Dec. 26, 1944. R. W. McLAUGHLIN, JR 2,365,891

GRAIN BIN

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Fig. 1.

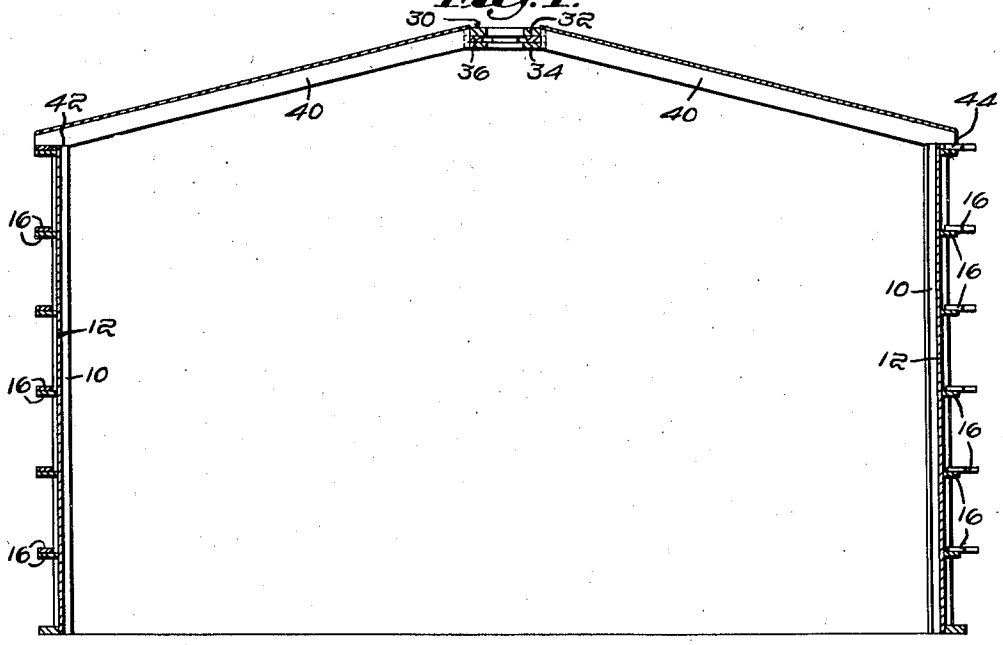
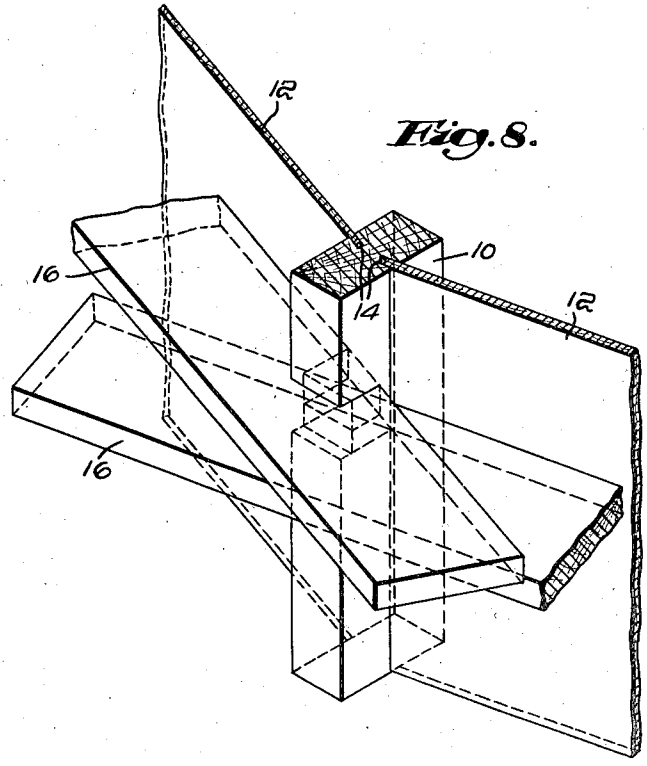


Fig. 8.



