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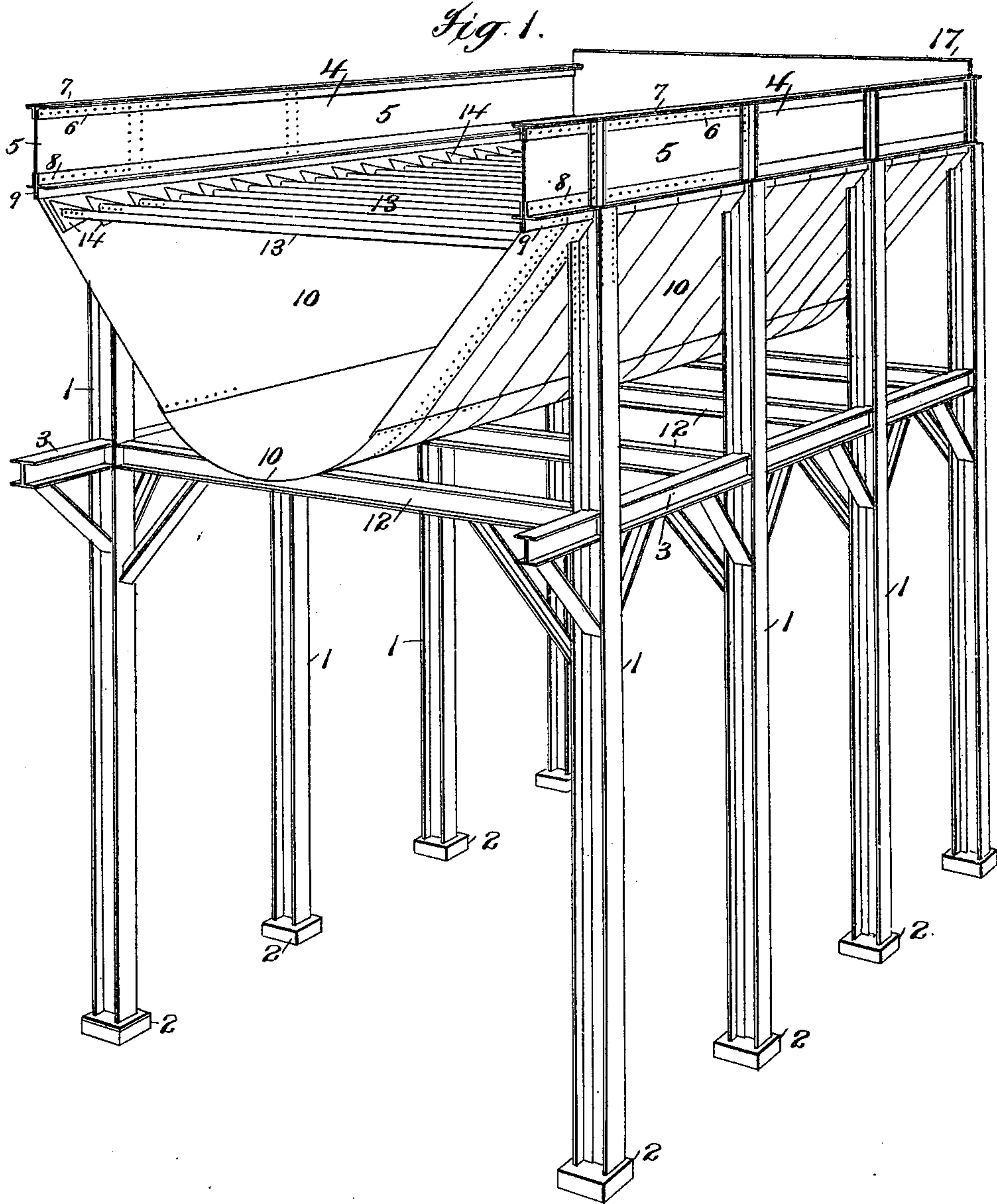
Patented May 30, 1899.

