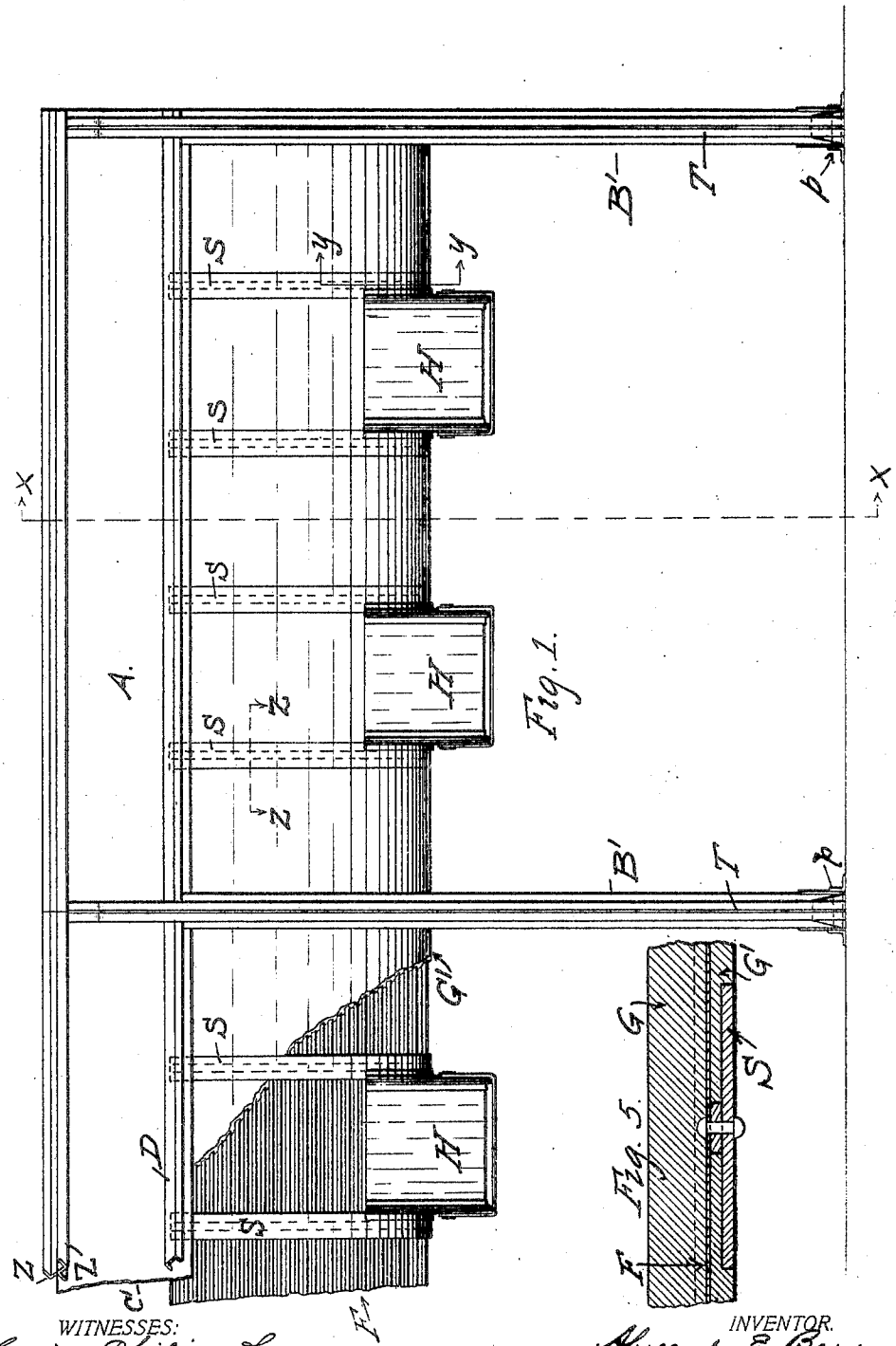
No. 802,263. PATENTED OCT. 17, 1905.

A. E. BROWN.

STORAGE BIN.

APPLICATION FILED DEC. 22, 1904.