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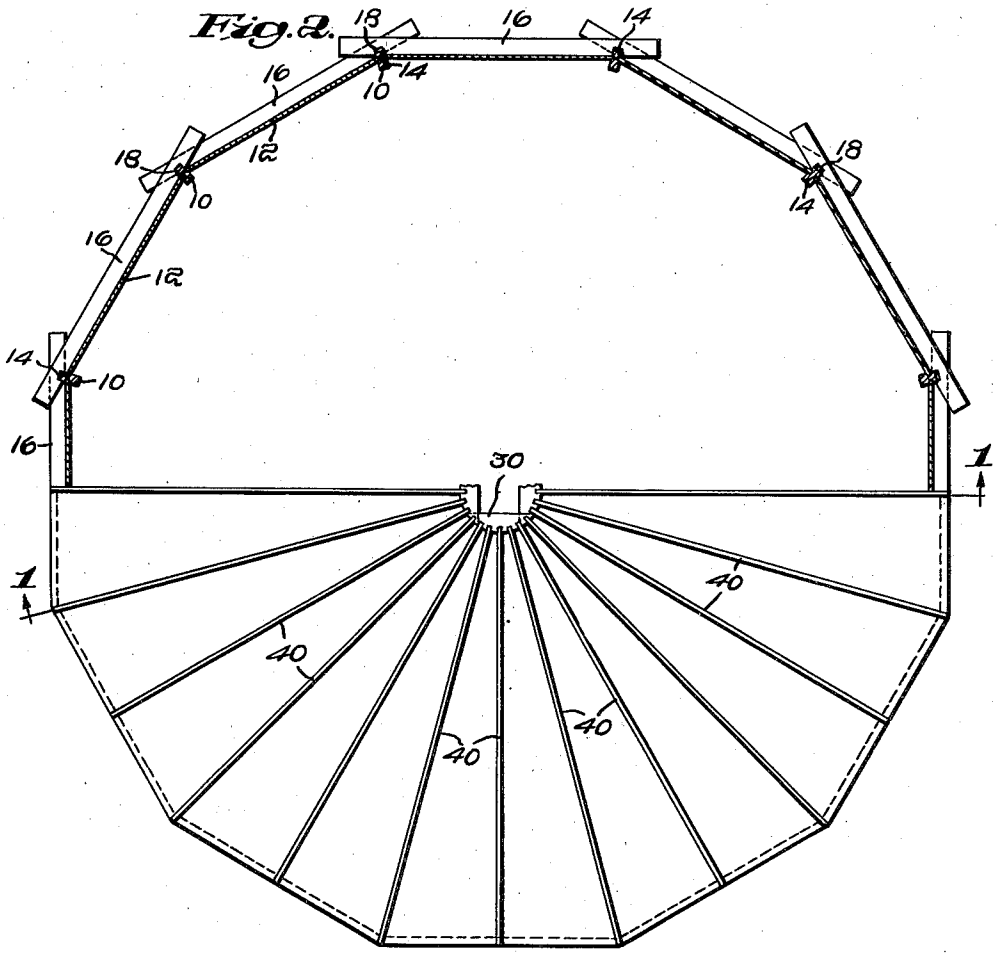
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Fig. 2.



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Fig. 3.