A. S. F. BERQUIST.
STORAGE BIN OR BUNKER.

(Application filed Jan. 20, 1899.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES:

A. W. Bourke,
J. E. Crane.

INVENTOR

Asel S. F. Berquist

BY *Philip Phelps*
Tanger
ATTORNEYS

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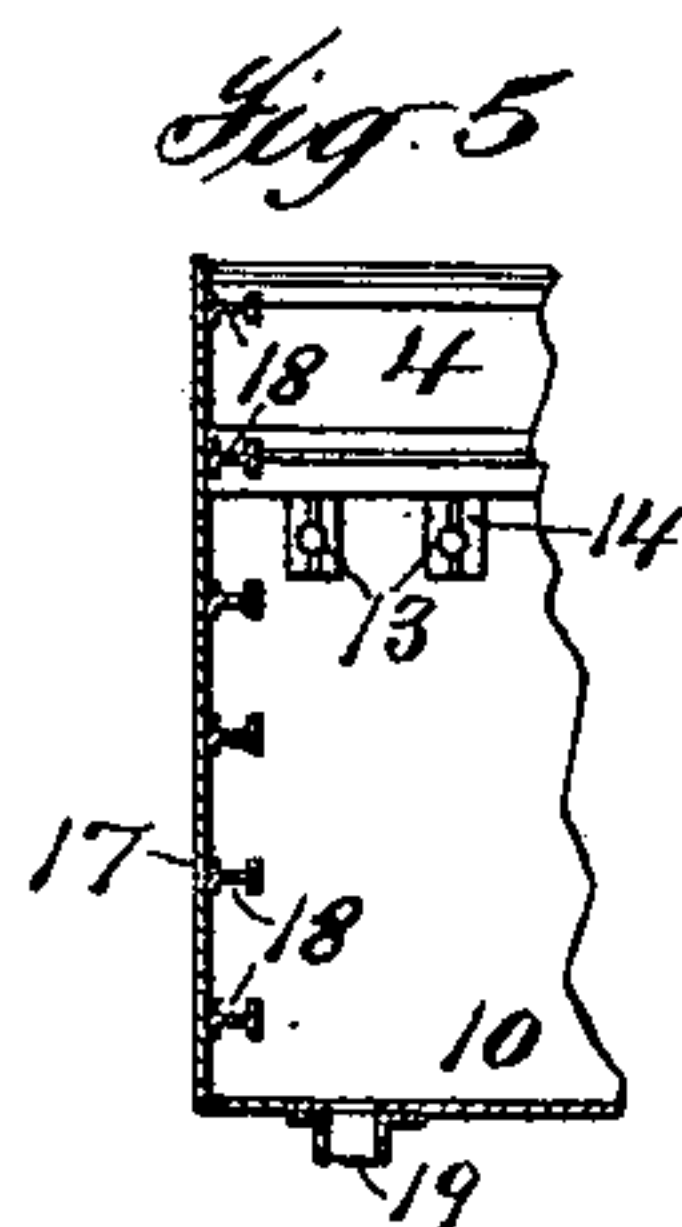
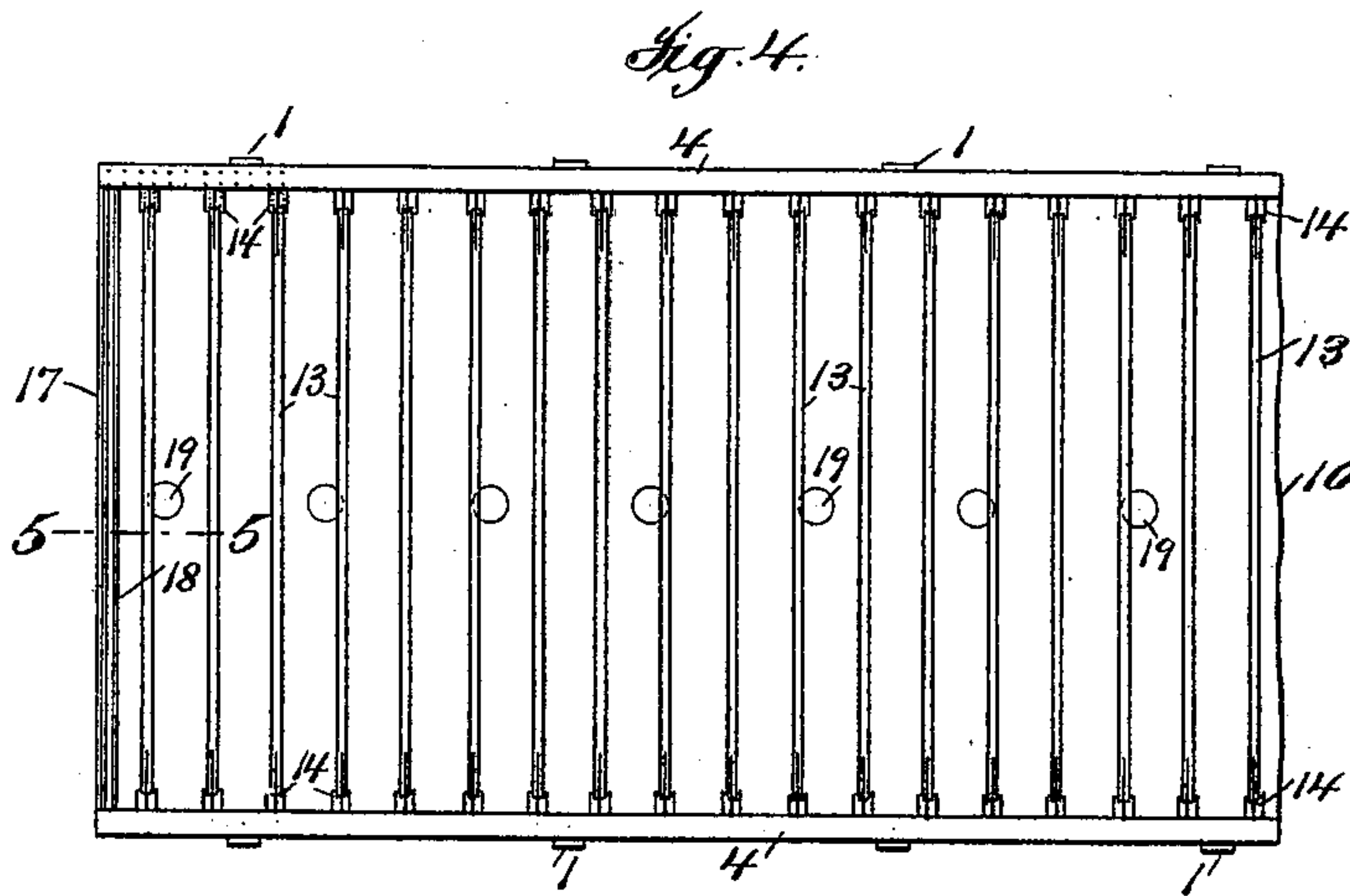