3 SHEETS—SHEET 1.



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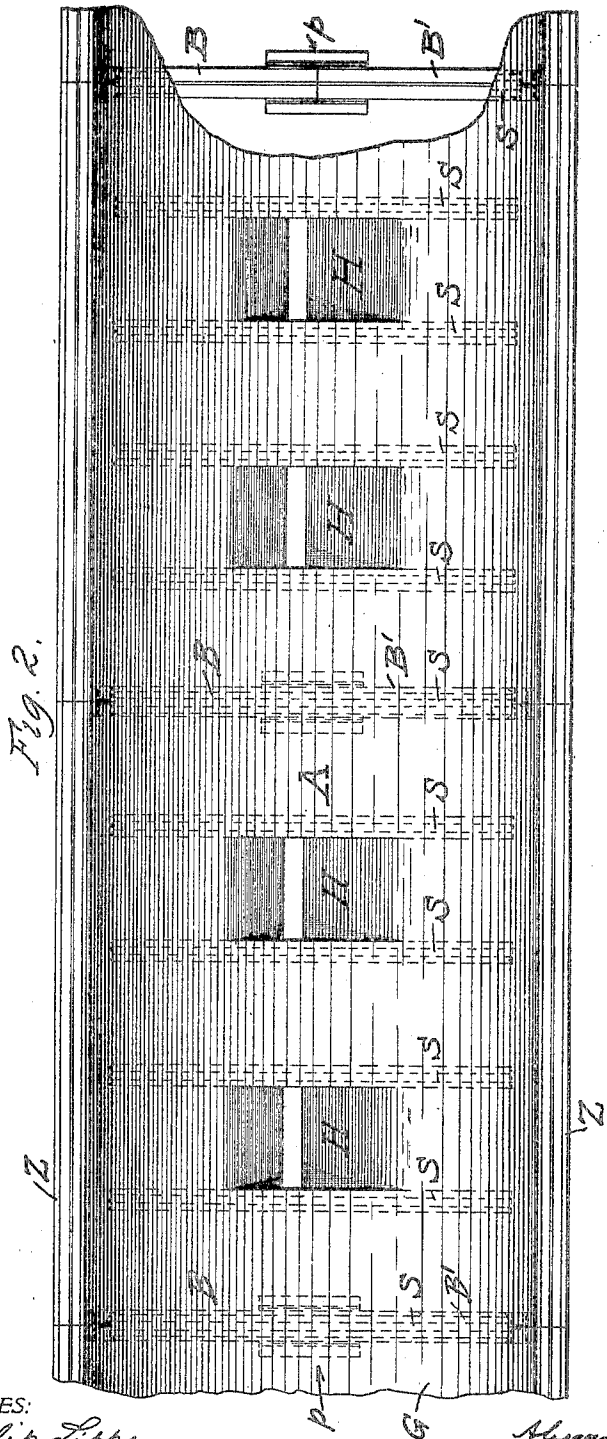
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

