March 8, 1949. H. VON BRETON 2,463,834

PLYWOOD GRAIN BIN OR THE LIKE

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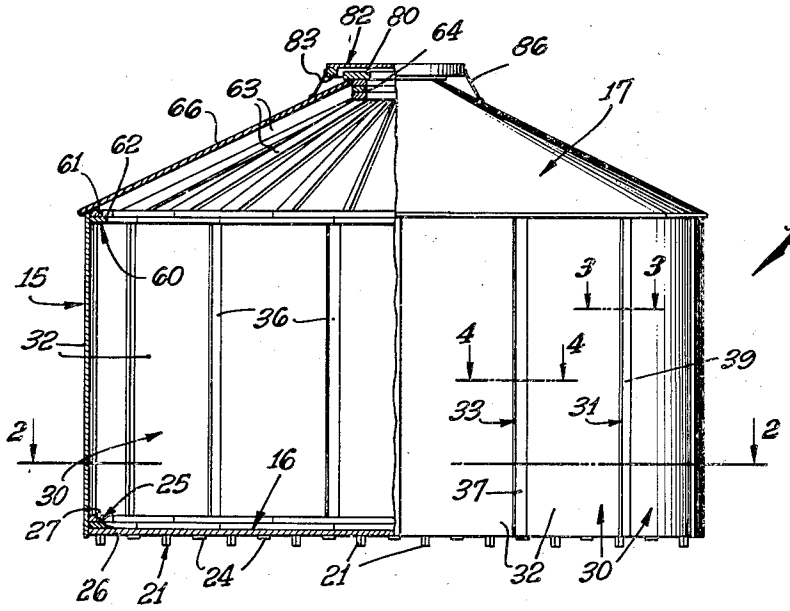

Fig. 1.

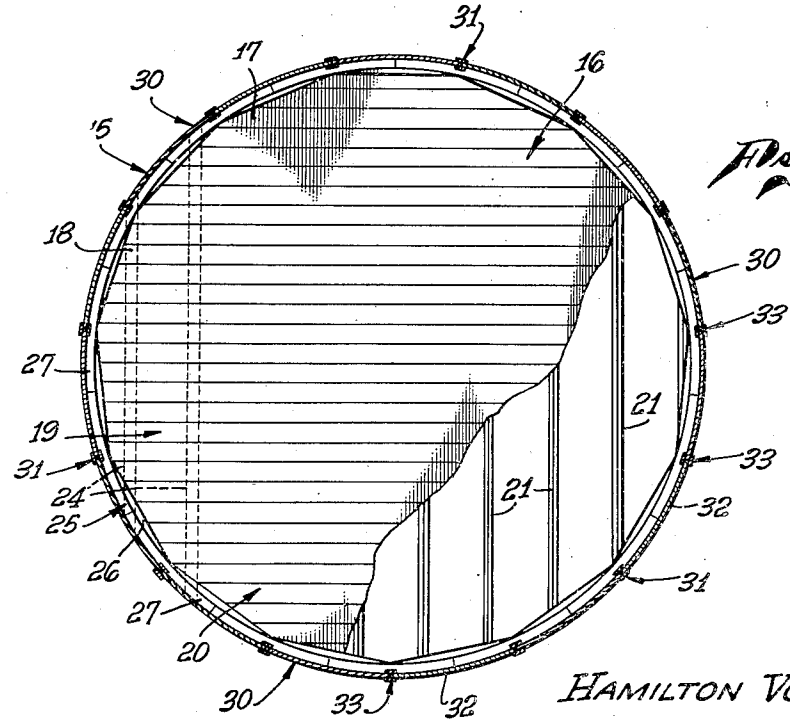

Fig. 2.

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PLYWOOD GRAIN BIN OR THE LIKE

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Fig. 3.

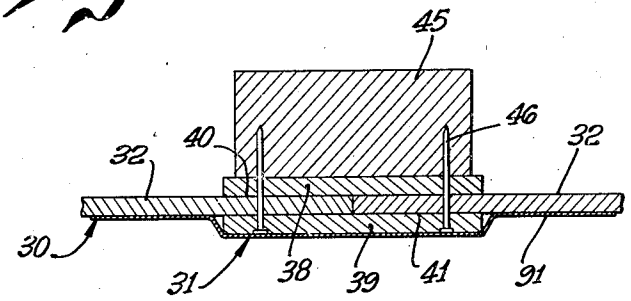


Fig. 4.

