for securing to-
5 gether the roof sections at the top of the silo,
which include a collar having an outwardly ex-
tending flange provided with a plurality of elon-
gated apertures, which apertures are so arranged
that at least one of said apertures will always
10 register with the aperture provided in the upper
end of each section, whereby bolts or screws may
readily be inserted through said aligned aper-
tures, in the operation of erecting the roof, and
whereby erection is greatly simplified and facili-
15 tated; and, in the novel construction and ar-
rangement of the crown piece or cap which is de-
tachably secured to the top of the silo roof,
whereby it may readily be removed when de-
sired to present an opening through the top of
20 the silo roof.

Other objects of the invention will appear from
the following description and accompanying
drawings and will be pointed out in the annexed
claims.

In the accompanying drawings there has been
25 disclosed a structure designed to carry out the
various objects of the invention, but it is to be
understood that the invention is not confined to
the exact features shown as various changes may
be made within the scope of the claims which
30 follow.

In the drawings:

Figure 1 is a perspective view showing my im-
proved dome-shaped roof;

Figure 2 is a detail plan view on a larger scale,
35 showing the top of the roof;

Figure 3 is a detail sectional view on the line
3—3 of Figure 2, showing the means for detach-
ably securing the cap in position on the roof;

Figure 4 is an enlarged detail sectional view
40 on the line 4—4 of Figure 1, showing the con-
struction of the joints between sections;

Figure 5 is a vertical detail sectional view on
the line 5—5 of Figure 1, showing the means for
45 securing the roof to the silo wall;

Figure 6 is a perspective view of one of the
segmental roof sections detached from the struc-
ture;

Figure 7 is a detail sectional view showing one
of the brackets for engaging the upper edge of
50 the silo wall; and

Figure 8 is a detail sectional view substantially
on the line 8—8 of Figure 1, showing the guides
provided for supporting the slide door in the roof.

The novel silo roof herein disclosed, is shown 55

comprising a plurality of segmental sections 2 constructed of sheet metal. The longitudinal edges of said sections are formed with inverted channels 3 and 4, the latter being relatively wider than the channel 3, whereby the channel 4 may be fitted over the smaller channel 3, as best illustrated in Figure 4. The channels are preferably inverted, as shown in Figure 4, so that when overlapped or interlocked, as shown in this figure, it will be impossible for water to enter the silo through the joints between said sections.

The channels 3 and 4 also greatly strengthen and reinforce the sections, whereby when the roof is assembled on a silo, as shown in Figure 1, a very rigid and substantial structure is provided.

A feature of the invention resides in the novel means provided for securing together the overlapped edges of the sections 2. As best illustrated in Figures 1 and 2, a plurality of clamping elements, generally indicated by the numeral 5, secure together the overlapped edges of contiguous sections, as best shown in Figure 4, whereby the sections cannot become separated from one another.

Each clamping element 5 comprises a body portion 6 formed to substantially fit the relatively wider channel 4, at one side of each section. The body 6 of the clamping element has an end portion 7 adapted to be seated against the outer surface of the section adjacent to the channel 4. The opposite end portion 8 of the clamping element 5 is seated against the outer surface of an adjacent section 2. A complemental clamping member 9 is fitted against the inner surfaces of adjacent sections 2 and has apertures therein adapted to receive a pair of threaded studs 11 and 12, inseparably secured to the end portions 7 and 8 of the clamping elements 5, by such means as welding. It is a very desirable feature of the invention to have the studs 11 and 12 inseparably secured to the clamping elements 5, as above stated, in that it greatly facilitates assembling the structure, as it prevents loss of the bolts or studs 11 and 12, and it also eliminates all danger of the studs turning, when the nuts 13 are tightened thereon.

To allow for expansion and contraction of the roof, the apertures 14 in the sections 2 adjacent to the small channels 3 in which the studs 12 are received, are elongated in a direction transversely of the sections, as best shown in Figure 6, whereby the overlapped edges of adjacent sections may move relatively to one another. The clamping elements 5 move with the sections having the larger channels 4 because of the bodies 6 thereof substantially fitting the width of the relatively wider channels 4. The complemental clamping members 9 preferably have enlarged or slotted apertures 10 for receiving the studs 11 and 12.

Another feature of the invention resides in the novel means provided at the uppermost portion of the roof for supporting the sections 2 in operative relation. As shown in Figures 1 and 2, the means provided for thus supporting the upper ends of the sections 2 is shown comprising an annular member or collar, generally indicated by the numeral 15. This collar has a horizontally disposed flange 16 upon which the upper ends of the sections 2 are seated and secured.