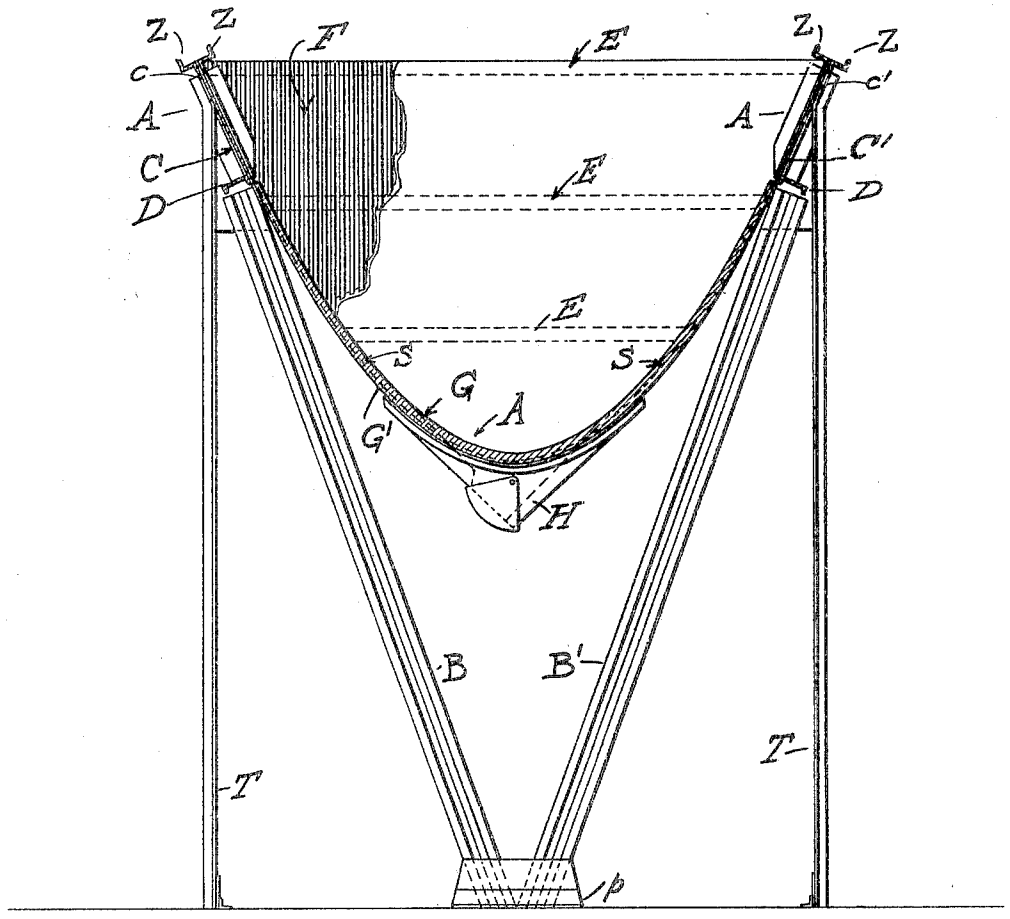


Fig. 3.

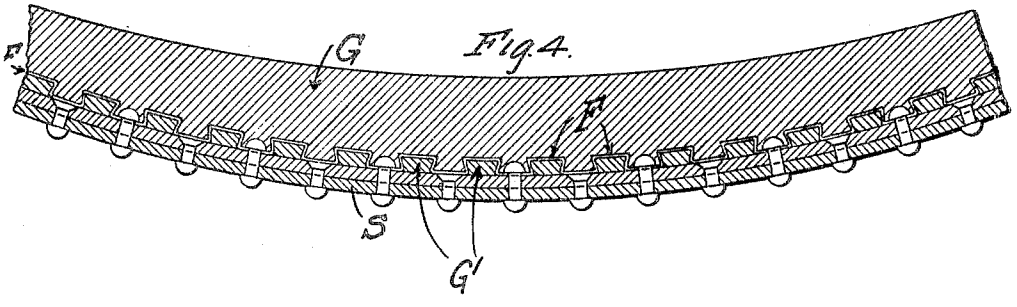


Fig. 4.

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UNITED STATES PATENT OFFICE.

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STORAGE-BIN.

No. 802,263. Specification of Letters Patent. Patented Oct. 17, 1905.

Application filed December 22, 1904. Serial No. 238,009.

To all whom it may concern:

Be it known that I, ALEXANDER E. BROWN, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Storage-Bins, as to which I hereby declare the following to be a full, clear, and exact description, reference being had to the drawings accompanying and which are to be regarded as a part of this specification.

Said invention relates to the special class of receptacles for coal, ore, and other gross material in bulk that utilize in their construction the tensile strength of the material forming their sides and bottom to resist the strains set up by the load. Bins of this kind have heretofore been made up of a series of rectangular plates riveted together to opposite horizontal girders that are sustained by vertical columns beneath the same, the several plates in the series being so bent as in the majority of cases to substantially describe parabolic or catenary sections between said girders and being connected laterally one to the other by either lap or butt joints. This form of structure involves the use of heavy and continuous sheets of steel or like material for the bin proper in order to get the requisite rivet values against shearing along the line of suspension and also a regular system of cross-bracing, so as to resist the tendency of the supporting-columns to approach each other under the force of the load and the bin to collapse. By reason of the weight and character of the material thus required for bins of the prevailing type referred to not only is the cost of their construction enhanced to an undesirable degree, but it becomes impossible to adequately protect their interior surfaces against the corrosive actions ascribable to the various substances with which they are to be in contact. As is well known, for instance, the reactions of coal or ore and the moisture to which they are inevitably exposed when in bunkers or storage-bins attacks steel to a destructive degree, and for this reason and as the only mode of meeting the conditions bins of sheet-steel of the kind in question have heretofore been painted inside, a measure, however, which has proven both imperfect and short-lived.

It is the object of my present invention to provide a storage-bin of the above type which while preserving all the advantages of prevailing structures so far as the character of their cross-sections is concerned makes use of further structural principles and details whereby intermediate cross-braces or struts of every description except those required at the ends to resist the longitudinal thrust of the load may be dispensed with, a thorough insulation of the surfaces obtained, and all at greatly-reduced costs. I realize this object in the form of construction I shall now proceed to more fully describe, referring to the several drawings wherein similar parts are designated by the same letters in each case.

