

Dec. 27, 1960

T. V. GERHOLM ET AL
RECTANGULAR SILO CONSTRUCTION

2,966,008

Filed July 7, 1958

4 Sheets-Sheet 1

FIG.1

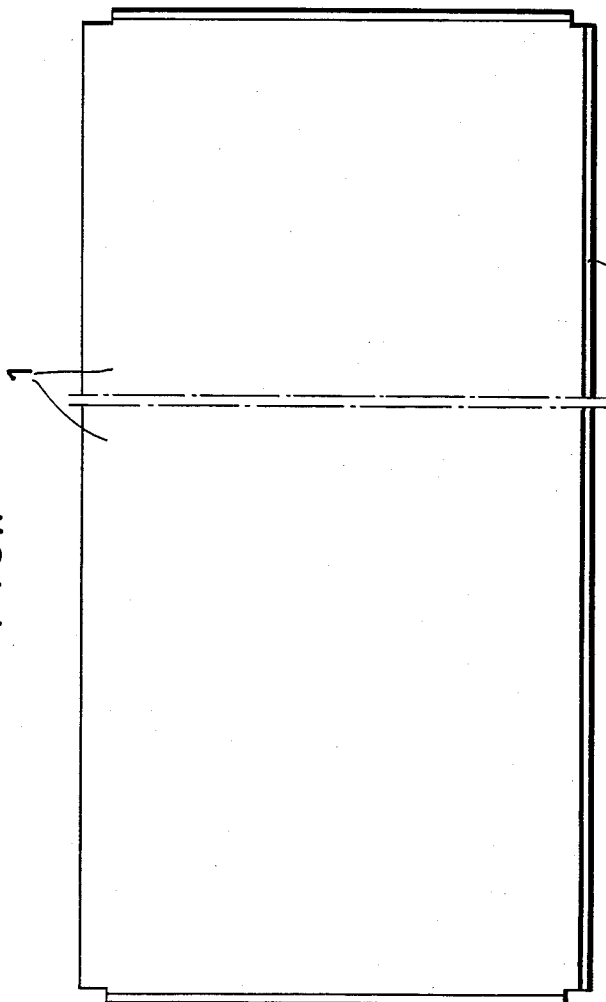


FIG. 2

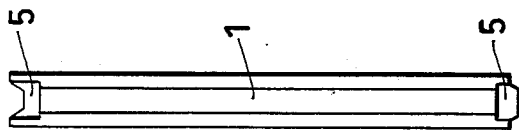


FIG. 3



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FIG. 4

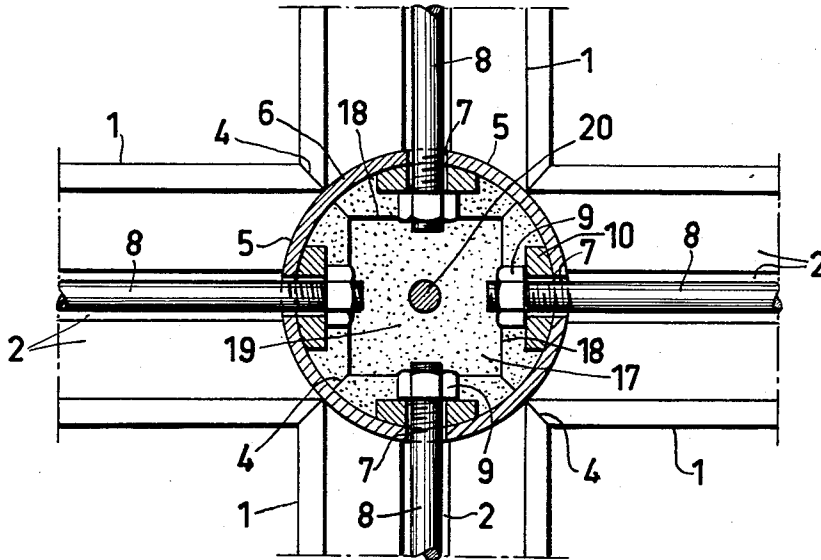
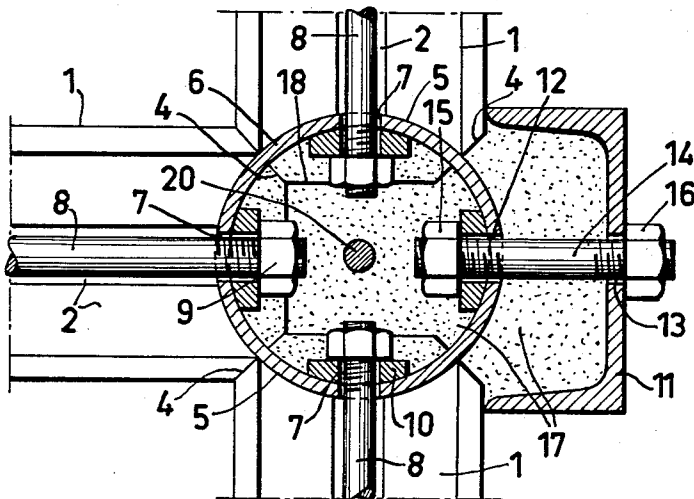