The flange 16 of the collar 15 is provided with a plurality of elongated apertures or slots 17 arranged in two circles around the length of the flange. The apertures 17 of one row of apertures are preferably staggered with relation to the

apertures in the other row, as best shown in Figure 2, whereby one of said apertures will always be alined with the elongated apertures 19 provided in the upper ends of the sections 2. The apertures or slots 19 in the sections 2 are disposed lengthwise thereof, whereby they are disposed at substantially right angles to the apertures 17 in the flange 16, when the sections are seated thereon. By thus arranging the apertures 17 and 19, a portion of each aperture 19 will always register with one of the apertures in the annular flange 16 of the collar 15, so that a bolt may readily be inserted therethrough. This greatly facilitates the erection of the roof. By thus securing the upper ends of the sections together by means of the annular collar 15, a very substantial and rugged roof structure is provided without the use of rafters for supporting the sections 16.

Another reason for arranging the apertures 17 and 19 as above described, is that it makes it possible to expand or enlarge the roof, even to the extent of inserting an additional section, by simply moving the sections outwardly, or in a radial direction, in which case, the bolts passing through the apertures in the flange 16 of the collar 15 will be received in the outer row or circle of apertures. This is a very desirable feature, in that it eliminates close fitting and thus greatly facilitates erection of the roof.

The collar 15 has an opening 21 therein, which preferably is large enough for a person to pass through, if necessary. If desired, the silo may be filled through the opening 21. A suitable cap or closure member, generally indicated by the numeral 22, is adapted to be fitted over the collar 15 to close the opening 21. The cap 22 is retained in place by a pair of hook elements 23 and a pivoted hook element 25, having an operating handle 24 disposed exteriorly of the roof whereby the pivoted hook element 25 may be conveniently swung out of engagement with the collar 15, when it is desired to remove the cap 22 from its normal closed position. In the drawings I have shown the collar 15 as being constructed of two parts, the flange 16 being formed independently of the angle iron body of the collar and suitably secured thereto by such means as welding or riveting. If desired, the entire collar 15 might be made of one piece, but to simplify manufacture, it is preferably made as shown.

Another feature resides in the novel means provided for securing the lower edges of the sections 2 to the upper edge of the silo wall 26. The means provided for thus supporting the roof upon the upper edge of the silo wall 26 is best shown in Figure 5, and comprises a plurality of angle-shaped brackets, generally indicated by the numeral 27. Each bracket 27 has a horizontal portion 28 adapted to be seated on the upper edge of the silo wall 26, and a depending portion 29 which engages the inner surface of the silo wall to prevent spreading or outward movement of the sections 2, when the roof is assembled upon the top of the silo wall.

Each bracket 27 further has an upstanding portion 31 fitted against the inner surface of one of the sections 2, and is secured thereto by a suitable bolt 32. The portions 31 of the brackets 27 are slotted, as shown at 33 to permit the brackets to be adjusted with respect to the lower edges of the segmental sections 2, whereby the portions 28 of said brackets may be horizontally alined so that each bracket will support its share of the load. A plurality of hook bolts, generally 75

indicated by the numeral 34, are shown having their upper ends engaged with certain of the inner clamping members 9, and their lower ends with a hoop 35, usually provided adjacent the upper end of the silo wall, as clearly illustrated in Figures 1 and 5. Each hook bolt 34 is preferably made in two parts connected by a suitable coupling member 36, whereby when the nuts 37 of the two parts of the hook bolt 34 are rotated in one direction, the brackets 27 will be forced firmly against the top edge of the silo wall, as will be readily understood by reference to Figure 5.

The novel silo roof, herein disclosed, is shown provided with a suitable door 38, which is slidably supported in suitable curved guides 39 provided in a roof section 41, which differs somewhat in form from the other sections 2 of the roof in that it has no channels in its longitudinal edges. One side edge of the section 41 is secured to one side of a section 42, having relatively small channels 43 formed in its opposite edges, as best shown in Figure 6. The opposite edge of the section 41 is secured to the adjacent edge of a section 2, as will readily be understood by reference to the drawings.

The door supporting section 41 is preferably made considerably wider than the remaining roof sections, whereby its edges will overlap the adjacent edges of adjacent sections a considerable extent. By thus making the section 41 wider than the other sections, any variations in the width of the gap between the sections 2 and 42, as viewed in Figure 2, which may result from variation in the diameter of the upper portion of the silo wall, will not interfere with the operation of erecting the roof, because the sections 41 may overlap the adjacent edges of sections 2 and 42 in greater or lesser amounts, depending upon the arrangement of the sections around the roof. The marginal edges of the section 41 are secured to the adjacent sections 2 and 41 by bolts or rivets, inserted in holes drilled or punched through the sections 2 and 42 upon the job, as will readily be understood by reference to Figures 1 and 8.