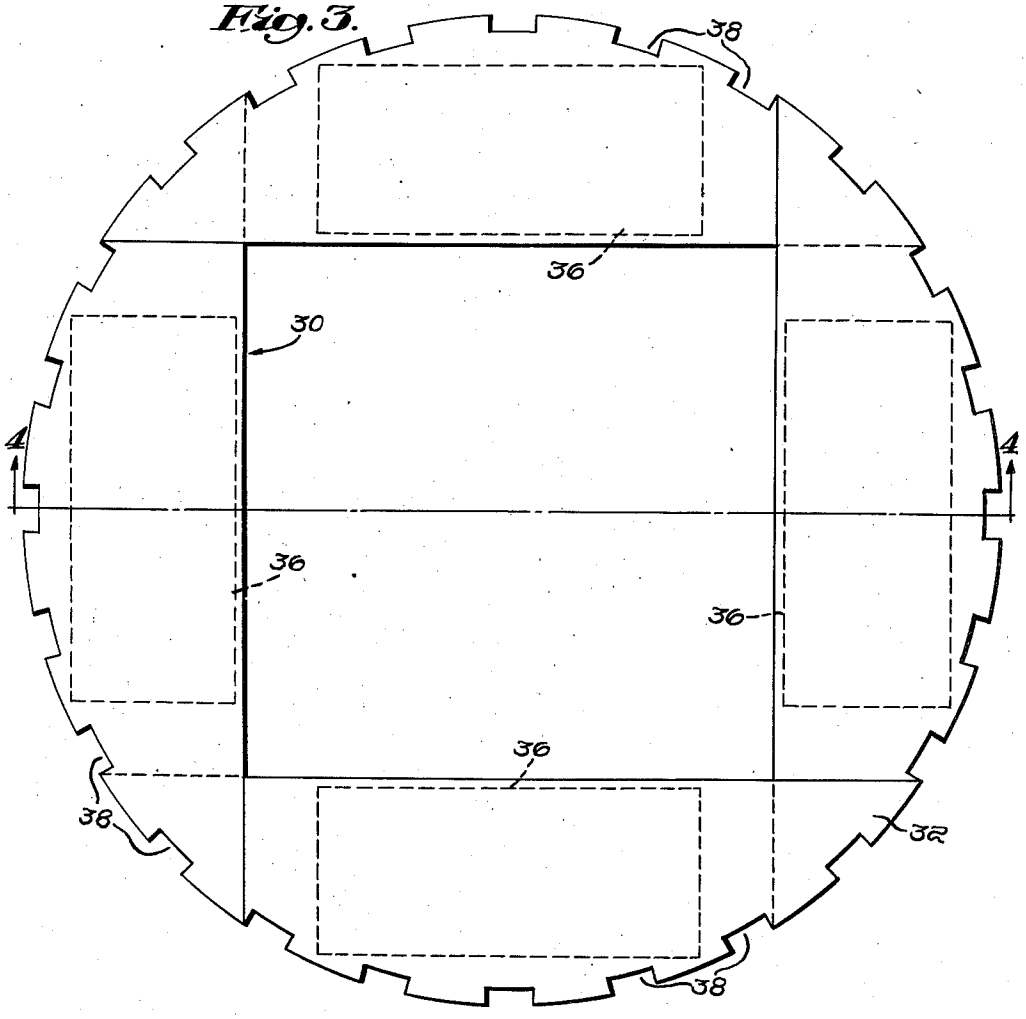
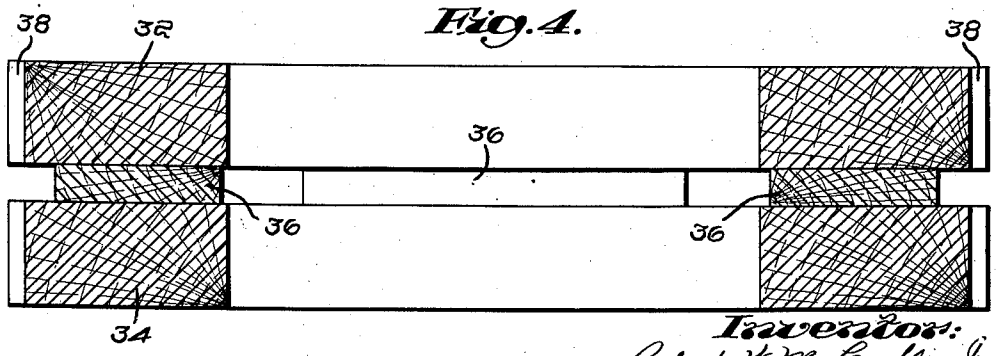


Fig. 4.



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Fig. 5.

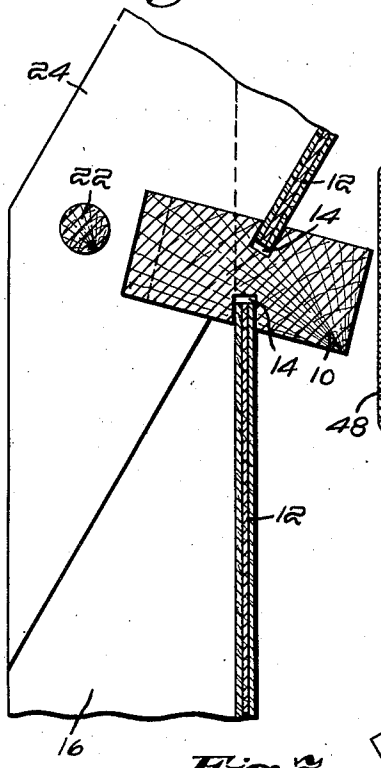


Fig. 6.