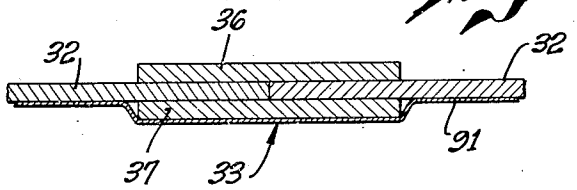
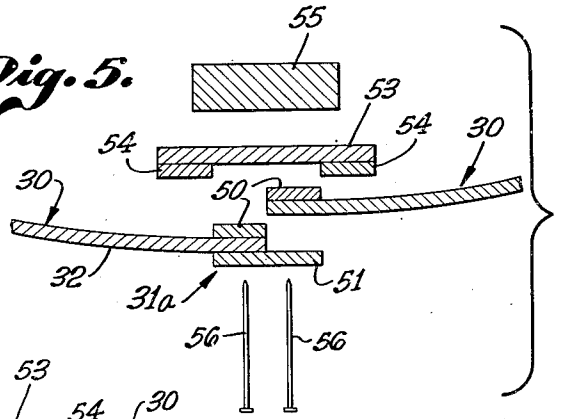


Fig. 5.



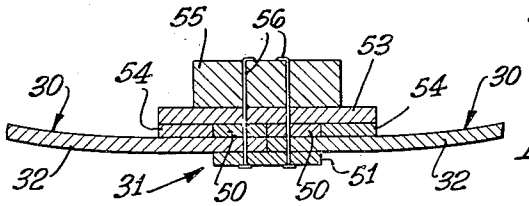


Fig. 6.

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PLYWOOD GRAIN BIN OR THE LIKE

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Fig. 7.

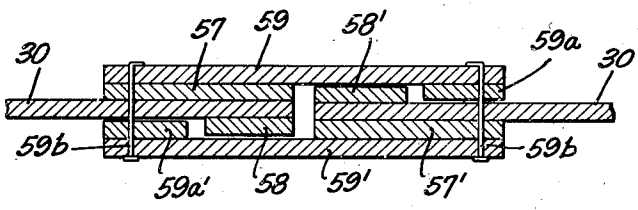


Fig. 8.

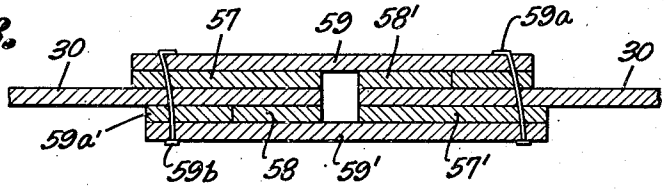


Fig. 13.

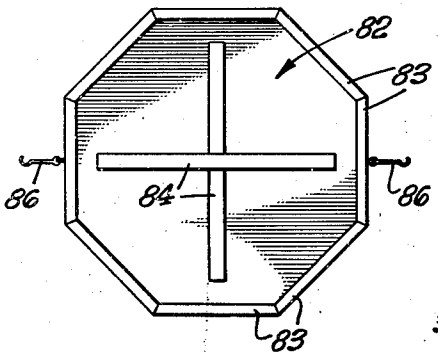


Fig. 14.

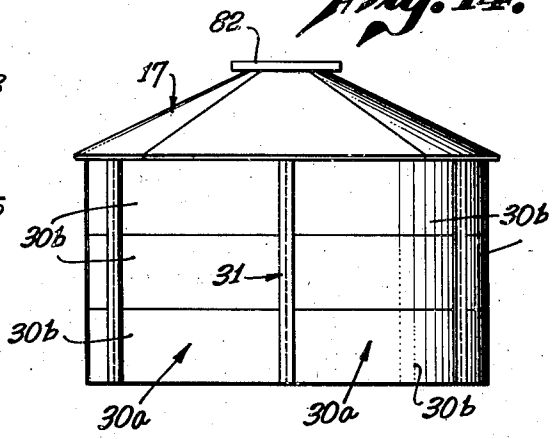


Fig. 15.