Suitable reinforcing ribs 44 may be formed in the sections 2 adjacent to the lower edges thereof, as best illustrated in Figures 5 and 6. These ribs cooperate with the longitudinal channels 3 and 4 to stiffen the sections 2.

The segmental sections 2 are preferably preformed in manufacture, so that they may readily be assembled on the job, without the necessity of having a sub-structure, such as rafters, for supporting the roof. To erect the roof, three or more segmental sections are seated upon the upper edge of the silo wall and in spaced relation, and have their upper terminals secured to the flange 16 of the collar 15, whereby the collar 15 is retained in position. The remaining sections may then be readily fitted between the initially erected sections, which cooperate to provide a skeleton structure for supporting the remaining sections 2, until the roof has been completed. When all of the sections have been secured together, as shown in Figures 1 and 2, and the brackets 27 are secured to the top of the silo wall, as shown in Figure 5, a very rigid silo roof is provided which is extremely strong and light in weight, and is very neat and attractive in appearance.

The unique design of the clamping elements 5 is also of importance in that by inseparably securing the studs 11 and 12 to the end portions 7

and 8 of the elements 5, the studs may readily be passed through the aligned apertures 17 and 19, when the clamping elements are positioned over the overlapped edges of the sections, as will readily be understood by reference to Figure 4. Also, by having the studs 11 and 12 inseparably and immovably secured to the clamping elements, the nuts 13 of the studs 11 and 12 may readily be turned into place without danger of the studs turning.

By providing two rows of apertures 17 in the horizontal flange 16 of the collar or annular member 16 and further, by providing elongated apertures 19 in the upper ends of the sections 2, the operation of securing the upper ends of the sections to the collar 16 is greatly facilitated, as hereinbefore stated. The slots 19 will always register with one or more of the slots 17 in the flange 16 of the collar 15, whereby bolts may readily be inserted through said aligned apertures to secure together said parts.

The erection of the roof is further facilitated by having the studs 11 and 12 permanently secured to the clamping members 5. I have found in erecting the roof, that the clamping members 5 may readily and conveniently be positioned in place from a suitable scaffold erected within the silo, and the nuts 13 applied to the studs 11 and 12. These nuts are preferably left sufficiently loose to permit the sections to move with respect to one another at the joints between sections, whereby the sections may be moved in a circumferential direction. This feature, in connection with the elongated apertures 17 in the flange 16 of the collar 15, and the apertures 19 in the sections 2, makes it possible to erect the roof on structures varying considerably in size, without making any structural changes in the construction of the roof parts. The nuts 13 are tightened when all of the sections have been placed in position.

I claim as my invention:

1. A silo roof comprising a plurality of segmental sections joined together to form a spherical dome-like structure, said sections being preformed into spherical shape and having their longitudinal edges formed with inverted channels adapted for overlapping engagement, clamping elements embracing the overlapped edges of adjacent sections, and one channel of each section being relatively smaller than the other channel thereof, whereby the smaller channel may be nested within the larger channel thereby permitting relative movement of said nested channelled edges to allow for expansion and contraction of the sections in a circumferential direction.

2. A silo roof comprising a plurality of segmental sections joined together to form a spherical dome-like structure, each section being a section of a sphere and having its longitudinal edges formed with inverted channels one of which is relatively wider than the other, whereby when said sections are arranged to form the roof, the narrower channels are nested within the wider channels, a clamping element overlying said channels and secured at one end to one of said sections, the opposite end of said clamping member being operatively secured to the edge portion of an adjacent section in a manner to permit said sections to move relatively to one another, thereby to allow for expansion and contraction of said sections, when the roof is complete.

3. A silo roof comprising a plurality of segmental sections joined together to form a dome-like structure, said sections having their longi-

tudinal edges formed with inverted channels adapted to be inter-engaged, a clamping element comprising an off-set body portion overlying said channels, one end of said clamping member having a stud inseparably secured thereto and received in an aperture in its respective section, and the opposite end of said clamping member being suitably secured to the edge portion of an adjacent section, whereby said adjacent section may move relatively to said clamping member and the section to which the clamping member is secured, thereby to allow for expansion and contraction of said sections.

4. A silo roof comprising a plurality of sections joined together along their longitudinal edges to form a dome-like structure, said sections having their longitudinal edges formed with channels adapted to be nested together, the two channels of each section being of different widths whereby the narrower channel of one section may be nested within the wider channel of an adjacent section to provide a joint which is substantially weather proof, a clamping element for securing together the overlapped edges of said sections, said clamping element being formed to substantially snugly fit over the wider channel and having its end portions seated against the bodies of adjacent sections, said end portions having threaded studs inseparably secured thereto and traversing apertures provided in said sections, a complemental clamping element fitting onto said studs on the opposite or inner sides of said sections, and means received in threaded engagement with said studs for causing the clamping elements to clampingly engage the channeled edges of said sections and retain them in operative relation.

