

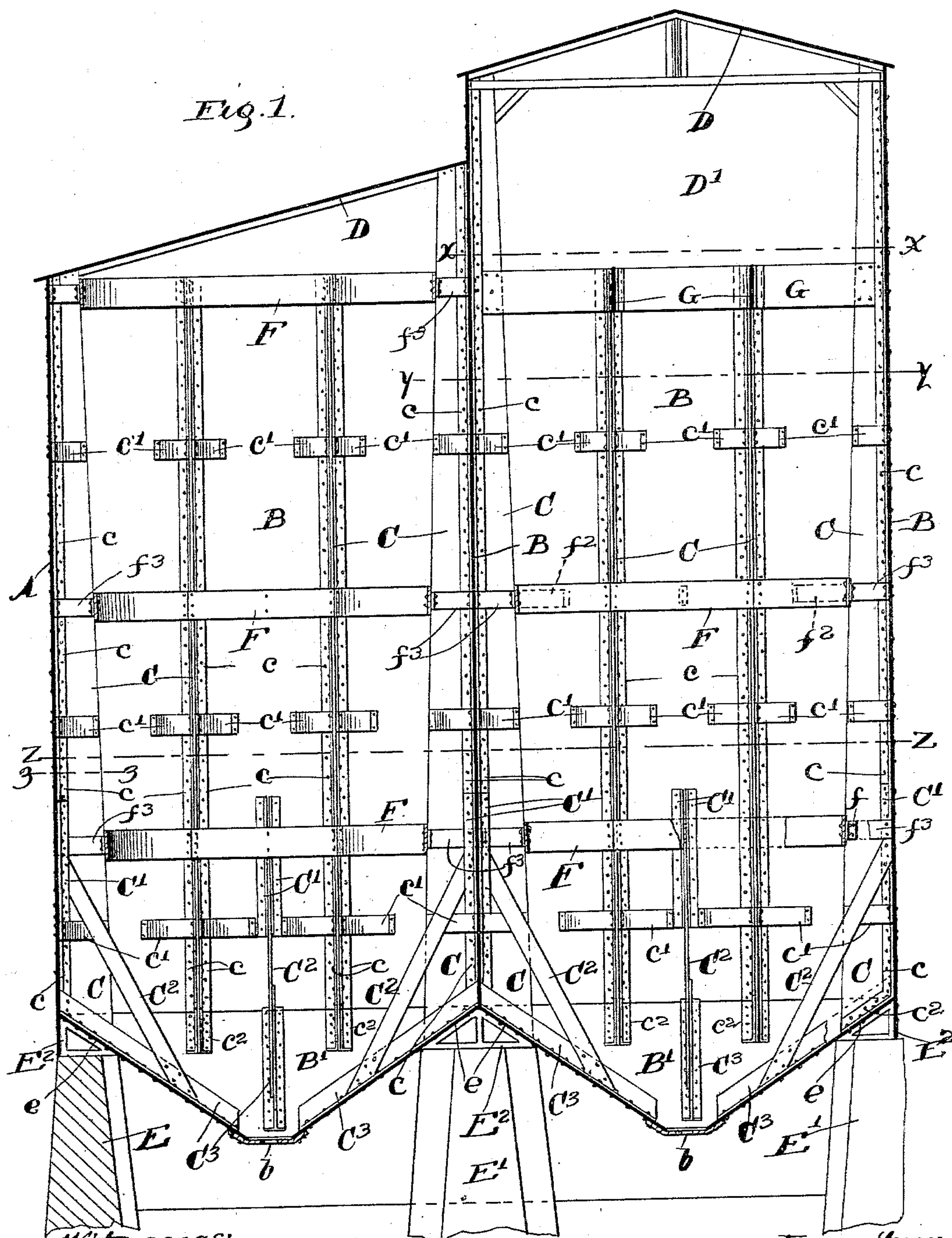
(No Model.)