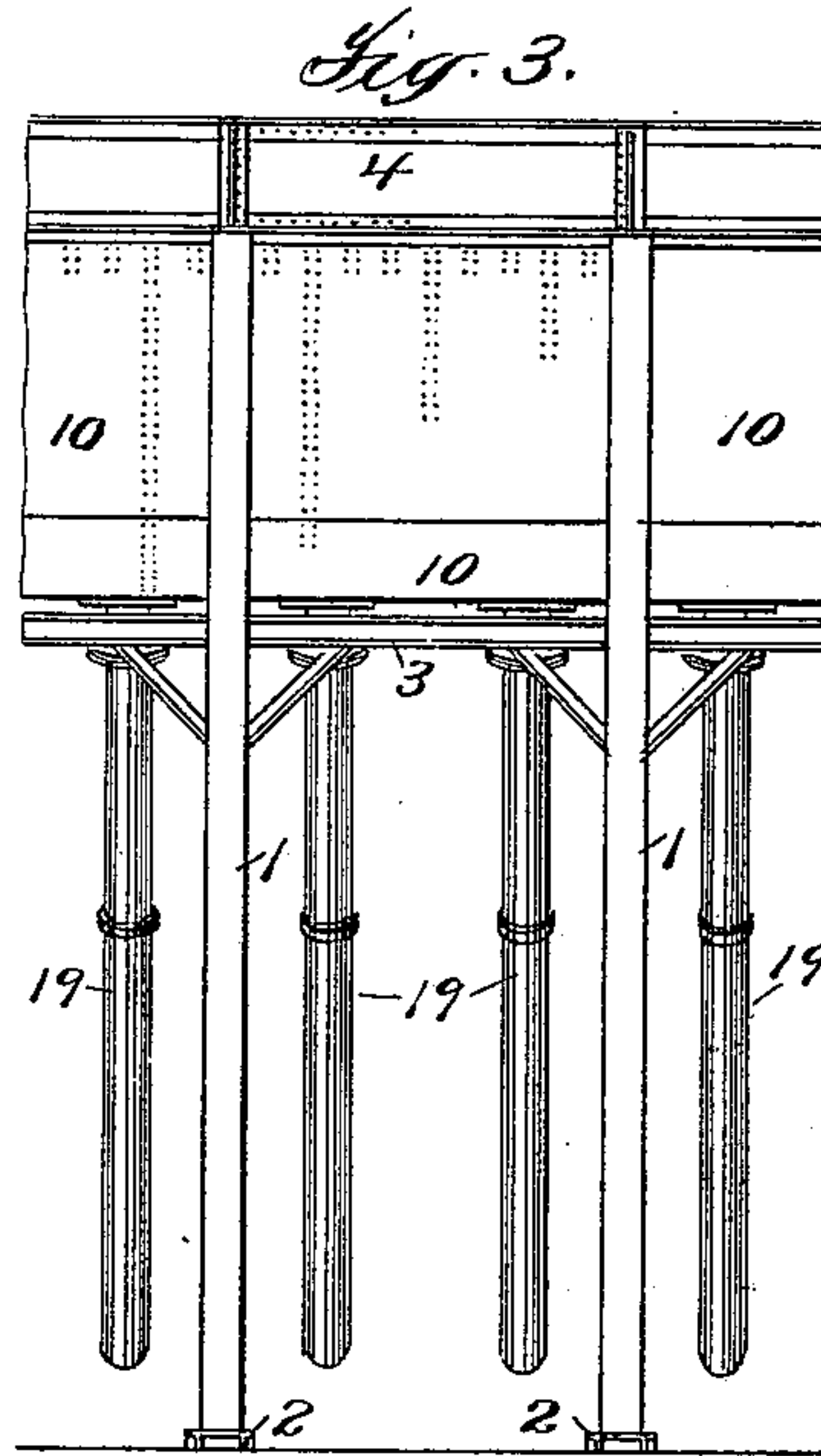
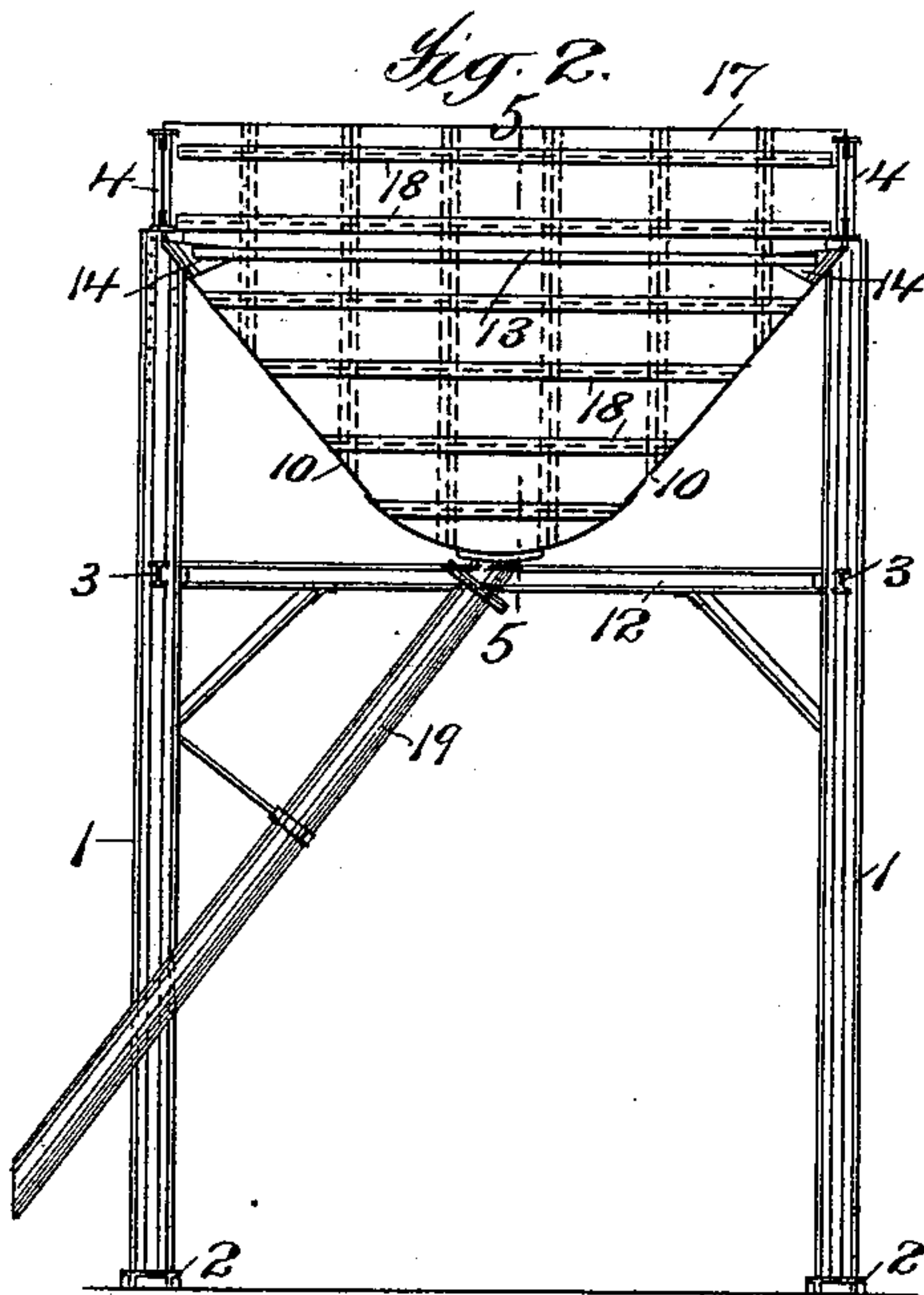
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(No Model.)

