

April 16, 1935.

B. M. BLACKBURN

1,997,808

OVAL ELEVATED STORAGE TANK

Filed Oct. 7, 1933

3 Sheets-Sheet 1

Fig. 1.

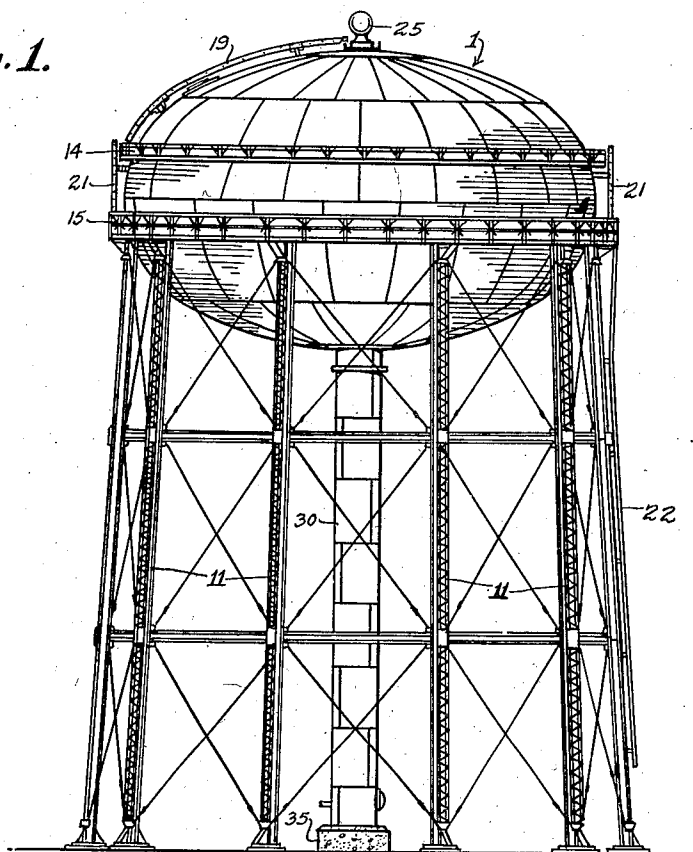


Fig. 12.

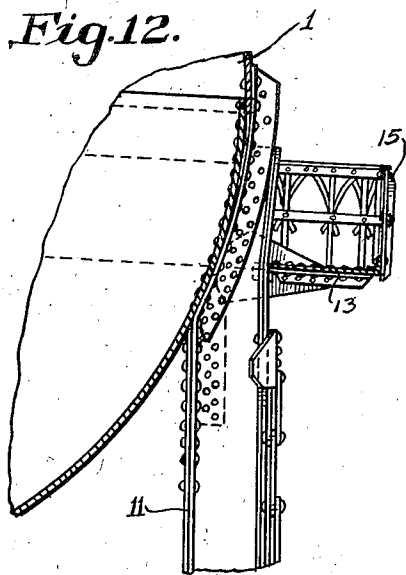
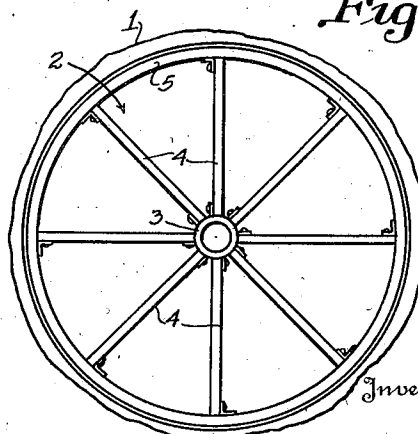


Fig. 3.