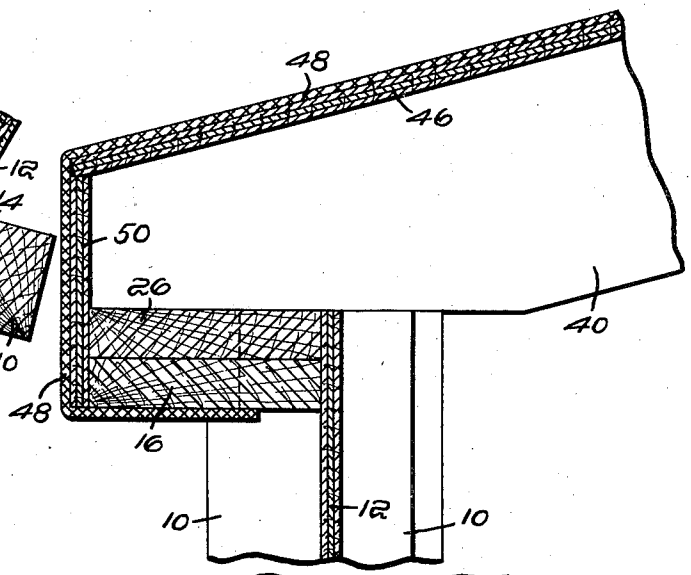


Fig. 8.

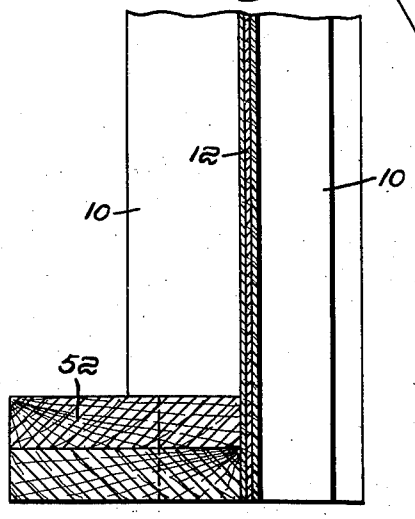
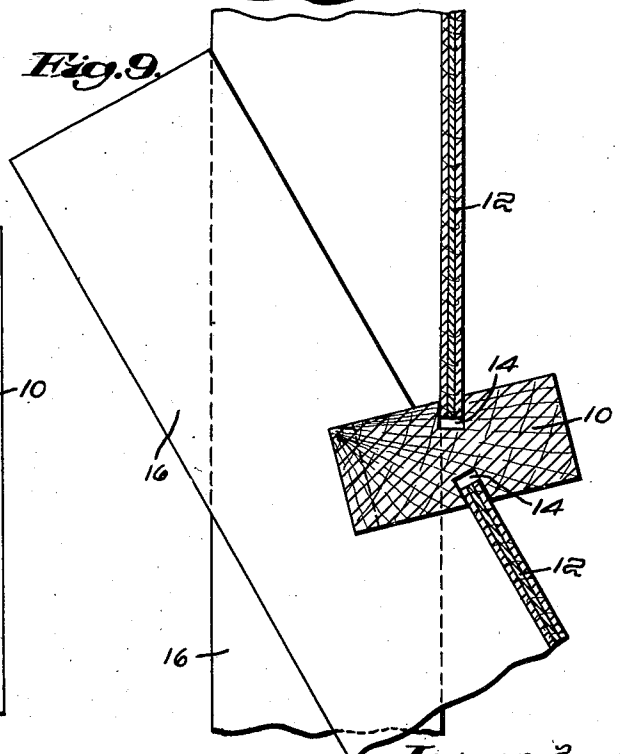


Fig. 9.



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Patented Dec. 26, 1944 2,365,891

UNITED STATES PATENT OFFICE

2,365,891

GRAIN BIN

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Application January 28, 1943, Serial No. 473,826

7 Claims. (Cl. 20—1.2)

This invention relates to an improved grain bin.

An object of the invention is to provide a grain bin of the character described which is formed essentially of prefabricated structural elements and which may be readily and cheaply assembled at the building site.

Other objects of the invention are to provide a grain bin formed of prefabricated wooden structural elements which is substantially air-tight, which employs a minimum of structural material, which is sturdily built, and which is adapted to withstand the outward pressure of the binned grain.

