

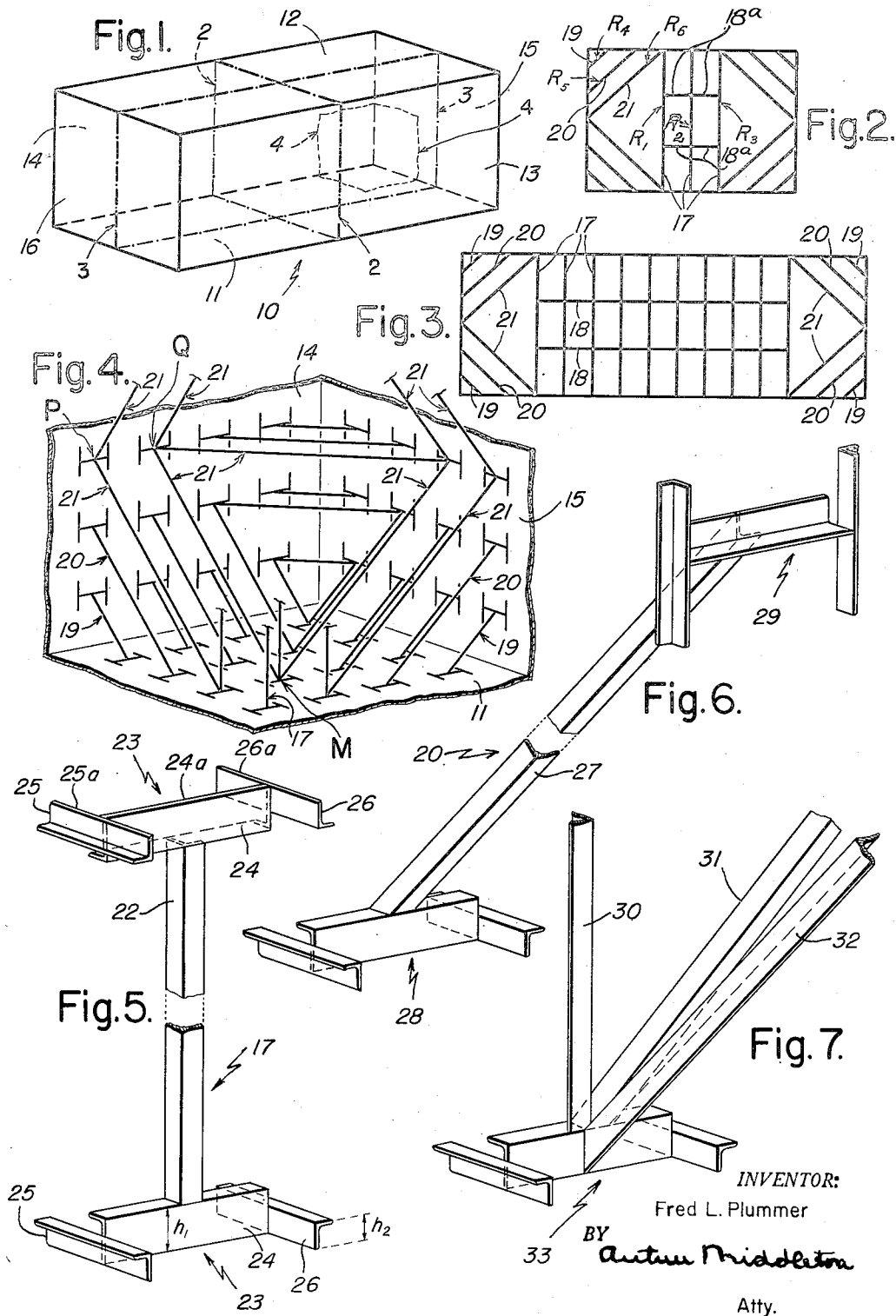
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INTERNAL BRACING FOR LIQUID STORAGE TANKS

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INTERNAL BRACING FOR LIQUID STORAGE TANKS

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1 Claim. (Cl. 220—71)

1 This invention relates to the internal bracing of liquid storage tanks of the type that are used while buried in the ground. Municipalities generally require such tanks and especially those for the storage of fuel liquids to be so buried. When such a tank is empty, the dirt around it tends to put the tank under compressive forces whereas when such a tank is full, its liquid contents and vapor pressure tend to put the tank under tensional forces. Thus, it is important to brace the tank internally so it will withstand assuredly both types of such forces.