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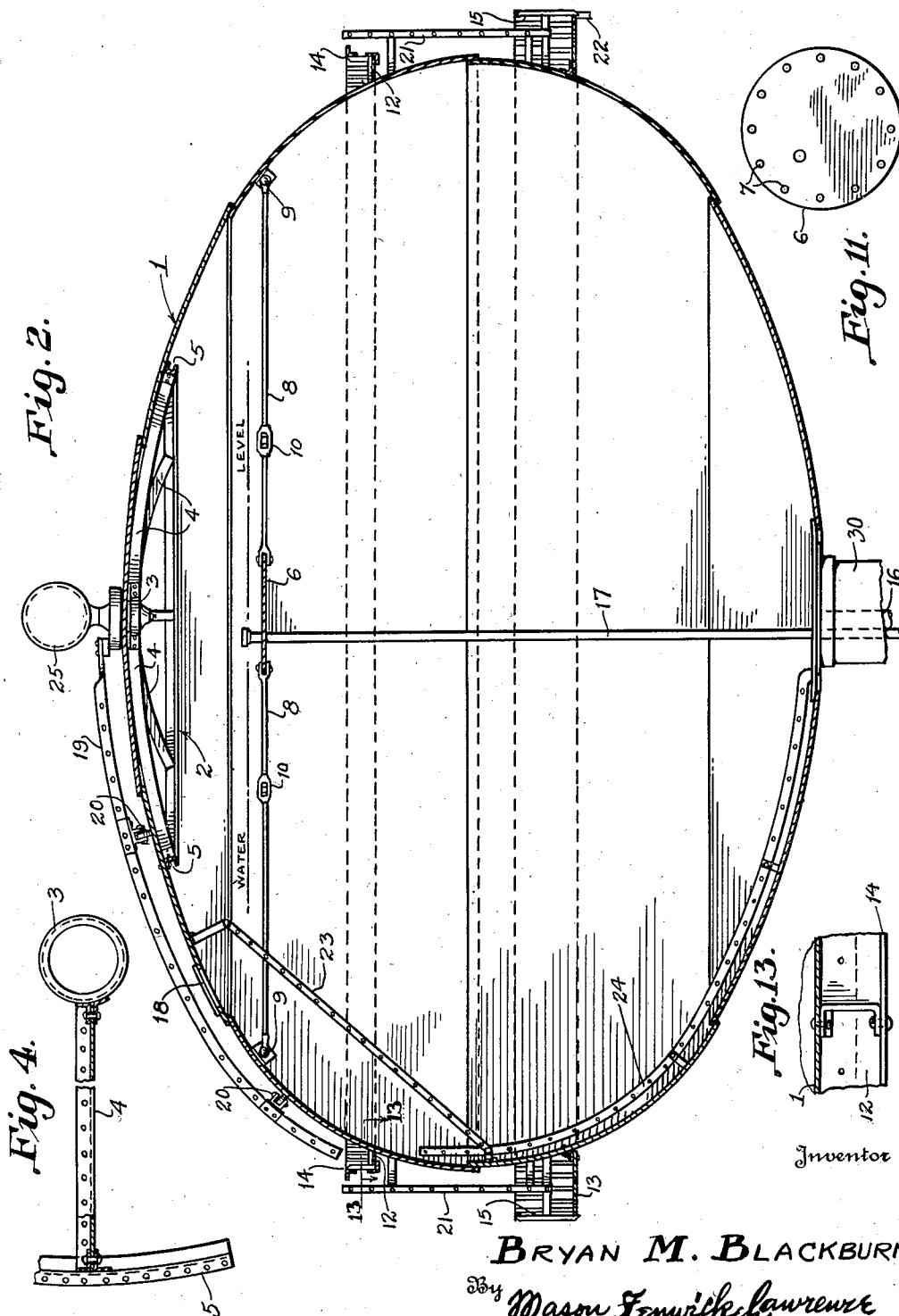
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Fig. 6.

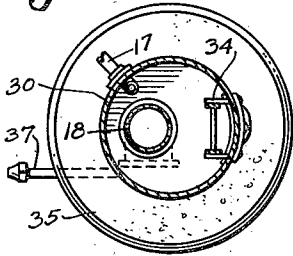


Fig. 7.