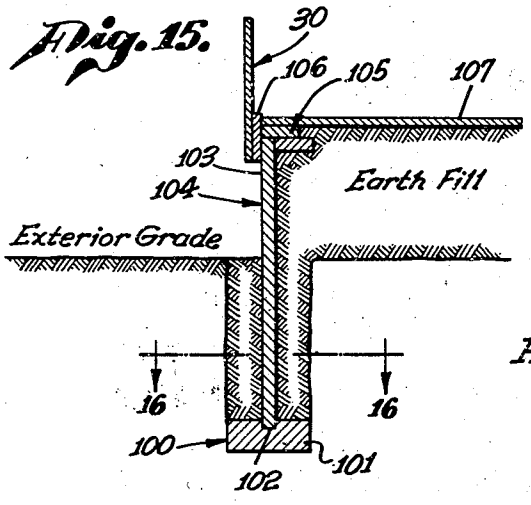
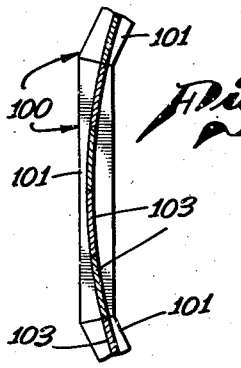


Fig. 16.



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March 8, 1949. H. VON BRETON 2,463,834

PLYWOOD GRAIN BIN OR THE LIKE

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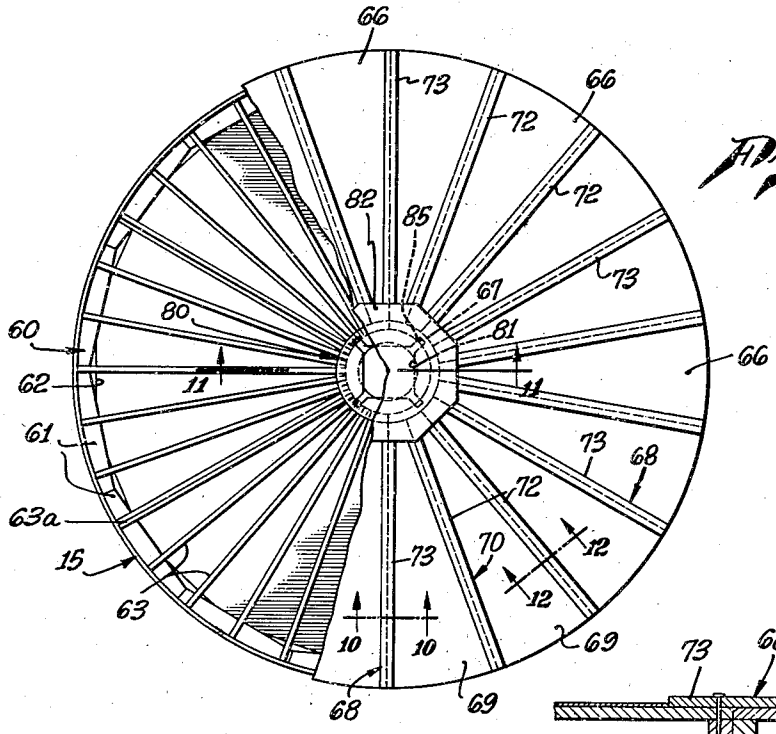

Fig. 9.

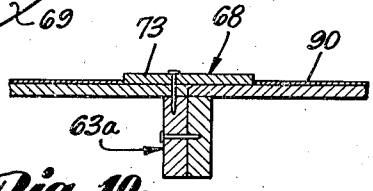

Fig. 10.

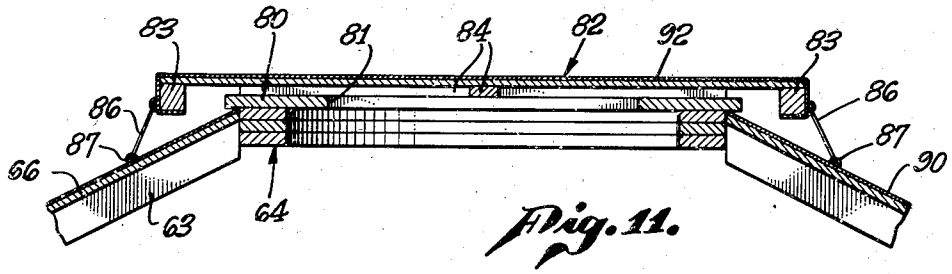

Fig. 11.