FIG. 5



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FIG. 6

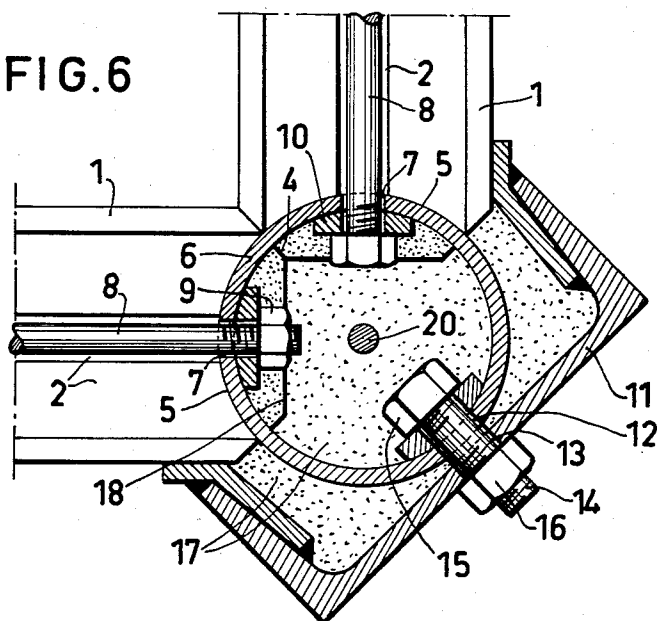


FIG. 7

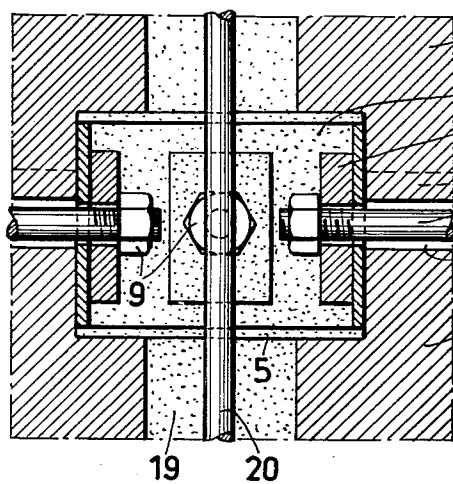
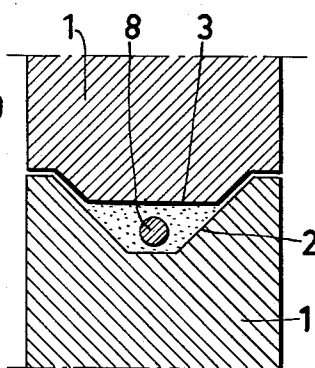