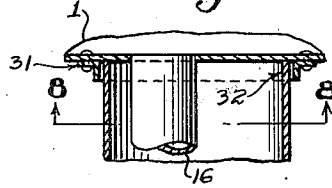


Fig. 5.

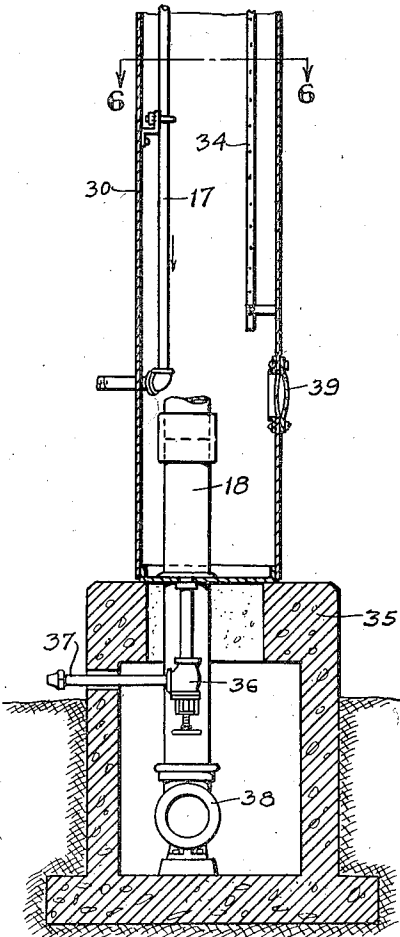


Fig. 8.

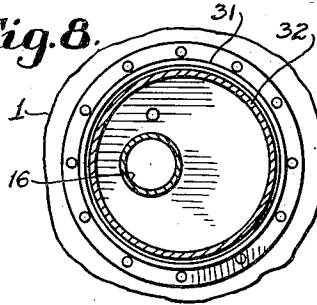


Fig. 9.

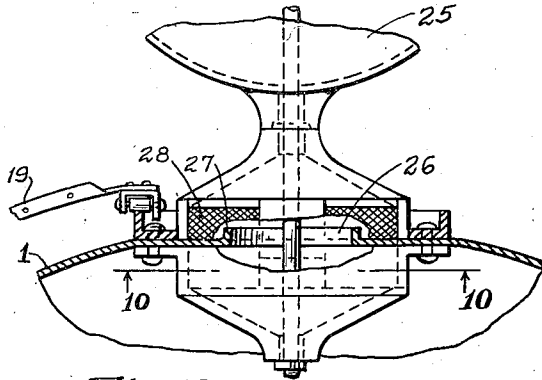
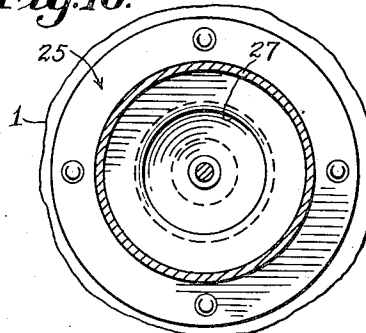


Fig. 10.



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UNITED STATES PATENT OFFICE

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OVAL ELEVATED STORAGE TANK

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Application October 7, 1933, Serial No. 692,692

7 Claims. (Cl. 220—1)

This invention relates to elevated storage tanks and particularly to the construction of a tank of oval contour. This shape which is selected primarily from the standpoint of architectural beauty, presents structural problems which is the purpose of the present invention to solve.

One of the objects of the invention therefore, is the provision in combination with the oval shell of the tank, of novel shape-sustaining devices.

Another object of the invention is the provision of a central tower, unconcerned with the support of the tank, but functioning to house the supply riser, overflow pipes and perhaps other conduits associated with the tank, and provided at its base with a chamber within which are located the instrumentalities concerned with the filling and draining of the tank.

Other objects of the invention will appear as the following description of a preferred and practical embodiment thereof proceeds.