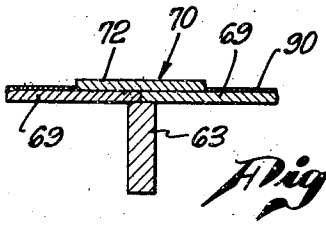

Fig. 12.

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UNITED STATES PATENT OFFICE

2,463,834

PLYWOOD GRAIN BIN OR THE LIKE

Hamilton von Breton, Los Angeles, Calif.

Application June 28, 1943, Serial No. 492,528

6 Claims. (Cl. 20—1.2)

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This invention relates generally to wood construction containers such as grain bins or the like, the general object of the invention being the provision of a practical, cheaply constructed and easily erected outdoor storage bin for grain and the like, which is fabricated principally of wood but which is strong enough to hold a relatively heavy grain, such as wheat, without likelihood of failure.

Grain bins are conventionally of metal construction. With the current unavailability of metals for such purposes, resort must be had to other materials, and the present invention contemplates the provision of an adequate grain bin structure inexpensively constructed of wood, and particularly, of plywood. Wood construction introduces a serious problem of strength against failure due to bursting strains, since a grain bin of fair size filled with a heavy grain as wheat is subject to rather severe bursting strains, and if constructed of wood, requires special construction features not heretofore available.

A particular object of the invention is the provision of a grain bin of adequate strength utilizing plywood in a novel manner for the cylindric sides.

A further object is the provision of a plywood grain bin of plywood construction having not only plywood sides but also a frusto-conical roof of novel plywood construction.

Another object is the provision of a plywood construction grain bin which can be largely prefabricated in the factory, leaving a minimum of construction at the site of erection.

A specific object is the provision of a side wall construction involving the use of plywood panels which are shipped from the factory in flat condition, and which are readily bent into curved shape and interlocked to one another at the edges in the field to form the cylindric sides of the bin, and a further and most important object is the provision of an interlocking joint for the said edges of the plywood panels such as will fasten the panels edge to edge in a secure manner with adequate factor of safety against the heavy bursting strains that will be encountered in the field.

The invention will be best understood by referring now to the accompanying drawings showing certain illustrative forms thereof, reference for this purpose being had to the accompanying drawings, in which:

Fig. 1 is a side elevation, partly broken away,

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of a typical grain bin in accordance with the invention;

Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1;

Fig. 3 is a detail section taken on line 3—3 of Fig. 1;

Fig. 4 is a detail section taken on line 4—4 of Fig. 1;

Fig. 5 is an exploded view of an alternate type of joint, prior to assembly;

Fig. 6 is a section similar to Fig. 5 but showing the parts after assembly;

Figs. 7 and 8 are horizontal sections illustrating a modified type of joint, before and after imposition of load;

Fig. 9 is a plan view of the grain bin, portions of the roof being broken away;

Fig. 10 is a section on line 10—10 of Fig. 9;

Fig. 11 is a section on line 11—11 of Fig. 9;

Fig. 12 is a section on line 12—12 of Fig. 9;

Fig. 13 is a plan view of the lid, looking at its underside;

Fig. 14 is a somewhat diagrammatic elevation of a grain bin in accordance with the invention showing a modified arrangement of the side wall sections and panels;

Fig. 15 is a vertical section showing a modified foundation construction; and

Fig. 16 is a section on line 16—16 of Fig. 15, the earth being omitted from the view.

Referring first to Figs. 1 and 2, the illustrative grain bin shown therein comprises, generally, a cylindrical side wall 15, a circular floor 16, and a frusto-conical roof 17.