Still other objects of the invention are to provide a grain bin of the character described in which the outward thrust of the stored grain is withstood by a multiplicity of horizontal ties adapted to so interlock with the vertical weight-supporting structural elements of the bin that the gripping or interlocking action between the ties and studs is increased proportionately to the increase of the outward pressure of stored grain; to provide wall closure elements in combination with said ties and studs of such a character as to provide a substantially air-tight bin wall and to provide means for sealing the edges of the said wall closure elements against the weather.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises a product possessing the features, properties, and the relation of elements which will be exemplified in the product hereinafter described, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the invention, reference should be had to the following detailed description of one embodiment thereof, taken in connection with the accompanying drawings, in which:

Figure 1 represents a view in vertical section, along the line 1—1 of Fig. 2, of a grain bin embodying a preferred form of the invention;

Fig. 2 is a view in plan of the bin shown in Fig. 1, the upper half of Fig. 2 representing a view taken substantially below the roof of the bin, and the lower half of Fig. 2 representing a view taken at the top of the roof rafters of the bin;

Fig. 3 represents a plan view of the rafter ring employed in the roof construction;

Fig. 4 is a view in section along the line 4—4 of Fig. 3;

Fig. 5 is a view, partially in plan and partially in horizontal section, of a detail of the wall construction of the device shown in Figs. 1 and 2;

Fig. 6 is a detailed view in vertical section of the roof and upper wall construction of the bin;

Fig. 7 is a detailed view in vertical section of the bottom of the bin wall;

Fig. 8 is an isometric view of a typical joint between a vertical stud element, wall closure element and horizontal tie elements employed in the preferred bin structure; and

Fig. 9 is a view in horizontal section of the joint shown in Fig. 8.

The grain bin of the present invention is a prefabricated structure, the structural units of which may be manufactured and, if desired, partially assembled at the factory, shipped in knock-down condition to the site at which the bin is to be erected, and there erected readily and rapidly by unskilled labor if necessary. The structure of the present invention is essentially a wooden structure and has been designed to employ a minimum of metallic fastening elements, such as ties, straps, nails, etc., as well as a minimum of metallic structural elements, such as studs, rafters, etc., in order to meet present-day requirements for the conservation of metals. It will be understood that the following description, while directed primarily to a structure formed essentially of wooden elements only, is to be understood as applicable to a structure which may be modified if and when it should be proved advisable so to do, by the substitution of light, strong metallic elements for the wooden elements disclosed.

The grain bin of the present invention is substantially airtight. It has been designed to withstand the outward thrust exerted by the grain within a filled bin. Its structure is such that as the outward thrust of the binned grain increases, the thrust-resisting elements, which are shown and described as horizontal ties, are caused to interlock more and more firmly with the vertical stud elements with which they are in engagement, so that no tendency for slippage or other failure of the structural parts of the bin with respect to one another arises.

The preferred material for use in the formation of the wall closure elements of the bin is plywood and the structure of the preferred embodiment of the invention is such that the plywood wall elements are so associated with the vertical studs that the latter furnish protection against the weather for the otherwise exposed edges of the wall panel elements.

In the embodiment of the invention shown in the drawings, the bin is illustrated as formed with twelve flat side panels so that a twelve-sided structure is produced It is, of course, to be understood that such a bin shape is not essential to the invention, although it is a preferred form.

The bin shown in the drawings comprises vertical stud elements **10**, which are equally spaced and supported on any suitable foundation. The foundation is not shown in the drawings for the sake of clarity. It may comprise, for example, either a platform of wood or an area of tamped earth or a concrete foundation. If the bin is built directly upon earth its base is preferably surrounded by concrete blocks.

Wall closure elements **12** are provided between the vertical stud elements and these wall closure elements may preferably take the form of panels of equal height and equal width. It has already been mentioned that a preferred material for use as the wall closure elements is plywood, and plywood, one-quarter inch thick, has been found adequate with a bin of such a size that the twelve panel elements are each four feet in width and eight feet in height. As shown most clearly in Figs. 5, 8 and 9, the panel elements are positioned in notches or grooves **14**, formed to receive them by rabbeting studs **10**. With such a construction, the studs act not only to position and hold the wall panel elements but they act also to protect the ends of the plywood panels from the weather. It is to be understood that the panel elements **12** are all alike and that any may be substituted for any other in the structure and that the same is true of the stud elements **10**.