Referring to the drawings which accompany and form a part of the following specification:

Figure 1 is a side elevation of a tank embodying the features of the present invention;

Figure 2 is a vertical diametrical section through the tank;

Figure 3 is a section showing the umbrella-like framework which maintains the shape of the top of the tank and cooperates with other elements to constitute a circular load supporting girder;

Figure 4 is a detail partly in section of the umbrella-shaped framework;

Figure 5 is a vertical section through the lower part of the tower;

Figure 6 is a section taken along the line 6—6 of Figure 5, looking down;

Figure 7 is a vertical section through the upper part of the tower showing the slip joint between the tower and tank;

Figure 8 is a section taken along the line 8—8 of Figure 6, looking up;

Figure 9 is a vertical section through a ventilating device at the base of the finial;

Figure 10 is a section taken along the line 10—10 of Figure 8, looking up;

Figure 11 is a plan view of the spider;

Figure 12 is a detail showing the means of attachment of the floor of the lower balcony and the ground column to the shell of the tank; and

Figure 13 is a detail showing the mode of attachment of the upper balcony to the tank.

Referring now in detail to the several figures, the numeral 1 represents the shell of the tank which is oval in vertical cross section, that is to say, spheroidal in shape and designed to be made in large sizes, for example sixty feet in diameter.

Such a tank devoid of any cylindrical wall por-

tions would ordinarily be impracticable in view of the difficulty of maintaining the oval shape under stress of the enormous load which it is called upon to support. The present invention however by the provision of ingenious devices, a description of which follows, makes the oval shape thoroughly practicable and with an ample factor of safety.

Co-axially arranged within the top of the shell and secured thereto is an umbrella-like framework 2 fabricated from curved members of commercial cross section and constituted by a central ring 3 from which emanate, preferably radially, a plurality of joists 4 secured at their outer ends to a circumferential ring 5. The upper surfaces of said members conform to the concave inner surface of the shell 1 and are secured thereto by rivets.

Within the tank and at a suitable distance below the framework 2 is a system of tension members comprising a spider 6 having a circumferential series of apertures 7, see Figure 11, in which are bolted the inner ends of a plurality of rods 8 extending radially and attached at their outer ends to suitable cleats 9 secured to the shell. The rods 8 are preferably provided with turn buckles 10 so that they can be adjusted to equalize the tension on all of said rods. The umbrella-like framework 2 together with the system of tension members and the web constituted by the intervening zone of the tank shell, constitute a circular girder whose maximum depth is the distance of the spider from the center of the framework 2. It is this girder which sustains the water load beneath it and thus determines the rigidity of that part of the shell which the system of tension members sub-tends.

The lower part of the oval shell is supported upon a series of ground columns 11 secured to said shell at equal intervals in a zone which lies below the equatorial plane of the spheroid. The intermediate portion of the shell is supported and reinforced by a pair of flat circumferential flanges 12 and 13 arranged on the outside of the tank and lying in planes parallel to the equatorial plane. For the sake of appearance and also with a utilitarian object in view, the flanges 12 and 13 are made the floors of upper and lower balconies 14 and 15, each of which affords a walk-way around the tank. Said flanges act according to the principle of barrel hoops and prevent the equatorial portion of the tank from bulging. By the cooperation of these several devices, the oval shape of the tank is perpetuated.

The tank 1 has a supply riser 16 opening adjacent the bottom thereof and an overflow pipe 17 which determines the high level of water within the shell. The upper end of the overflow pipe preferably passes through the spider 60

6 being supported thereby. Access to the interior of the tank is obtained through a trap door 18. A ladder 19 which follows the curvature of the upper portion of the tank, is revolvably mounted about the axis of the tank and may be swung to any desired angular position, the ladder travelling on rollers 20 which bear against the surface of the shell. The lower end of the ladder ends adjacent the upper balcony 14 and a second ladder 21 extends between the two balconies. The lower balcony is reached by means of a ladder 22 which rises from the ground. Adjacent the trap door 18 on the inside of the tank is the ladder 23 which in conjunction with the curved ladder 24 permits easy access to the bottom of the tank.