Figure 1 is a side elevation of a portion of an exteriorly-insulated storage-bin with a portion of such insulation removed. Fig. 2 is a down plan view of such bin. Fig. 3 is a vertical sectional view of Fig. 1 through the line $x\ x$ in the direction of the arrows. Fig. 4 is an enlarged transverse sectional view in the direction of the arrows through the line $y\ y$ of Fig. 1 of a portion of a bin made of ferro-inclave sheets carrying a cement coating on both sides, and Fig. 5 is an enlarged longitudinal sectional view in the direction of the arrows of a like portion through the lines $z\ z$ of Fig. 1.

My said suspension-bin, as shown, has as its chief component members the body portion A and the several pairs or sets of inwardly-inclined columns or posts B B′, that support the same. The portion A is composed of two opposite and obliquely-related horizontal girders C C′, made up of the webs or plates $c\ c'$, surmounted at the tops on each side by the Z-bars Z Z and further stiffened by the channel-beams D D, that extend along the outer surface of the same near their lower edges. To the lower edges of said webs at suitable intervals are riveted or otherwise attached the respective ends of a series of metallic ribs or straps S S of sufficient strength to sustain the weight to be applied thereto, as will hereinafter appear and having a downward curve between the said girders that is the same substantially as that which said straps or bands would assume when thus suspended if they were at the same time semi or partly flexible, inextensible, and free to move between their ends. It is of course needless to say that by reason of the element of rigidity that is necessarily present in greater or less degree in metallic straps the curve thus

indicated will in fact correspond more nearly to a parabola than a catenary and should be that best suited to resist the strains of a superimposed laterally-confined load of loosely or freely flowing granular matter. In practice it is found that if the strap constructions are laid out as parabolas a load applied to the resultant bin, whether such load be surcharged, level, or concave, will vary the curve-section to but a most insubstantial degree. Nevertheless, since the extent of this variation from a parabola in a given case will depend upon the character of the material to be loaded in and drawn from the bin, the amount thereof may be calculated in the first instance according to such material near enough for all practical purposes and designs be made to conform thereto. Upon and to said ribs or straps S are contiguously laid and riveted in their places the sheet-plates of whatever character used. These latter are made to conform to the contour of said ribs or straps at their respective points of support and together make up and complete the bottom and sides of the bin-body A. While the use of plain metallic sheets or plates upon said straps to form the bin-body A is in itself the broader application of my invention as I intend to claim the same, perhaps its greater utility in practice is in connection with corrugated sheet material of all kinds and particularly that kind of such material known as "ferro-inclave," which is the subject of and is fully illustrated and described in United States Letters Patent granted to me under date of December 17, 1901, and numbered 689,281, wherein the sheet is accurately crimped by special machinery into dovetailed sections with the openings of each alternate section of the sheet at one end slightly wider than the same openings at the other end, thereby allowing the ends of two sheets to slide into one another and fit securely.

As will be understood the feature of suspending a bin-body from its frame indirectly, as explained, instead of directly, as in prevailing methods, permits a lighter gage of sheet material to be employed, and therefore a gage which can be corrugated, and thereby adapted to receive and maintain an interior coating of cement or other plastic medium that will effectually withstand any reagents which the bin will encounter in its use. The fact that ferro-inclave plates, as said above, can be directly fitted into each other at their ends has the further advantage in the connection of enabling a form of seam to be made use of to unite the several plates that has all the merits of a lap-joint and the sufficiency of the butt form, and yet which dispenses with the special covers or welts that the one form requires or the double row of rivets that characterizes the other. Furthermore, when a series of ferro-inclave plates are wedged tightly together end to end and fastened longitudinally to said straps and are then reinforced by a given thickness of cement upon their upper face, the whole course will constitute a continuous beam or sheet girder of exceeding strength in proportion to the material, the compression member of the same being the cement and the tension member the ferro-inclave, a form of disposing metal for the purpose that in the nature of things must obtain the advantage of the entire weight involved to the fullest degree.

Throughout the drawings the bin is represented and assumed to be one where ferro-inclave (represented by F) is used and is fortified and insulated within and without by cement or like substance, the cement on the interior of the bin being represented by G and that on the exterior by G'. Preferably the coating G should be made thickest in the bottom of the bin and graduated each side upward to a minimum depth at the top, as is indicated in Fig. 3. The bottom and sides of the bin-body A, having been made up as above described, the same material may enter into the end formations. Here, however, the same structural principle is of course not involved, and such material may be applied in any suitable manner. Fig. 3 indicates ferro-inclave, duly coated and fastened to the inner faces of cross-struts E to constitute a vertical wall or end partition.

H H are the usual relief-chutes, disposed throughout the structure as is deemed best.