2 Sheets—Sheet 1.

W. GRAVER.  
STORAGE TANK.

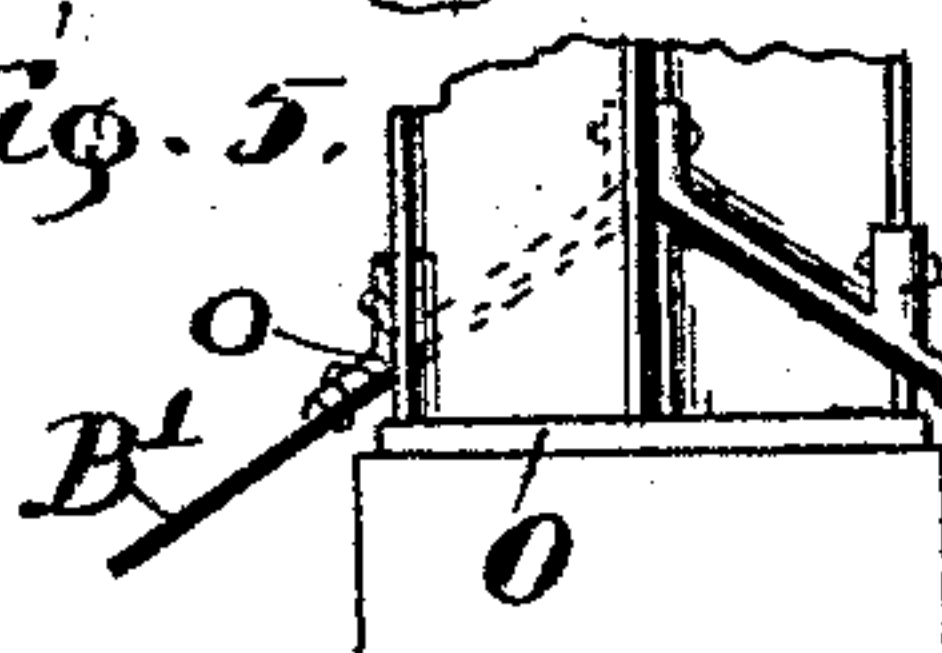
No. 597,879.

Patented Jan. 25, 1898.



Witnesses:  
Chas. O. Sherway  
R. D. Bailey

*Fig. 5.*



Inventor:

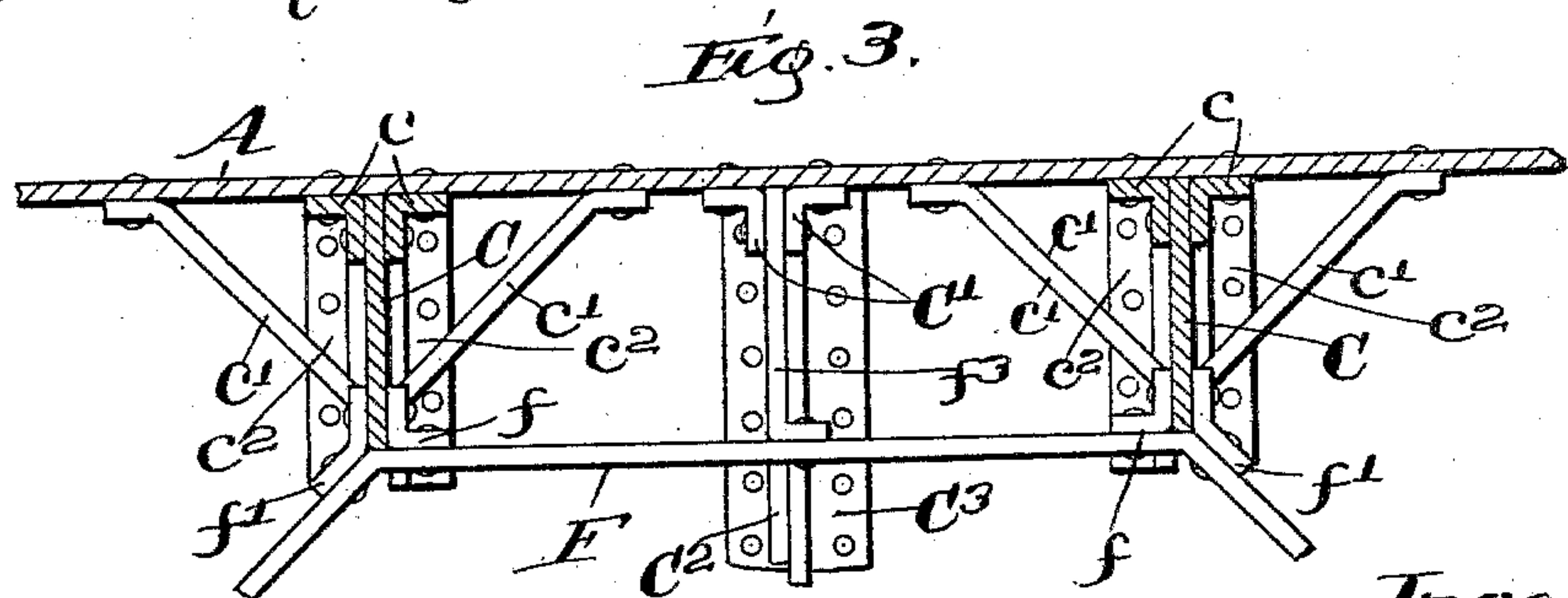
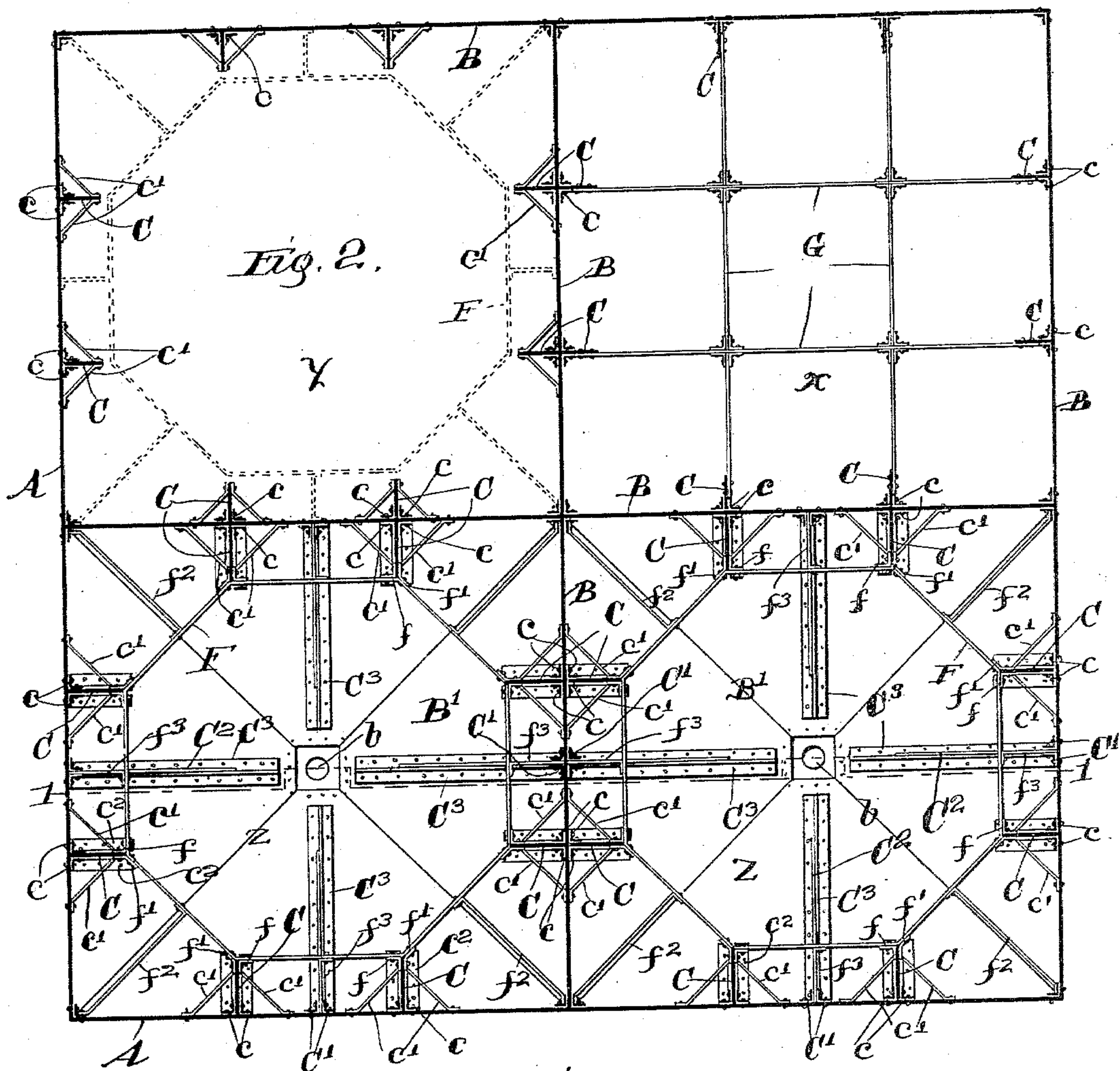
William Graver  
by Wm. M. M. M. M. M.  
Attys.