Horizontal locking tie elements or girts **16** are provided for the purpose of holding the studs and wall panels in interlocked position and to receive the outward thrust of the binned grain. These horizontal ties, as shown most clearly in Fig. 1, are positioned at spaced intervals from the base to the top of the bin wall on the outer surface of the wall. Their inner edges are in engagement with outer surfaces of the wall panel elements **12** and the ties are notched near their ends as, for example, at **18**, to receive the vertical studs. The interlocked structure of the ties and studs is perhaps shown most clearly in the isometric drawing, Fig. 8, and, as will be apparent from that drawing, the studs may be notched, preferably rather shallowly, to insure a proper position of the tie elements vertically along the studs.

Although the ties are shown in Fig. 1 as regularly spaced along the vertical walls of the bin, it is to be understood that such an arrangement may not be preferred and that if desired the ties may be closer spaced adjacent the bottom or lower portion of the bin wall so as to compensate for the added outward thrust of the stored grain at this portion of the structure. Where the ties are interlocked with the vertical studs they may be lightly nailed to the studs, primarily for the purpose of assuring proper alignment. This is not, however, essential, especially if the ties are formed of plywood so that there is little or no tendency for them to split where they are grooved to interlock with the studs as a result of the shearing force exerted by the outward thrust of the binned grain. If the ties are not formed of plywood, but are constructed of regular planks or the like, it has been found desirable to key them together where adjacent ties overlap with the stud elements by using preferably a hard wood peg **22**, which is clearly shown in Fig. 5.

For most of the interlocking joints between the horizontal ties and the stud elements, the tie ends are left squared as shown, for example, in Figs. 8 and 9. However, those horizontal ties which are immediately adjacent the upper edge of the wall have their ends bevelled as at **24**, in Fig. 5, to conform with the adjacent overlying tie edge. This modification makes possible a more convenient roof assembly.

Preferably, one horizontal series of ties **16** is positioned immediately adjacent the upper edge of the bin wall to provide a partial support for the roof structure of the bin. This will be clearly apparent from Fig. 1 and Fig. 6. With reference to Fig. 6 particularly, there is disclosed a detail of the structure wherein the tie, illustrated as at **16**, is one of the underlying ties of the group positioned adjacent the upper edge of the wall. Under these circumstances the tie is spaced from the upper wall edge a distance equal to the thickness of the ties which have overlain it at the studs with which it is interlocked. The space between the underlying tie **16** and the upper edge of the wall panel element **12** adjacent thereto is, under these conditions, closed by employing suitable blocking **26**. This blocking cooperates with the overlying adjacent tie elements to provide a substantially smooth platform interlocked with the vertical studs **10**, for the reception of the outer ends of the roof rafters.

The roof structure is shown most clearly in Figs. 1 to 4, inclusive. It comprises a central rafter ring **30**, which is shown in detail in Figs. 3 and 4. This ring is shown as comprising two sections, **32** and **34**, spaced by the members **36**. The outer edge of the sections **32** and **34** is essentially circular as is clearly apparent from Fig. 3, but is notched as at **38**, to receive the inner ends of the rafters **40**. These alignment notches **38**, in the rafter ring **30**, make possible a rigid and accurate assembly of the roof structure. The outer edges of the rafters, as shown most clearly in Fig. 1, rest, and are fixed to either the vertical stud elements, as at **42**, or the uppermost of the horizontal locking ties **16**, or the blocking elements **26**, as at **44**. The roofing itself may comprise suitable sheathing grade plywood **46**, in Fig. 6, over which there may be laid a suitable roofing felt **48**, for example. The spaces between the outer ends of adjacent rafters may be closed by any suitable means, for example, the same grade of plywood **50**, in Fig. 6, and this may in turn be covered by an extension of the roofing felt **48**, as shown.

In the embodiment of the invention shown, twenty-four rafters **40** are provided, i. e. two rafters for each stud. As shown clearly in Fig. 2, the rafters extend radially from the rafter ring **30**, alternate rafters extending to, and resting upon, the studs, and the remaining rafters, slightly shorter in length, extending to the midpoints of the vertical wall closure elements. This rafter ring and radially extending rafter construction gives a roof which is easily and rapidly assembled and which is rigid and durable.

Detail of the base of the wall on the preferred bin is shown in Fig. 7, where the wall closure panel **12** is shown as supported at its base by a heavy sill **52**.