Circular floor 16 preferably comprises four shop-assembled panels or sections 17, 18, 19 and 20, each made up of tongue and groove flooring, and the floor panels being laid side by side, in abutting relationship, on transversely extending joints 21. Each joint 21 may comprise two 2" by 4" members nailed together, and, in a typical construction, the joints may be laid on 24" centers. The floor panels 17, 18, 19 and 20 are so shaped that when laid properly on joists 21, they form a circular floor, and in a typical construction, this floor may be of a diameter of about 19'. The tongue and groove flooring of each of the four sections or panels 17, 18, 19 and 20 is pre-assembled in the shop by nailing to its underside a plurality of 1" by 2" strips or ribs 24. The floor joists 21 are preferably laid on some suitable leveled foundation, such as concrete blocks, brick, or treated wood, as will be understood. The foundation forming no part of the invention, no illustration thereof is made

in the drawings. The flooring sections 17 to 20 having been laid on joists 21, in the arrangement disclosed in Fig. 2, they are securely nailed to the joists, in an obvious manner.

A two-ply floor plate 25 is nailed to the upper face of circular floor 16, around the periphery thereof, said plate being assembled of lower plate sections 26 and upper plate sections 27, arranged with their joints broken, as clearly appears in Figs. 1 and 2. This two-ply plate 25 forms a circular surface conforming to the circular outline of floor 16, to which the side sections of the bin may be nailed.

The cylindrical side wall of the bin, which for a 19' diameter may typically be about 12' in height, is comprised of a plurality of somewhat flexible plywood main sections 30, which sections are bent into arcuate form about the circular floor or floor plate and are joined at abutting vertical edges by means of joints 31 (see Fig. 3). In the illustrative embodiment, there are but three of such sections 30 and joints 31, and with such a few number of sections, I subdivide each of the sections into a plurality of individual plywood panels 32 joined at abutting vertical edges by means of joints 33 (see Fig. 4). The plywood is preferably three-ply and $\frac{5}{16}$'' in thickness, and the individual panels are in this instance arranged with their long dimensions extending vertically. The several panels 32 comprising each of the main sections 30 are assembled in the factory to form the sections 30, whence the joints 33 may be referred to as "shop joints," and the assembled sections 30 are shipped to the field in flat condition. The sections 30 are bent to arcuate shape in the field at the time of erection of the bin, and the "field joints" 31 are made or completed at that time. It may here be mentioned that by arranging the plywood panels with their long dimensions horizontal, or circumferential of the bin, and by employing a somewhat larger number of "field joints," the necessity for the vertical subdivision of the main sections and for the "shop joints" 33 is avoided. In Fig. 14, for instance, assuming again a bin of about 19' in diameter, each main plywood side wall section 30*a* is made up of a plurality of circumferentially arranged plywood panels 30*b*, arranged one above the other, with vertical "field joints" 31 holding the abutting vertical edges of the sections 30*a* in assembly.

Inasmuch as the side sections must be considerably stressed in bending them into the necessary arcuate shape, the joints 31 and 33 must be designed to have the necessary strength in tension to hold the side sections in their stressed positions. Moreover, when the bin is filled with heavy grain as wheat, severe parting strains are exerted on the joints. A feature of the invention is accordingly the provision of joints between side sections which are adequately strong in tension to resist both the strain imposed thereon by the bent and stressed sidewalls, and also the strains arising from the loading imposed by the contained grain. With these requirements in mind, the joints 31 and 33 are embodied, in one simple form of the invention, as now to be described.

Each shop joint 33 comprises, preferably, a pair of inside and outside gusset plates 36 and 37 securely glued to the inside and outside surfaces of the panels 32 over their abutting edges, as clearly illustrated in Fig. 4. As hereinbefore indicated, these joints 33 are made and completed in the shop, and securely join the individual panels of each section against bending or parting strains that will be experienced in erection and loading.

The field joints 31, made or completed in the field, likewise include inside and outside gusset plates 38 and 39. Preferably, one-half of inside gusset plate 38 is securely glued in the shop to the edge portion of one of the two panels 32, as for instance at 40, and one-half of the outside gusset plate 49 is similarly glued in the shop to the edge portion of the other panel 32, as at 41. Then, at time of erection of the side wall in the field, the other half of inside gusset plate 38 is glued to the edge portion of the other of the panels 32, and the other half of the outside gusset plate 39 is glued to the edge portion of the first-mentioned panel 32. The three side wall sections 30 are erected one at a time, each being nailed securely to the bottom plate 25, with the bottom edge of the section extending below floor 16 for a distance of say ¼''. The first side section 30 is thus bent into arcuate shape to conform to the circular floor 16, and nailed securely to bottom plate 25. The second section 30 is then erected in a manner similar to the first section, the joint 31 being glued as described above. For reinforcement purposes, the field joint 31 is backed up by a vertical member 45 engaging inside gusset plate 38, the member 45 resting at the bottom on floor plate 25, and extending upwardly to the later described roof plate. Nails 46 are then driven through the gusset plates and end portions of the panels 32 in to the member 45, affording a strong and secure joint. The last section 30 is then erected, and the remaining joints 31 made as already described.