FIG. 8



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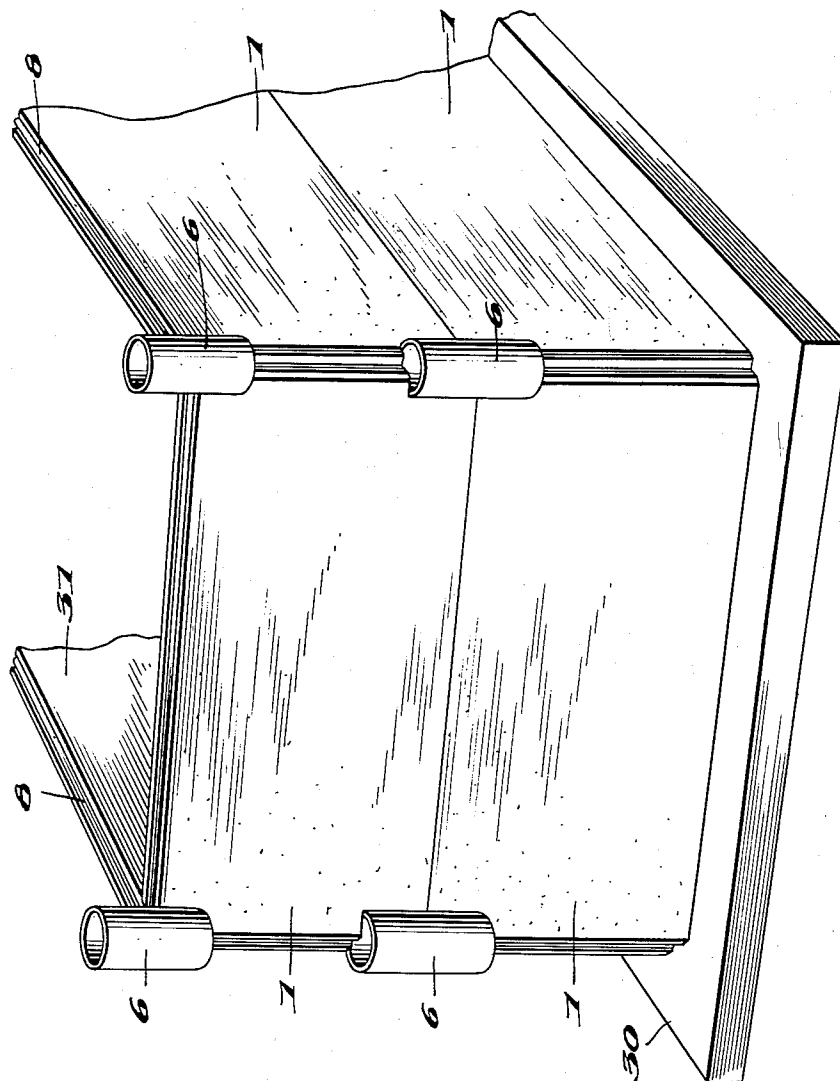


Fig. 9.

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RECTANGULAR SILO CONSTRUCTION

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5 Claims. (Cl. 50—132)

Silos are generally used for the ensilage of fodder and grain, for storing sand, gravel, macadam and cement, or for the storage of wood chips in saw mills. While previously constructed of wood, in recent years silo structures have been constructed in many ways, such as from an assembly of concrete blocks, sheets of metal (such as aluminum), or from concrete cast by the "sliding mold" method.

In practically all of these cases the silos are of annular shape so that tension forces are produced which facilitate the jointing.

However, when silos of annular shape are arranged in a group, dead spaces are formed therebetween which cannot be properly utilized. When constructed under roof, it is quite difficult to adapt an annular-shaped silo to the space available. Wooden silo constructions involve a great risk of destructive burning and are, furthermore, liable to damage when being repeatedly soaked and dried up again. Silos assembled of thin aluminum, plywood or Masonite slabs easily suffer damages from working tools. Damages due to ensiling fodder were of considerably greater extent in silo structures cast of concrete according to the sliding mould system than in structures of concrete blocks or slabs.