3 Sheets—Sheet 2.



WITNESSES:

J. M. Burke
J. A. Erace

INVENTOR

Asel S. F. Berquist

BY *Philip Phelps*
Sanger
ATTORNEYS

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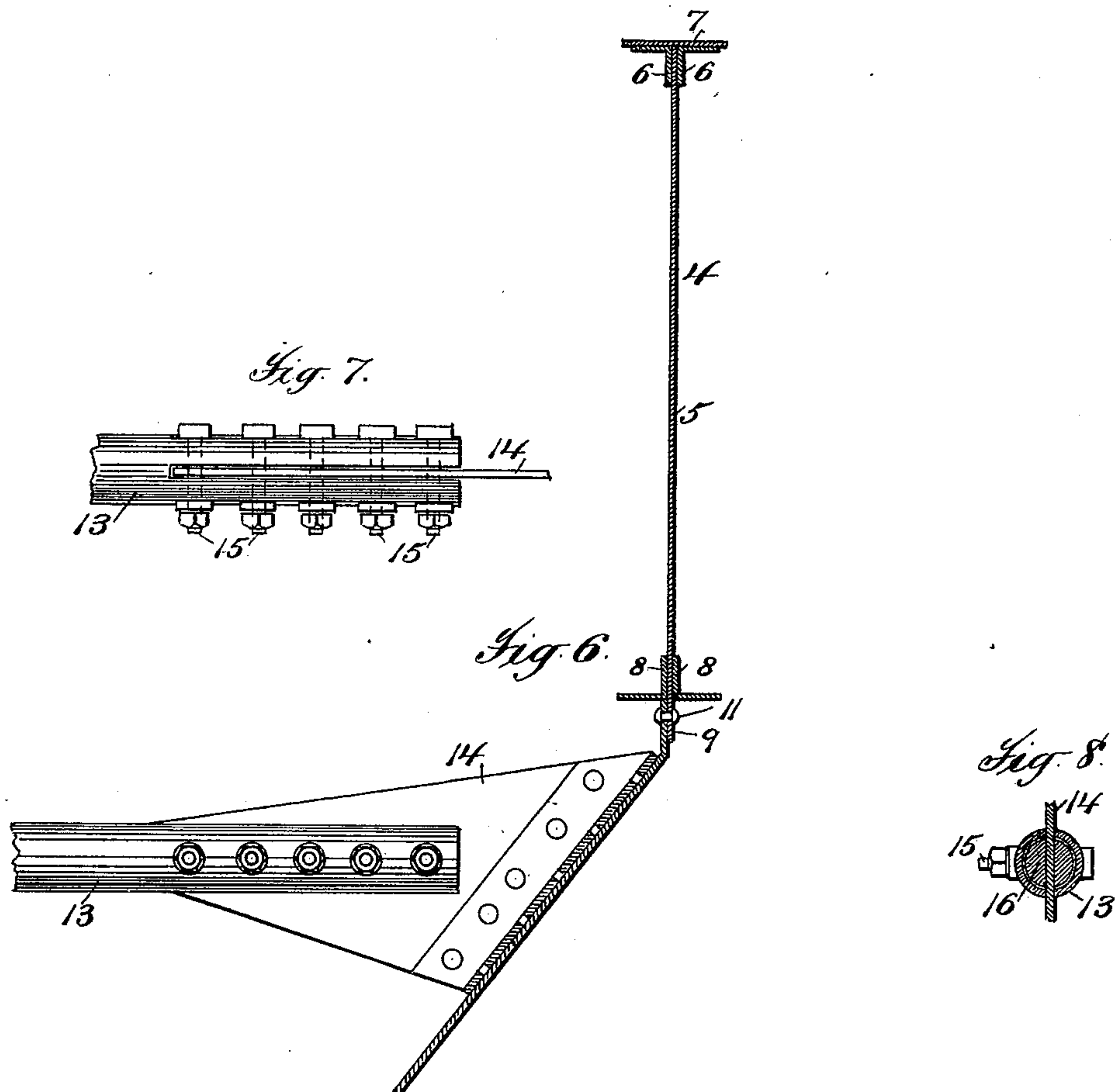
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(No Model.)

3 Sheets—Sheet 3.



WITNESSES:

J. W. Sparks.
J. A. Evans.

INVENTOR

INVENTOR
Axel S. Fr Berquist

BY *Philip P. Phelps*
& Samy

ATTORNEYS

UNITED STATES PATENT OFFICE.

AXEL SAML. FR. BERQUIST, OF NEW YORK, N. Y.

STORAGE BIN OR BUNKER.

SPECIFICATION forming part of Letters Patent No. 625,947, dated May 30, 1899.

Application filed January 20, 1899. Serial No. 702,815. (No model.)

To all whom it may concern:

Be it known that I, AXEL SAML. FR. BERQUIST, a subject of the King of Sweden and Norway, residing at New York city, county of Kings, and State of New York, have invented certain new and useful Improvements in Storage Bins or Bunkers, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to certain improvements in storage bins or bunkers, such as are more particularly designed for holding and storing granular material in bulk—as, for instance, coal, sugar, cement, coffee, sand, broken stone, and other analogous substances.

In bins and bunkers as heretofore constructed the form and dimensions have been determined simply by the amount of material to be stored and the space which the storage-receptacle was to occupy. Such receptacles have usually been constructed with straight sides and straight bottoms, the bottoms being placed at such an angle to the sides as to insure the discharge of the material through the usual openings made in the bottoms for that purpose.

The forces developed in masses of material stored in bulk produce in bins or bunkers of the class adverted to excessive deforming strains acting against the straight sides. These strains have heretofore been counteracted, resisted, or absorbed by bracings, either external to the bunker or internal, or both. As the strains set up in this class of bunkers are, however, very great, it is necessary in order to successfully resist them to use a very large amount of bracing. Indeed, the use of and necessity for such bracing have caused the problem of successfully constructing such storage bins or bunkers to practically resolve itself into a problem of designing and locating the bracing, no attempt having hitherto been made, so far as I am aware, to utilize to any considerable extent the tensile strength of the material forming the sides and bottoms of the bunkers to resist the strains set up by the load, except in the spaces between the braces. As the strains which can be successfully resisted by a large unsupported width of flat plate are necessa-

rily comparatively small, it will be readily understood that the greater portion of the strains must, as has been heretofore indicated, be taken by the bracing.