Figs. 5 and 6 show an alternative lock type of joint 31*a* as a substitute for the joint 31 between the vertical edges of the sidewall sections 30. Vertical strips 50 are glued to the inside surfaces of the abutting panels 32, along the vertical edges thereof, and an outside gusset plate 51 is glued to the outside of one of the panels 32, these members being glued in place in the shop. At the time of erection, in the field, the extending portion of the gusset plate 51 already glued to one of the panels 32 is glued securely to the other panel 32. A vertical bridging member 53, having spaced vertical strips 54 secured to one face thereof, is then applied from the inside, the strips 54 being so spaced as just to receive the two members 50, with a comparatively snug fit. The member 53 is backed up by a vertical strip 55, and nails 56 are driven through to secure the parts in assembly, all as will be readily understood from an inspection of Figs. 5 and 6. It will be understood of course that the members 50, 53, 54 and 55 all may extend from bottom plate 25 upwardly to the later described roof plate. The joint of the form of Figs. 5 and 6 has somewhat greater strength than that previously described, the interlocking members 50 and 54 positively locking the sections 30 against parting.

A still more secure lock joint for the vertical edges of the panels 30 is illustrated in horizontal section in Figs. 7 and 8. On the outer surface of one of the abutting panels 30, adjacent the vertical edge thereof, is glued a vertical spacer strip 57, and on the inner surface of said panel, also adjacent the vertical edge thereof, is glued a narrower vertical strip or cleat 58. Similar spacing strips 57' and strips or cleats 58' are glued to the other panel 30, but on the reverse surfaces thereof, as illustrated. Glued to the spacer strips 57 and 57', and projecting forwardly therefrom in overlapping relation to the edge portion of the other panel in each instance, are bridge strips 59 and 59', respectively, to the for-

ward edges of which are glued vertical locking strips 59a and 59a', each of which is engageable with the panel 30 overlapped thereby, in back of the cleat 58 carried by that panel. The joint is assembled as appears in Fig. 7, with an approximately ¼'' space between the locking strips 59a and 59a' and the corresponding cleats 58 and 58' with which the respective strips 59a and 59a' interlock, and nails 59b being driven through the overlapped members at each end of the joint, as illustrated. Fig. 7 shows a slight clearance between the locking strips and the panels 30 and between the cleats 58 and 58' and the bridge strips 59 and 59', respectively; it is to be understood that no such clearance is left after assembly, the parts actually being drawn tightly together by nails 59b, and that the clearances appearing in the drawings are merely to aid in distinguishing the parts making up the glued assemblies carried by the two abutting edge portions of the two panels 30. Fig. 8 shows the condition of the joint after the bin has been loaded, and shows that the joint gives until the locking cleats 59a and 59a' engage the cleats 58 and 58'. The joint is then, however, adequately secure, and under substantial overloading under test conditions, has not been found liable to failure.

The preferred roof 17 is constructed as follows: A two-ply roof plate 60, made up of members 61 and 62 similar to the members 26 and 27 of floor plate 25, is installed at the upper edge of cylindrical side wall 15, being secured in position by driving nails in through the side wall panels, as will be understood. Roof rafters 63, which may be 1'' by 3'' members, arranged radially of the bin, and with a pitch as illustrated, are then nailed to the roof plate 60 and to top or cone plate 64, the latter consisting of a three-ply circular member abutted by the upper ends of the rafters, all in the arrangement clearly illustrated in Figs. 1, 9 and 11.