For the reasons stated before, rectangular silo constructions of pre-fabricated concrete elements are to be preferred to annular structures of cast-in-situ concrete, wood, aluminum, plywood, Masonite or similar material.

Concrete elements to be used for silo constructions can be either small-size elements or of such large dimensions that no vertical joint is required. The use of small-size elements requires auxiliary equipment of only adequately small capacity, but includes, on the other hand, the disadvantage of a large number of joints required. Since in the case of larger silo constructions a crane is employed for lifting up the elements in position, the weight of the element is only a matter of minor importance.

The present invention relates to silo constructions comprising large-size elements of such dimensions that they stretch from one corner of the silo to the other, the silos preferably being designed square-shaped so that for each silo type only one element type is required.

The invention is substantially characterized in that the horizontal edges of the elements are provided with tenons and mortises and that the vertical edges of the elements are chamfered in such a way that when a first group of said elements are arranged to define a rectangular prismatic space therebetween, the chamfered surfaces of a pair adjacent elements arranged at right angles to each other will be in contiguous engagement. When an identical second group of said elements is positioned above and contiguous with said first group of elements, the tenons extending downwardly from the lower horizontal edges of said second group of elements will extend into the mortises in the upper edges of said first group of elements. The upper and lower portions

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of the vertical edges of the elements have arch-shaped concave recesses therein which receive tubular metal members vertically arranged at each corner joint between said first and second groups of elements. The tubular metal members are connected to each other by horizontal bars which extend through holes in the walls of the tubular members, said bars being threaded at their ends so that tension may be applied to the bars by nut means threadably mounted thereon. At a common juncture point of two or three elements a U-shaped beam or the like can be placed with its shanks against the outer surfaces of the two outside elements in such a way that a channel-shaped vertical space between the U-beam or the like and the free end portions or the arched cavities is obtained.

The accompanying drawings show by way of example the silo construction according to the invention.

Figures 1, 2 and 3 show a concrete element from the front, short and long side of the element respectively, Figure 4 shows the horizontal section of a junction point of four elements, Figure 5 a junction point of three elements and Figure 6 a junction point of two elements. Figure 7 shows the vertical section of a junction point and Figure 8 the vertical section of two elements assembled above each other. Figure 9 is a perspective view of a portion of the silo during assembly consisting of two groups of elements mounted upon each other.

1 indicates a rectangular building element the horizontal bottom edge of which is provided with a tenon 3 and the horizontal upper edge with a mortise 2, the lower portion of said tenon in assembled state of the element not reaching quite down to the bottom of said mortise (see Fig. 8). The vertical edges of said element 1 are chamfered in such a way that the elements when being assembled two by two so that the chamfers 4 abut upon each other form a rectangular triangle, the two other chamfers aligning. On the top and bottom of each element cavities 5 are provided, said cavities forming the portion of an arch and crossing the chamfers. In each of the cavities 5 in a junction point a tube portion 6 is placed, for example a cut-off steel tube, a hole 7 being cut in the centre of said tube portion and round bars 8 being inserted in said tube portions, said bars stretching between one tube portion 6 and another one located, for example, in the other corner of the silo. On the ends of said round bars inserted in said tube portions nuts 9 are screwed on abutting washer 10 the arch-shaped surface of said washer contacting the inside of the tube portion. As it appears from Fig. 7, the tube portion 6 is somewhat smaller than the arched cavities 5 of two elements being assembled above each other.