Heretofore, this bracing has been done by using columnar supports extending between adjacent and opposite walls, with the ends of the columnar supports in contact with their adjacent walls, but this required a great many such supports or carrier bracing members in order to reinforce the tank adequately. So an object of this invention is to interpose load-distributing constructions between the columnar ends and their adjacent walls with a view to dispersing the thrust (or the reverse) over a larger wall area whereby fewer columnar supports or bracing members can be used without detriment. Heretofore, it has frequently been considered necessary to space such supports not more than two feet apart, whereas by the use of this invention, one such support can be provided for each sixteen square feet of wall surface. In other words, one fourth as many supports can be used. This provides more space for cleaning and maintenance, as well as fewer pieces and more economical erection and fabrication.

This load-distributing construction comprises load-distributing or base members welded to the ends of bracing members as well as welded to the tank walls. These base members are H-shaped and the ends of the bracing members are connected therewith or welded thereto substantially at the center or center of gravity of that H-shape.

Each such H-shape represents a rectangular bracing area on the tank wall, and a pattern or composition of such H-shapes may be arranged or predetermined for respective walls of a tank to satisfy certain structural bracing requirements. The arrangement of such a pattern covering a tank wall may represent rows of H-shapes suitably spaced from one another so that these rows have vertical as well as horizontal intersecting lanes of wall area between them, the widths of which lanes are such as to satisfy the structural bracing requirements.

One object of this invention is to provide an internal bracing system that satisfies the structural bracing requirements that the proportion

2 of the braced to the unbraced portion of the total tank wall area must not be below a certain specified value, and also that such a proportion should be provided substantially uniformly for respective wall areas of the tank; and to provide such a system that can be constructed cheaply and quickly and with a minimum of weight, and can be erected with a minimum of cost in labor and with a minimum of inconvenience to the erecting crew.

To that end, this invention finds embodiment in the load-distributing construction disposed between each end of the columnar support and its adjacent tank wall. This construction is characterized in part by the shape of its contact pattern with the tank wall, the extent of which pattern is significantly larger or more extensive than the cross-sectional area or shape of the columnar support. Depending upon structural and stress-conditions and size encountered in the design of any particular tank, the size and proportions of the H-shape of the base members may vary. It is therefore one of the features of this invention to provide base members to suit any particular requirement, by constructing the H-shape thereof from suitable lengths of commercially available angle irons. That is to say, after the size and proportions of the H-shape have been fixed by determining the lengths of the vertical and of the horizontal portions of the H-shape, such lengths are then cut from the commercial lengths of angle iron, and these cut-off lengths are then welded together to constitute the H-shape. This H-shape then presents narrow longitudinal edges of its component portion all in one plane, namely the plane in which these edges are to be welded to the tank wall. Thus one shank of the angle profiles of these component portions extends at right angles from the face of the tank wall, while the other shank of these profiles extends parallel to and spaced from that face. Thus the horizontal angle iron of the H-shape presents parallel to the respective tank wall a face to which the bracing member proper can be welded.

The invention possesses other objects and features of advantage, some of which with the foregoing will be set forth in the following description. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit. In the accompanying drawings there has been illustrated the best embodiment of the invention known to me, but such embodiment is to be regarded as typical only of many possible embodiments, and the invention is not to be limited thereto.

The novel features considered characteristic of my invention are set forth with particularity in the appended claim. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings in which

Fig. 1 is a perspective diagrammatic view of a liquid storage tank in which the dotted lines indicate sections taken upon the tank such as represented by Figs. 2, 3 and 4;

Fig. 2 is a cross-section taken on the dotted line 2—2 of Fig. 1, diagrammatically showing an idealized pattern of the bracing system;

Fig. 3 is a longitudinal section taken on the dotted line 3—3 in Fig. 1, showing a corresponding view of the diagrammatical or idealized arrangement of the bracing system;

Fig. 4 is a perspective view of a corner portion as indicated by the dotted line 4—4 in Fig. 1, showing schematically the idealized load distribution pattern whereby the load upon the members of the bracing system is transmitted to respective H-shaped bases;

Figs. 5 and 6 are detail perspective view examples of the vertical columnar and of the inclined bracing members respectively;

Fig. 7 is a perspective detail view example of a combination of a vertical columnar with an inclined corner bracing member.