The frame-supporting columns or posts B B are located in pairs at such points beneath the girders C and C' as the bending strength of the latter demands. Their angle of convergence or obliquity inward to the base-plates *p p* is arrived at as the resultant of the horizontal and vertical strains of the bin-body A and, as is evident, they sustain a tangential relation to the same at the girder portion thereof, C and C'. It is further evident that by arranging the supporting-columns B B' in the manner just described any tendency of said girders to be forced together by the weight of the load is taken up and provided for and that consequently the cross-bracing of the bin to prevent its collapse that is essential when the same is vertically supported may be entirely dispensed with. To steady the structure against windage or other vibratory shocks, I provide tie-rods T T at suitable distances along and fastened to the sides of the bin and duly anchored below.

Although I have described and shown what is substantially a parabolic curve as the section of the storage-bin to which my invention applies, I wish it to be understood that I do not limit the same to that or any other particular line of curvature, but have chosen a parabola as representing the theoretical standard for the purpose, at the same time realizing that such standard may be departed from and my invention still be recognized, although,

as must always be the fact, the curve of the ribs or straps S S, and consequently of the bin A, be different, provided only such different curve is one that the material referred to as composing the bin proper will tend to assume when suspended as described and subjected to the strain of the load it is to contain. So although as an advantageous form of the structure I introduce the feature of the oblique columnar supports my invention is nevertheless complete and useful to an extent if the suspended bin made up as described depends from a framework having vertical columns, for instance, instead of as shown, and while I have also specifically described various structural details for a bin embodying my invention—such, for instance, as the manner of making up the girders C C′, the dovetail section in the corrugated plates, &c.—I do not wish the invention in the broadest sense to be restricted to such details of structure, but to be interpreted more comprehensively.

What I claim, and wish to secure by Letters Patent, is—

1. In a storage-bin, or like receptacle, the combination, with a suitable base or framework, of a series of a substantially parabolic-shaped ribs or straps sustained thereby, and, a bin-body, having its bottom and sides formed by a series of continuous sheet-girders or beams attached to, and supported by said ribs or straps, each member of which last-named series conforms in contour to the ribs or straps that immediately support the same at the points of its support, substantially as shown and described.

2. In a storage-bin, or like receptacle, the combination, with a suitable base or frame, of a series of a substantially parabolic-shaped ribs or straps sustained thereby, and, a bin-body, having its bottom and sides formed by successive courses of sheet-plates attached to and supported by said ribs or straps, each member of said courses conforming in contour to the ribs or straps that immediately support the same at the points of its support, substantially as shown and described.

3. In a storage-bin or like receptacle, the combination, with a suitable base, or frame, of a series of a substantially parabolic-shaped ribs or straps, sustained thereby, and a bin-body having its bottom and sides formed, by successive courses of corrugated sheet-plates attached to and supported by said ribs or straps, each member of said course conforming in contour to the ribs or straps that immediately support the same at the points of its support, substantially as shown and described.

4. In a storage-bin, or like receptacle, the combination, with a suitable base or frame, of a series of a substantially parabolic-shaped ribs, or straps sustained thereby, and a bin-body having its bottom and sides formed by successive courses of ferro-inclave sheets or plates attached to and supported by said ribs or straps, each member of said course conforming in contour to the ribs or straps that immediately support the same at the points of its support, substantially as shown and described.

5. In a storage-bin or like receptacle, the combination, with a base or framework containing a series of oppositely-arranged supporting columns or posts that converge inwardly to their points of support, at the angle of the resultant of the horizontal and vertical strains to be sustained, a series of a substantially parabolic-shaped ribs or straps connected with and supported by said columns or posts, and a bin-body having its bottom and sides formed by successive courses of sheet-plates or similar material, attached to and supported by said ribs or straps each member of said courses conforming in contour to the ribs or straps that immediately support the same at the points of its said support, substantially as shown and described.

6. In a storage-bin, or like receptacle, the combination, with a base or framework containing a series of oppositely-arranged supporting columns or posts that converge inwardly to their points of support at the angle of the resultant of the horizontal and vertical strains to be sustained, a series of a substantially parabolic-shaped ribs or straps, connected with and supported by said columns or posts and a bin-body made up of successive courses of sheet-plates, or like material, attached to and supported by said ribs or straps and coated with cement, or other non-reactive substance, the said sheet-plates, that constitute said courses, severally conforming, in contour, to the ribs or straps, that immediately support the same, at their respective points of support, substantially as shown and described.

ALEXANDER E. BROWN.

In presence of—
R. G. CARR,
RICHARD DEVENS.