Doors may be readily provided in any selected wall panel element. The doors (not shown) may comprise sliding panels, each, for example, sub-

stantially one-half the width of the wall closure panel and of a height equal to the distance between adjacent series of horizontal ties 16. Such sliding panels, which may be cut from the wall closure element itself, may be mounted between adjacent series of ties in a U-shaped molding to slide over one another and thus provide a suitable closure. Supplemental grain-holding elements should preferably be placed behind such a door and when the door is opened by sliding back a panel the grain is permitted to run out by forcing aside one of these grain-holding elements. As any suitable door structure may be employed, and as the type described is not believed to be essential to the invention, it is not shown in the drawings.

It will be readily apparent that the erection of the grain bin illustrated in the drawings may be quickly accomplished. The vertical studs are interchangeable. The wall closure panels are interchangeable. The horizontal tie elements, with the exception of the bevelled elements forming the uppermost ring, are interchangeable. In the precise embodiment of the invention shown in the drawings, half of the rafters are interchangeable with one another, and the remaining half of the rafters are interchangeable. With such structural elements, even unskilled labor can rapidly erect the grain bin by following simple instructions. With interlocking horizontal ties and vertical studs of the character described, it is practically impossible to erect improperly the structure of the invention. It will be apparent, moreover, that the grain bin may be quickly and readily taken down, shipped in compact form to a new site, and re-erected, without loss of structural elements. The type of interlocking shown and described, between the horizontal tie elements and the vertical studs coupled with the structural arrangement of wall panel elements, studs and ties, insures a tighter and closer interlock between the structural elements of the bin as the bin is filled with grain, and the outward thrust thereof against the wall panel elements increases. Moreover, the structure of the present invention utilizes the outward grain thrust to insure a more satisfactory airtight joint between the vertical studs and the wall panel elements.

The materials employed in the bin structure are relatively light in weight, of low cost and cheap to manufacture. The structure meets a widespread and insistent demand for cheap but satisfactory grain storage facilities.

While the device of the present invention is referred to herein and in the claims as a "grain bin," it is to be understood that the structure may be used for other storage purposes, for example, as a silo, or for the storage of liquids, or even for such non-storage purposes as, for example, a chicken house. All such uses are to be deemed as falling within the scope of the claims, which shall be understood as covering the claimed structure, however used.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A grain bin comprising, in combination, a multiplicity of stud elements, wall-closure panels positioned between and in engagement with said studs, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of adjacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin, and a roof for said bin.

2. A grain bin comprising, in combination, a multiplicity of stud elements, wall-closure panels positioned between and in engagement with said studs, said studs being rabbeted to receive the edges of said panels, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of adjacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin, and a roof for said bin.

3. A grain bin comprising, in combination, a multiplicity of substantially identical stud elements, substantially identical wall-closure panels positioned between and in engagement with said studs, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially identical horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of adjacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin, and a roof for said bin.

4. A grain bin comprising, in combination, a multiplicity of stud elements, wall-closure panels positioned between and in engagement with said studs, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of adjacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin and being so positioned as to provide a plurality of spaced, substantially parallel series of closely adjacent overlying ties extending around the outer face of said bin, and a roof for said bin.

5. A grain bin comprising, in combination, a multiplicity of stud elements, wall-closure panels positioned between and in engagement with said studs, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of ad-

jacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin and being so positioned as to provide a plurality of spaced, substantially parallel series of closely adjacent overlying ties extending around the outer face of said bin, adjacent ties in each series being fastened together, and a roof for said bin.

6. A grain bin comprising, in combination, a multiplicity of stud elements, wall-closure panels positioned between and in engagement with said studs, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of adjacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin, said panels and ties being formed of plywood, and a roof for said bin.

7. A grain bin comprising, in combination, a multiplicity of stud elements, wall-closure panels positioned between and in engagement with said studs, adjacent ones of said panels being angularly positioned with respect to one another, a multiplicity of substantially horizontal ties, each tie being positioned to engage the outer surface of a panel and being notched in its panel engaging edge to interlock with a plurality of adjacent studs, said ties being positioned against the outer faces of said studs and said panels so as to resist, in combination with said studs and panels, the outward thrust of grain within said bin and being so positioned as to provide a plurality of spaced, substantially parallel series of closely adjacent overlying ties extending around the outer face of said bin, adjacent ties in each series being fastened toegther, and a roof for said bin, the uppermost series of said ties serving to support a portion at least of said roof.

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