According to the diagrammatic Figs. 1, 2 and 3, a rectangular tank 10 has a bottom 11, a top 12, longitudinal side walls 13 and 14 and end walls 15 and 16.

The system of brace members diagrammatically shown in Figs. 2 and 3 comprises three rows R^1 , R^2 , R^3 of vertical members or columns 17 interconnected by horizontal brace elements 18 and 18^a. Each of the bottom, top, side and end walls is stiffened with respect to each of its adjoining tank walls or portions by means of three rows R^4 , R^5 , R^6 of inclined corner brace member 19, 20 and 21 respectively. Thus there presents itself a pattern of vertical columnar and of inclined corner brace members as representatively illustrated in the perspective showing of the corner portion in Fig. 4. This pattern includes vertical columns 17 such as detailed in the perspective Fig. 5, inclined corner brace members 20 such as detailed in the perspective Fig. 6, and a plural brace connection or connection of several converging brace members as exemplified at point M in the perspective Fig. 4 and as detailed in the perspective Fig. 7 comprising a vertical columnar member and a pair of inclined corner brace members, all converging upon and welded to a common H-shaped brace structure.

The entire bracing system is shown to comprise exclusively straight lengths of standard steel profiles, namely those that are L-shaped in cross-section or known as angle irons. These lengths of profile irons are welded together to compose the various bracing elements including their H-shaped bases, and these bases in turn by way of their H-shaped pattern are welded to the respective walls of the tank. The vertical member 17 as exemplified in Fig. 5 comprises a vertical columnar portion or angle iron 22 to which is welded at each end a horizontally extending H-shaped load-transmitting structure 23 comprising a transverse portion 24 to each end of which in turn is welded a transverse portion 25 and 26 respectively. The portions 24, 25 and 26 of the

base are welded together in such a manner that their edges 24^a, 25^a and 26^a fall into a common plane, namely that of the respective tank wall portion to which they in turn are welded. The height h_1 of portion 24 is shown to be somewhat greater than the height h_2 of the portions 25 and 26. As an alternative, instead of the L-shaped cross-sectional profile of portion 24 a T-shaped profile may be used, with the base edge of the T to be welded to the tank wall. According to another alternative the transverse portion 24 being L-shaped or T-shaped in cross section may be used with or without the supplementary cross pieces 25 and 26.

The example of an inclined corner brace member 20 in Fig. 6 comprises an inclined bracing portion or angle iron 27 cut on the bias at each end in such a manner as to render it suitable for welding connection with a horizontally extending H-shaped base structure 28 and with a vertically extending H-shaped base structure 29. The base structures 28 and 29 of this inclined element are identical with the base structure 23 described in connection with Fig. 5. The example of a plurality of bracing members converging upon and welded to a common H-shaped base structure (see Fig. 7) comprises a vertical or columnar angle iron 30 and substantially converging upon it a pair of inclined corner bracing elements or angle irons 31 and 32, all welded to a common H-shaped base structure 33. This example corresponds to the juncture of bracing members at point M in Fig. 4.

An inspection of Figs. 2, 3 and 4 will further show that the inclined corner braces 21 converge upon and are welded to a common H-shaped base structure as exemplified at point P (in Fig. 4) while an example at point Q (in Fig. 4) shows a third brace member 21 joining the two other members 21 upon a common H-shaped load-transmitting base structure.

I claim:

In a tank for the storage of liquids having top, side and end walls, internal bracing means extending between and interconnecting two of said walls comprising a load-distributing H-shaped base member welded to each wall, the H-shape of said base member comprising component portions in the form of angle irons and disposed for edgewise contact of the one shank of said angle irons with the wall and thus presenting an H-shaped contact edge welded to the wall, and a bracing member having welded connection with the central portion of said H-shape.

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