In the Fig. 5 and 6 where the junction points of two and three elements respectively are shown, an U-shaped beam is placed with its shanks against the outer surfaces of the two outside elements, said U-beam being provided with an aperture 13 which directly faces an opening 12 in the tube portion 6. Through said aperture 13 and opening 12 a round bar 14 is inserted and fastened on the tube portion 6 and on the outside of the U-beam with a nut 15 and a tightening nut 16 respectively. Between the U-beam and the free end portions 18 or the arch-shaped cavities 5 a channel-shaped vertical space 17 is thus obtained which corresponds to the channel-shaped vertical space 19 being formed through the free end portions 18 of the elements in Fig. 4. In both these spaces 17 and 19 a vertical round bar 20 is placed.

The silos are assembled in the following way.

On a cast concrete foundation slab 30 (Fig. 9) the bottom elements are placed in grooves in such a way

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that four elements 1 define a rectangular prismatic space 31 forming one silo compartment. Thereafter, the tube portions 6 are fastened together with the round bars 8, and through screwing on of the nuts 9 the elements are pressed against each other. While in silos intended for stationary use the round bars 8 are placed in cement mortar filling the mortises 2 and the vertical round bars 20 in the channels 19 and 17 are cast in cement mortar, in silos intended to be later dismantled no bars are cast in mortar, the round bars 20 being kept in stretched position by means of nuts in the top and bottom of the silo.

According to the invention every element is connected in its upper portion, the same method of connection being likewise applicable for forming inside corners as shown in Figs. 4 and 5 or outside corners as shown in Fig. 6. A permanent silo structure is obtained through casting cement mortar in the joints or junction points whereby a monolithic structure is obtained. It is further possible to increase the number of silo compartments if desired, or to dismantle one or several compartments. The invention allows thus the construction of a single silo unit as well as of groups of silos.

The invention is not limited to the embodiments shown, the details being variable in many ways without exceeding the scope of the invention. The elements can, for example, be manufactured of metal, wood or other suitable material, and the corner beams can be of wood.

What we claim is:

1. A silo structure comprising a first group of four rectangular vertical wall elements arranged to define a rectangular prismatic space therebetween and an identical second group of four rectangular elements positioned above and contiguous with said first group of elements, the upper horizontal edges of said first group of elements having mortises into which extend tenons extending downwardly from the lower edges of said second group of elements, the vertical edges of each of said elements being chamfered at an angle of substantially 45° to cause the chamfered surfaces of adjacent elements arranged at right angles to each other to be in contiguous engagement, the upper and lower portions of the vertical edges of each of said elements having arch-shaped concave recesses therein, tubular metal members vertically arranged at each corner joint between said first and second groups of elements within the chambers

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defined by the arch-shaped recesses in the elements, and horizontal rod means connecting each tubular member to the tubular members at adjacent corners of the structure.

2. A silo structure as defined in claim 1 wherein the ends of the rod means extend through apertures in said vertical tubular members and terminate in threaded portions to which nuts are threadably secured, whereby tension may be applied to the rod means by tightening of the nuts.

3. A silo structure as defined in claim 1, and further including a vertical U-shaped beam positioned adjacent one of said tubular members on the outside of a corner joint of said rectangular element, the shanks of said beam extending inwardly into engagement at their extremities with the outer surfaces of the rectangular elements defining the corner joint, and bolt means connecting said U-shaped beam to said tubular member.

4. A silo structure as defined in claim 1, and further including another pair of vertically-arranged rectangular elements arranged at a corner joint of the structure coplanar with a first pair of rectangular elements and at right angles to a second pair of rectangular elements which define said corner joint, and a vertical U-shaped beam positioned adjacent the tubular member at the corner joint, the shanks of said beam extending inwardly into engagement at their extremities with the outer surfaces of the coplanar elements defining the joint, and bolt means connecting said U-shaped beam to said tubular member.

5. A silo structure as defined in claim 1, wherein a plurality of said groups of rectangular elements are arranged on top of each other, and further including a vertical rod at each corner of the structure extending through the vertically-spaced tubular members at the associated silo corners.

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