2 Sheets—Sheet 2.

No. 597,879.

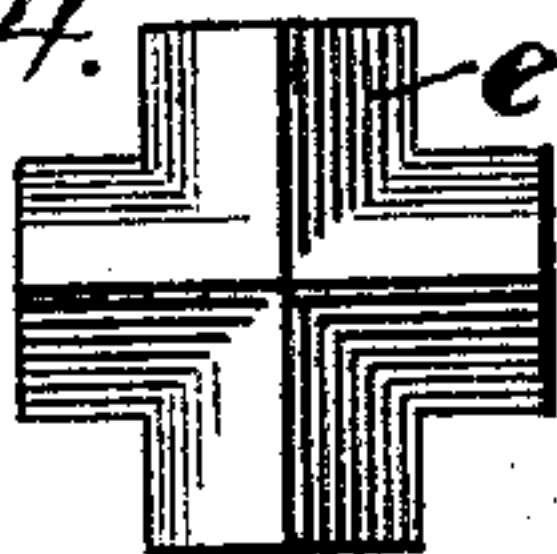
Patented Jan. 25, 1898.



Chas. Shervoy

R. O. Bailey

*Fig. 4.*



*Inventor:*

Wm. Graver  
by  
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His Atty<sup>s</sup>



# UNITED STATES PATENT OFFICE.

WILLIAM GRAVER, OF CHICAGO, ILLINOIS.

## STORAGE-TANK.

SPECIFICATION forming part of Letters Patent No. 597,879, dated January 25, 1898.

Application filed February 19, 1897. Serial No. 624,279. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM GRAVER, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Storage-Tanks, of which the following is a specification.

My invention relates to certain improvements in storage-tanks, the object being to produce a light, substantial, and non-collapsible storage-tank, also to group together a number of tanks, so as to form a structure for storing grain, &c., in such a manner as to give the greatest storing-capacity possible in proportion to the area occupied by the structure.

To such end it consists in certain novel features of construction and arrangement which will be fully described in the following specification and more definitely pointed out in the appended claims.

The invention is clearly illustrated in the drawings furnished herewith, in which—

Figure 1 is a vertical cross-section through two of the tanks, the line of section being 1 1, Fig. 2, certain portions of the right-hand tank being broken away to expose other important parts which would otherwise be hidden from view. Fig. 2 is a plan view of four tanks grouped together, the walls and vertical supporting members being in horizontal section and the plane of section of the tank lettered  $x$  being at  $x x$ , Fig. 1, the one lettered  $y$  at  $y y$ , Fig. 1, and the ones lettered  $z$  at  $z z$ , Fig. 1, the object of taking the sections at different points along the same being to show the manner of bracing the structure at these three different points. Fig. 3 is a detail horizontal section through the walls and vertical supporting members, the section being taken at 3 3, Fig. 1. Fig. 4 is a detail plan view of a bracket used in connection with this construction, and Fig. 5 is a detail sectional view of a modification.

In the construction of storage-tanks much difficulty has been encountered in producing a tank which shall be absolutely non-collapsible, the great weight of the contents tending to bend and break the tie-rods which extend from wall to wall, especially in their movement downward when being withdrawn. When these tie-rods break, it is evident that

the walls are apt to spring outward and the structure collapse. My invention is intended to obviate this difficulty, and to such end I have devised a peculiar bracing which effectually prevents any such disaster.

The drawings show a number of tanks grouped together to form a structure; but a number of tanks are broken away in order that the views may be as large as possible to clearly illustrate the invention. The removed tanks are constructed similarly to the ones shown.

A represents the outside or bounding walls of the structure; but these walls also form side walls for the tanks located adjacent to the said walls.