The frusto-conical roof covering consists of six substantially sector-shaped plywood sections 66, the outer edges of which overhang the side wall 15 somewhat, and the inner ends of which are arcuately formed, as at 67, so as to fit around and abut against the upper portion of the circular cone plate 64. Each of these six sector-shaped panels 66 is joined to the next along its radial edge by means of a joint 68, formed in the field, and each of said sections 66 preferably, and as herein embodied, comprises three plywood panels 69 joined along abutting radial edges by means of joints 70 formed in the shop. Thus, the six roof sections 66 are each assembled in the shop of three individual panels 69, and are shipped in such form to the field. The joints 68 between roof sections 66 are then formed after the roof sections are in place.

As will be seen in Fig. 12, the shop-made joints 70 consist simply of gusset plates 72 lapping over the abutting edges of adjacent panels 69 and glued to the panels. The joints 70 are arranged to come directly over roof rafters 63, as also shown in Fig. 12.

Fig. 10 shows the joint 68 between roof sections 66, and is made in the field, and it will be observed that this joint consists also of a gusset plate 73 lapped over the abutting edges of the two adjacent roof sections. This gusset plate 73 is both glued to the surfaces of the roof panels, and nailed in position, the nails being driven into the underlying roof rafter 63a, which in this instance is made of double width for additional strength. Thus, as shown in Fig. 10, the rafter

underlying each roof joint 68 may comprise two 1'' by 3'' rafter members secured together, so as to make one double width rafter.

A ring 80 is preferably mounted on top of cone plate 64, being here shown as formed with a substantially square central opening 81, formed with notches 85 at the corners.

An octagonal lid 82, formed of plywood and provided with framing members 83 secured to its underside around its marginal edges, is disposed over ring 80, and secured to the underside of this lid is a cross 84. In one position of adjustment of the lid (Fig. 11), this cross 84 rests on top of ring 80, to provide space for circulation of air into the bin under the lid and via the central opening 81 in ring 80. In another position of adjustment (not illustrated), the cross 84 may be received at its ends into the notches 85, so that the lid will then rest down flat against the upper side of ring 80, and thus close off the air passage into the bin. Suitable hooks 86 fastened to the lid are engageable with eyes 87 secured to the roof to fasten the lid in position, as clearly appears in Fig. 11. The bin is finished by covering its roof, between gusset plates 73, with suitable roofing paper, as indicated at 90, and by likewise covering sidewall 15 with roofing paper, as indicated in Figs.3 and 4 at 91. Roofing paper 92 may also be applied to lid 82.

In Fig. 15 is illustrated a type of foundation omitting the necessity of the wood flooring of the previously described embodiments. A sill 100 is first laid in a trench dug in the earth, as appears in Fig. 15, this sill comprising typically a number 2'' x 6'' members 101 arranged to form a polygon, as will be understood from Fig. 16. In the top of this polygonal sill 100 is formed a circular groove 102 which receives vertical 1'' boards 103 rising to a level somewhat above exterior grade and forming a circular wall 104. A two-ply band sawed circular floor plate 105 is secured to the top of this wall 104, and may be of the same general nature as the floor plate 25 of the embodiment of Figs. 1 and 2, excepting that the upper ply is arranged with an overhang at its outer edge so as to be capable of resting on the upper edge of wall 104, while the wall 104 abuts the outside edge of the lower ply, all as clearly appears in Fig. 15. A circular band 106 is preferably secured around the circular floor plate and the upper edge portion of the wall 104, and the plywood side wall member 30 is secured to the band 106, nails being driven in through wall 30 and band 106 into the two ply plate 103 and upper edge portion of wall 104, as will be understood. Earth is filled in inside wall 104 to the level of the floor plate, and a floor covering 107, such as a sheet of asphalt impregnated fiber board, coated on the bottom with tar, is stretched over this filled-in earth and fastened down on top of the floor plate.