If a given quantity of granular matter having a certain specific gravity and a certain internal resistance or angle of friction be stored in a receptacle of flexible material hung between supports spaced a given distance apart, the sides and bottom of the receptacle would dispose themselves in a curve of such a character that the strains set up by the load would be taken up by the tensile strength of the material itself—that is to say, the strains set up by the load in the receptacle are in equilibrium with the forces due to the internal or cohesive strength of the material of which the receptacle is formed.

It is the object of this invention to utilize this principle of equilibrium in the construction of bins, bunkers, and similar storage-receptacles intended to hold large quantities of granular material, thus doing away, so far as the sides and bottoms of the bins or bunkers are concerned, with the exceedingly expensive bracing heretofore necessarily employed and depending upon the tensile strength of the material of which the sides and bottom are constructed to absorb, counteract, and resist the strains set up by the load, whereby the construction of such bins and bunkers is greatly simplified and cheapened.

The invention consists in a certain construction and certain parts, improvements, and combinations, which will be hereinafter fully described and then defined in the claims hereunto appended.

In the accompanying drawings, which form a part of this specification and in which like characters of reference indicate the same parts, Figure 1 is a diagrammatic sectional elevation showing a portion of a storage bin or bunker constructed in accordance with the invention. Fig. 2 is a transverse section on a smaller scale than Fig. 1, showing more particularly the means for bracing the ends. Fig. 3 is a side detail view on a small scale. Fig. 4 is a plan. Fig. 5 is a section of one end of the bin on line 5 of Figs. 2 and 4. Figs. 6, 7, and 8 are detail views illustrating certain parts of the construction.

Referring to Fig. 1, which illustrates one concrete embodiment of the invention, 1 indicates vertical pillars or columns of any suitable construction standing on suitable foundation-plates 2. These columns are connected by suitable braces 3 and carry at their upper ends girders 4, which are located along the upper longitudinal sides of the bunker.

The girders 4 may be constructed in any suitable or desired manner. Preferably, however, they will consist of a web 5, having at its upper edge suitable angle-bars 6 and a cross-plate 7. At its lower edge the web is provided with suitable angle-bars 8, below which extends a depending portion 9 of the web.

The sides and bottom 10 of the body portion of the bunker preferably consist of suitably-connected steel plates, these plates being secured to the depending portion 9 of the web 5 by suitable bolts or rivets 11.

It will be understood that the bottom and sides of the bunker are formed on a curve, this curve being of such a character that the strains set up by the load to be carried are resisted by the tensile strength of the material of which the bunker is composed. The curve of the body portion and sides is preferably that which would be assumed by the load of material were it carried in a flexible support suspended from beams the same distance apart as the girders 4, since this curve utilizes to the best advantage the tensile strength of the material and is therefore best adapted to the purpose. It is to be understood, however, that there are other curves which generally correspond in sweep to the curve mentioned and which will carry the load more or less effectively without necessitating the use of bracing, either external or interior, except such bracing as is necessary to prevent the collapse of the structure. The invention is not, therefore, limited to the particular curve described, but includes constructions in which the sides and bottom of the bin or bunker are curved so as to carry the load by the tensile strength of the material. Since, furthermore, the specific gravity and internal friction of different materials which are to be stored in the bunker vary considerably, it will be understood that the curve on which the bunkers are constructed will vary according to the material which it is intended to store therein.

The columns 1 will preferably be braced by cross-braces 12, the function of which is to steady and stiffen the structure. These braces also tend in a degree to overcome any tendency of the columns to be forced toward each other by the load in the bin or bunker. These braces are, however, not a necessary feature of the construction and may, if desired, be omitted.