B represents the inner walls, running longitudinally and transversely through the structure and dividing the same into separate tanks, each inner tank having therefore walls in common with the adjacent tanks. By extending the dividing-walls in this manner the tanks are made square in cross-section, and inasmuch as all the tanks are continuous to each other all of the ground area occupied by the structure is converted into storing space. The walls are preferably constructed of steel or iron to give strength, lightness, and durability to the structure, and it is obvious that the walls may be built up of plates, as is customary in the construction of iron structures of this class. Other material suitable for the purpose may, however, be employed, if desired.

To support the walls, I provide vertically-extending webs or uprights C, which taper toward the top, these webs being arranged within each tank in such a manner as to have two at each wall, each web being approximately one-third the distance from the corners. The walls are secured to the webs by means of angle-irons  $c$ , which extend on either side of the webs and are riveted to the webs and walls, respectively, as seen in Fig. 3. Besides supporting the walls of the tanks these webs are strengthening-ribs, preventing the walls from buckling at any point, as it is impossible to bend them transversely. The roofing D may also be supported by these webs, as shown in the drawings, and certain ones are extended above the rest to form supports for a chamber D', which generally con-



tains the machinery used in connection with structures of this class.

The webs prevent the walls from buckling at any point on account of their width, and I have provided braces  $c'$ , extending from the edges of the webs to the walls of the tanks at an angle of approximately forty-five degrees to hold the webs rigid against lateral strain and at the same time forming a stay for the walls, thus dividing the large wall-space into smaller ones and therefore increasing the strength thereof. These braces  $c'$  are riveted or otherwise fastened to both the web and wall and are placed at regular intervals along the walls of the tanks, as is seen in Fig. 1.

E represents the foundation, which may be constructed of any suitable material,  $E'$  being posts or piers located under all of the internal webs C and under all of the intersections of the cross-walls. Brackets  $E^2$  are placed upon the foundation walls and piers and are formed with inclined faces  $e$ , upon which are laid the funnel-shaped bottoms  $B'$  of the tanks, outlets  $b$  being provided in the said bottoms for the escape of the contents. The brackets which support the webs are formed with only two inclined faces, but the ones at the intersecting walls have four inclined faces conforming to the under surfaces of the bottom. The lower ends of the webs are beveled off to the angle of the bottom and are secured thereto by means of the angle-irons  $c$ , which extend along the lower edges of the webs, as seen at  $c^2$ , and are riveted to the same and the bottom, respectively. Midway between each pair of webs C C two short angle-irons  $C' C'$  are secured to the walls of the tanks, a diagonally-extending brace  $C^2$  being riveted to these short angle-irons and to a T-iron  $C^3$ , riveted to the bottom, as seen in Fig. 1. The angle-irons  $C'$ , brace  $C^2$ , and T-iron  $C^3$  form a hanging bracket which supports the bottom.

Between the braces  $c'$  I provide plates or braces F, connecting the inner edges of the webs C and forming octagonal braces or tie-plates. These octagonal braces may either be single plates or a number secured together in any suitable manner. Angle-irons  $f f'$  are provided at each point of contact of the octagonal braces with the webs by which they may be rigidly secured to the webs. Braces  $f^2$  extend from all of the corners of the tanks to the octagonal braces, and braces  $f^3$  connect the latter with the walls at points midway between the webs, the object of which will hereinafter be more fully explained. The braces  $f^3$  of the lowest set are secured between the angle-irons  $C'$  in place of being riveted directly to the walls.

The braces G (shown in Fig. 2) are intended to support the flooring in the upper room which usually contains the machinery. Said braces are secured directly to the webs. The arrangement of these braces is immaterial, the one shown being suitable for the purpose. From the above it will be seen that this par-

ticular bracing and arrangement gives great strength and rigidity to the structure, and each tank may be filled without regard to the others—that is to say, the walls of each tank are braced separately—so that each is independent of the others, so far as such bracing is concerned. It will be noticed that no tie-rods are used in this construction, tie-rods being too light to prevent the walls from bulging outward from the great thrust exerted upon them. It has been found that the tendency of the downward-flowing grain is to break the tie-rods, and I have discovered that by using thin plates in their place this difficulty is removed. The width of these plates may be proportioned to the weight and pressure that is to come upon them.