Thus, it will be seen that I have provided a wood construction grain bin, adapted to be largely prefabricated in the factory, and to be erected in a field with a minimum of constructional effort. A feature of particular interest and importance is the construction of the side walls from plywood panels which are shipped to the field in flat condition, and are formed to arcuate shape, and tightly and securely jointed in such shape in the field. The construction provided by the invention is adequately strong to contain relatively heavy grain such as wheat and the like, and is designed and adapted for quantity manufacture in the factory, at relatively low expense, and for erection in the field by the

ultimate user with a minimum of difficulty. The bin of the present invention has been subjected to substantial overloads under test conditions without showing any sign of failure. Such a test was made by constructing a test bin 19' in diameter and 16' in height, even though 12' is the height for which the bin was originally designed, as it was desired to subject the construction to a substantial overload. The sidewall arrangement of Fig. 14 and the type of lock of Figs. 7 and 8 were employed. This bin was filled to overflowing with pea gravel, which was allowed to stand for forty-eight hours to allow all materials to be subjected to the full force of the overload and to allow the bin to fail if it would do so because of fatigue of the materials. No sign of failure was detected.

The bin as disclosed omits any showing of grain door in the side wall or hatch in the roof; such features, which are usually provided, form no part of the present invention, and any suitable or appropriate form thereof may be provided as may be desired.

The drawings and description are of course merely illustrative of rather than restrictive on the broad invention, and various changes in design, structure and arrangement may accordingly be made without departing from the spirit and scope of the invention or of the appended claims.

I claim:

1. In a grain bin or the like having a substantially circular floor plate: a cylindrical side wall structure consisting essentially of a plurality of initially flat sections of flexible plywood, each bent into a stressed arcuate form around said floor plate and extending upwardly therefrom, so as to form a complete cylinder, each of said sections having substantially vertical edge portions disposed adjacent the like edge portions of adjacent sections, and means attached to the corresponding edge portions of adjacent sections for supporting said edge portions against parting strains.

2. In a grain bin or the like having a substantially circular floor plate: a cylindrical side wall structure consisting essentially of a plurality of initially flat sections of flexible plywood, each bent into a stressed arcuate form around said floor plate and extending upwardly therefrom, so as to form a complete cylinder, each of said sections having substantially vertical edge portions disposed in abutting relationship to the like edge portions of adjacent sections, and means attached to the abutting edge portions of adjacent sections adapted to support said edge portions against parting strains.

3. In a grain bin or the like having a substantially circular floor plate: a cylindrical side wall structure consisting essentially of a plurality of initially flat sections of flexible plywood, each bent into a stressed arcuate form around said floor plate and extending upwardly therefrom, so as to form a complete cylinder, each of said sections having substantially vertical edge portions disposed in abutting relationship to the like edge portions of adjacent sections, and gusset plates overlapping the adjacent edge portions of adjacent sections and secured to said edge portions.

4. In a grain bin or the like having a substantially circular floor plate: a cylindrical side wall structure consisting essentially of a plurality of initially flat sections of flexible plywood, each bent into a stressed arcuate form around said floor plate and extending upwardly therefrom, so as to form a complete cylinder, each of said sections having substantially vertical edge portions disposed in abutting relationship to the like edge portions of adjacent sections, and inner and outer gusset plates overlapping the adjacent edge portions of adjacent sections and secured to said edge portions.

5. In a grain bin or the like having a substantially circular floor plate: a cylindrical side wall structure consisting essentially of a plurality of initially flat sections of flexible plywood, each of said sections comprising a plurality of rectangular plywood panels joined edge to edge, and each of said sections bent into a stressed arcuate form around said floor plate and extending upwardly therefrom, so as to form a complete cylinder, each of said sections having substantially vertical edge portions disposed in abutting relationship to the like edge portions of adjacent sections, and means secured to the abutting edge portions of adjacent sections joining said sections against parting strains.

6. In a grain bin or the like having a substantially circular floor plate or the like: a cylindrical side wall structure consisting essentially of a plurality of rectangular plywood panels deformed into a stressed arcuate shape around said floor plate and extending upwardly therefrom, said panels having abutting vertical edges, and tension means attached to the two abutting edge portions of adjacent panels adapted to support the panels in said arcuate shape against the stresses occasioned by said deformation.

HAMILTON VON BRETON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,267,888	Arnold	Dec. 30, 1941
2,295,103	Friedly	Sept. 8, 1942
2,345,694	Wilson	Apr. 4, 1944

FOREIGN PATENTS

Number	Country	Date
198,940	Great Britain	June 14, 1923

OTHER REFERENCES

American Builder, August 1942, page 42 (copy of page 42 in Division 33 filed under 20–2.B uxr).