5. A silo roof comprising a plurality of segmental sections joined together to form a dome-like structure, each section having one longitudinal edge formed with a bead and its opposite edge with a relatively wider channel adapted to overlie the bead of an adjacent sheet, clamping elements for securing together the overlapped edges of said sections, said elements comprising complemental members between which the adjacent edge portions of contiguous sections are received, and bolts securing together said complemental clamping members, said bolts traversing suitable apertures in said sections, one of said apertures being elongated to permit said sections to relatively move at the joint therebetween, thereby to facilitate erection of the roof and allow for expansion and contraction.

6. A silo roof comprising a plurality of segmental sections having their longitudinal edges joined together to form a dome-like roof, one edge of each segment being formed with a longitudinally extending bead and the opposite edge thereof with a longitudinally extending channel of relatively greater width than said bead, said channel of one section being adapted to overlie the bead of an adjacent section to provide a joint therebetween, strap-like clamping elements overlying said joints and substantially fitting the channels of said sections, each clamping element having its ends seated upon bodies of adjacent sections, and said clamping elements having studs inseparably secured to the ends thereof and passing through suitable apertures in said sections.

7. A dome-shaped roof comprising a plurality of segmental sections having their longitudinal edges overlapped and suitably secured together, an annular member having a horizontal flange upon which the upper ends of said sections are

seated, said horizontal flange having a plurality of rows of elongated apertures therein arranged lengthwise around the flange, the apertures of one row overlapping the adjacent apertures of another row, elongated apertures in the upper ends of said sections adapted to overlap said rows of elongated apertures in said flange, whereby bolts may be inserted in said aligned apertures to secure the upper ends of the sections to the annular flange, and means at the lower ends of said sections for securing them to the upper edge of a wall.

8. A roof comprising a plurality of segmental sections having their longitudinal edges overlapped and suitably secured together, a collar having a horizontal flange upon which the upper ends of the sections are seated, said horizontal flange having a plurality of rows of elongated apertures therein arranged lengthwise around the flange, the apertures of one row overlapping the adjacent apertures of another row, an elongated aperture in the upper end of each segment disposed at right angles to the elongated apertures in said flange, when the segments are seated on the flange, the apertures in said sections overlapping the rows of the apertures in said flange, whereby bolts may be inserted therethrough to secure the segments to said collar, brackets secured to the lower ends of said sections having portions extending inwardly and adapted to be seated on the upper edge of a wall, thereby to support the roof thereon, and means associated with said brackets for securing the roof to the wall.

9. A dome-shaped silo roof comprising a plurality of segmental sections having their longitudinal edges overlapped and suitably secured together, a collar of angular cross-section having a horizontal flange upon which the upper ends of said sections are seated, said flange having a plurality of elongated apertures therein, arranged in two rows lengthwise around the flange and the apertures in one row being staggered with relation to the apertures in the other row and overlapping said apertures, an elongated aperture in the upper end of each section adapted to overlap the rows of staggered apertures in said flange, whereby a bolt may be inserted therethrough to secure the section to the collar, the staggered arrangement of the apertures in said flange facilitating erection of the roof in that the apertures in said sections will always be aligned with one or more of the apertures in said flange, whereby a bolt may be inserted through said aligned apertures, and means for securing the lower portions of said segmental sections to the upper edge of a silo wall.

10. A silo roof comprising a plurality of segmental sections having their longitudinal edges overlapped and suitably secured together, a collar at the top of the structure having an outwardly directed flange provided with a plurality of rows of elongated apertures, the apertures of each row being disposed lengthwise around their respective rows in closely spaced relation and adjacent apertures in the rows being in overlapped relationship, the upper ends of said segmental sections being seated on said flange, each section having an elongated aperture in its upper end adapted to overlap the rows of apertures in said flange, and means for securing the sections to said flange, the elongated apertures in said flange and said sections, permitting the sections to be moved in a radial direction with respect to and independently of the collar, where-

by the roof may be enlarged or reduced in diameter at its base, to adapt it for structures of different diameters.

5 11. A dome of the kind described made up of a multiplicity of spherical segments having substantially U-shaped interlocking channel-like reinforcing flanges at their edges, the flanges at the one edge being relatively narrow and the flanges at the opposite edge being relatively wide,

the relatively narrow channel-shaped flanges being nested within the relatively wide channel-shaped flanges, with lateral clearance such as would permit circumferential expansion and contraction of the dome structure, and means 5 for locking the interlapped channels in said interlapped condition.

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