The object of the octagonal brace is to assist in preventing the walls from bulging outward. Inasmuch as the thrust of the contents is always downward and outward it tends to force the walls outward; but it is evident that the octagonal brace must prevent this, as no two opposite walls can increase the distance between themselves without elongating the octagonal brace and thereby bringing the two other walls nearer together, which is impossible, because the contents must press equally against all of the walls. The motion of the grain in its downward movement is in the form of an inverted cone, the tendency being to force the octagonal braces toward the center of the tank, but this is prevented by the use of the braces,  $f^2 f^3$ , which connect them with the walls. These tanks may evidently be used singly or in groups, as desired, inasmuch as each has a complete set of bracing by itself. In the above the webs C have been shown and described as flat bars or plates, but this is not essential in my device, as the webs may be formed of I-beams or other similar beams. An I-beam is shown in Fig. 5 and it extends through openings in the bottom  $B'$  and rests upon a foundation-plate O. When this form of web or upright is used, it is left square upon the lower end, so as to have a perfect bearing upon the foundation-plate, the bottom  $B'$  being secured to the I-beam by means of a casting  $o$ . The webs have also been shown and described as arranged in sets of eight, two upon each wall, and connected by octagonal braces, but this may also be altered according to the size of the tanks and strength required of the supporting members—as, for instance, one web may be secured upon each wall and a square brace used to connect the four, or several webs may be arranged along each wall and connected with a brace of suitable number of sides to form a perfectly secure and substantial connecting-brace for the webs.

I claim as new and desire to secure by Letters Patent—

1. A tank having sheet-metal walls supported against lateral strain and braced by the inwardly-extending web-shaped uprights



secured vertically to the sheet-metal walls and extending inward therefrom, and a series of tie rods or braces connecting the inner edges of these webs, whereby the outer walls  
5 are supported against bulging, the webs offer the minimum resistance to the vertical and inward movement of the contents, and said webs are supported laterally by each other; substantially as described.

10 2. A sheet-metal tank four-sided in horizontal section having secured to the inner side of each wall a pair of vertically-extending web-shaped braces, and an octagonal series of tie rods or braces connecting the inner  
15 edges of said web-shaped braces; substantially as described.

3. A tank comprising bounding-walls, vertically-extending supporting-webs secured to the walls and connected together by a brace,  
20 a trough-shaped bottom secured to the webs, supporting members secured to the bottom and diagonally-extending braces connecting the said supporting members with the bounding-walls; substantially as described.

25 4. A tank comprising walls, vertically-extending supporting-webs secured to the walls, funnel-shaped bottom, B', brackets, e, and diagonally-extending braces, C', connecting the walls with the bottom, the webs being adapted  
30 to rest upon the brackets and to support the walls; substantially as described.

5. A tank comprising four bounding-walls, and a funnel-shaped bottom, supporting-webs, C, resting upon suitable foundations and  
35 adapted to support the walls and bottom, a brace connecting each web with the next ad-

jacent one, and the braces, c', connecting the inner edges of the webs with the walls; substantially as described.

6. A tank comprising four bounding-walls, 40 supporting-webs, C, arranged in pairs and secured to the walls, the octagonal braces, F, connecting the free edges of the webs, the diagonally-extending braces, f<sup>2</sup>, and braces, f<sup>3</sup> connecting the octagonal brace with the walls; 45 substantially as described.

7. A storage structure comprising an exterior bounding-wall, longitudinally and transversely extending interior walls dividing the structure into a number of equal-sized tanks, 50 a funnel-shaped bottom for each tank having an outlet in the bottom, a set of supporting-webs in each tank, each set being made up of pairs secured to each wall and adapted to support the walls and bottom, octagonal braces 55 connecting each web with each adjacent web and the braces, c', connecting the free ends of the webs with the walls of the tanks; substantially as described.

8. The combination with a tank having vertical sheet-metal walls, and vertical web-shaped braces secured to said walls and extending inward therefrom, of a funnel-shaped bottom secured to said walls and braces and supported therefrom by means of a metal angle, o, adapted to be secured to the bottom and the wall and to embrace and be fastened to one of the braces; substantially as described.

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Witnesses:

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CHAS. O. SHERVEY.