As the bunkers are designed to carry heavy loads, a considerable force will necessarily be developed, which will tend to move the supports for the bunkers toward each other, and thus collapse the structure. Some means

will, therefore, usually be provided to resist this tendency. These means may be widely varied in form, construction, and location. Preferably, however, there will be provided struts 13, which are located in the bunker and extend across the same from side to side. While the struts may be of any suitable form, they are preferably in the form of circular pipes, both because they are strongest for a given amount of material and also because they offer the least obstruction to the material to be dumped into the bunkers. These pipes or struts may be secured to fins 14, suitably bolted to the sides of the bin. The fins 14 enter slots in the ends of the struts 13 and bolts 15 secure the struts to the fins, said bolts passing through short filling-pieces 16, which prevent any collapse of the strut under the strain of the bolts.

While the ends of the bunker might be given the same curve as the material which composes the sides and bottom, such construction would be expensive and unnecessary, since the strains borne by the ends are not so great as those carried by the sides. The ends will, therefore, preferably be constructed with flat plates 17, which are suitably secured to the body of the structure. Were these ends unsupported they would tend to bulge under the load of the material stored in the bunker. In order to overcome this tendency to bulge, a series of beams 18 will preferably be located across the ends, the beams being bolted to the plates.

The material is discharged from the bunker through openings in the bottom, to which are connected suitable pipes 19, which may be closed by valves of any usual construction or in any other suitable manner.

It is to be observed that a bunker constructed in accordance with this invention is far simpler and much less expensive than the bunkers heretofore constructed. All the exterior bracing, which has heretofore been mainly depended upon to carry the load in the bunker, is dispensed with, the tensile strength of the material alone being depended upon for this purpose and the only bracing employed being that which is used to prevent the collapse of the structure and the comparatively unimportant bracing which prevents the bulging of the ends.

The mechanical details by which the invention is carried into effect may be considerably varied. It is to be understood, therefore, that the invention is not limited to the details of construction shown and described, but that it includes all changes and modifications which are within the spirit and scope of the invention as defined by the claims hereunto appended.

What I claim is—

1. A storage bin or bunker suspended at its edges and having its sides and bottom mainly disposed in a curve of such a character that the strains set up by the load to be carried will be resisted and absorbed by the

tensile strength of the material of which the bin or bunker is composed, substantially as described.

2. A storage bin or bunker suspended at its edges and having its sides and bottom disposed in a curve which is approximately that which would be assumed by the material were it similarly suspended in a flexible receptacle, substantially as described.

3. A storage bin or bunker consisting of side beams, suitable supports on which said beams are carried, a body portion of sheet material hanging from the side beams and means for resisting the tendency of the supporting-beams to be forced toward each other, substantially as described.

4. A storage bin or bunker consisting of side beams, supports on which said beams are carried, a body portion of sheet material hanging from said side beams, and internal struts for resisting the tendency of the supporting-beams to be forced toward each other, substantially as described.

5. In a storage bin or bunker, the combination with suitable supports, of a pair of girders, each girder consisting of a web and suitably-disposed angle-bars and having a portion of the web extending beneath the angle-bars, a body portion of sheet material connected to the extending portions of the web, and disposed in a curve of such a character that the strains set up by the load to be carried will be resisted by the tensile strength of the material of the body, substantially as described.

6. A storage bin or bunker consisting of

side beams, supports in which said beams are carried, a body portion of sheet material hanging from the side beams, means for resisting the tendency of the side beams to be forced toward each other, and suitably-braced ends, substantially as described.

7. A storage bin or bunker consisting of side beams, supports in which said beams are carried, a body portion of sheet material hanging from the side beams, means for resisting the tendency of the side beams to be forced toward each other, and ends consisting of flat plates suitably braced, substantially as described.

8. In a storage bin or bunker, the combination with suitable columns or pillars, of side beams carried thereby, a body portion of sheet material hanging from the side beams, and means for resisting the tendency of the side beams to be forced toward each other by the load in the bin or bunker, substantially as described.

9. A bin or bunker consisting of an unbraced curved body portion, suitable ends therefor, suitable supports for the body portion, and means for overcoming the tendency of said supports to approach each other under the strain of the load of the material in the bin or bunker, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

AXEL SAMUEL FR. BERQUIST.

Witnesses:

T. F. KEHOE,

JOHN A. GRAVES.