An ornamental finial 25 of any suitable construction or design may grace the top of the tank, and preferably the lower part of this finial forms a ventilator for aerating the body of water within the tank. With this end in view, the top of the shell, surrounding the axis thereof, is formed with an opening 26, see Figure 9, preferably provided with an upwardly extending flange 27. The bottom of the finial is constituted as a circumferentially reticulated screen 28 through which air may pass, and through the opening 26, into the tank. The up-turned flange 27 of the opening 26 acts as a baffle to change the direction of the entering air so that the velocity thereof will be momentarily checked and foreign matter borne by the wind will be deposited outside the tank.

The tank is at the head of a central tower 30 preferably fabricated from curved sheet metal sections and so arranged as to be relieved from the load of the tank and its contents, which load is borne practically exclusively by the series of ground columns 11. Since the thermal expansion of the tower 30 will be different from that of the ground columns 11 in view of the loaded condition of the latter, it has been found advantageous to provide a slip joint between the top of the tower and the under-surface of the tank. This slip joint is shown in Figures 7 and 8, and is constituted by an annular flange 31 riveted or otherwise secured to the bottom of the shell of the tank and affording a cup or socket into which the upper end portion 32 of the tower extends. The wall of the tower is not fastened to the annular flange 31, permitting relative longitudinal movement between the tank and tower.

Figure 5 shows that the overflow pipe 17, the riser 16, and a ladder 34 are housed within the tower. The lower end of the tower in the present embodiment of the invention rests upon a hollow concrete base 35, the inner chamber of which functions as a housing for the valves which control the access and discharge water from the tank. The valve 36 controls a blow-off pipe 37 which is opened for the purpose of draining the tank. The valve 38 controls the admission of water to the tank by way of the riser. The riser may also serve the purpose of a discharge conduit from the tank to the water mains, being suitably valved for that purpose. Access to the lower part of the tower 30 is obtained through a man-hole 39.

It is obvious that while the invention has been described in connection with a tank of spheroidal shape, it may be equally practiced in connection with tanks of different contour. It is also to be understood that the details of construction and the arrangement of the several cooperative shape-

sustaining devices within the shell of the tank may be varied according to the exigencies of use without departing from the spirit and scope of the invention as claimed.

What I claim is:

1. Elevated storage tank having a shell of curved contour, a stiffening framework within said shell symmetrically arranged about the upper pole of its vertical axis and conforming to the contour of the polar region of said shell, a series of ground columns constituting the wall support for said shell and secured thereto at intervals in a zone below the equatorial plane of said shell, and a central tower from the ground to the bottom of said shell having a slip joint connection with said shell and thus being free from contributing to the support of said tank.

2. Elevated storage tank having a shell of curved contour, a stiffening frame fabricated from metallic membranes of commercial cross section arranged symmetrically with respect to the upper pole of the vertical axis of said shell, conforming to the curvature of the polar region thereof and secured thereto within said shell, said framework comprising inner and outer rings connected by a series of radiating struts, and a radiating series of tension members within said shell lying in a plane perpendicular to the vertical axis thereof and below said framework, said radial struts being secured at intervals into said shell and constituting with said framework and the intervening portion of said shell, a girder.

3. Elevated storage tank having a shell of oval contour, means for sustaining the shape of said tank under load comprising a stiff framework secured within the upper polar region of said shell symmetrically with the vertical axis thereof, a series of radiating struts arranged below said framework lying in a plane perpendicular to said vertical axis and secured at intervals to said shell, and a pair of encompassing flanges extending outwardly from said shell on opposite sides of the equatorial plane thereof and parallel to said equatorial plane.

4. Elevated storage tank as claimed in claim 3, said outwardly extending flanges constituting the floors of balconies.

5. Elevated storage tank as claimed in claim 3, said outwardly extending flanges constituting the floors of balconies, and a series of ground columns secured to said shell at intervals in a zone below the lower of said outwardly extending flanges.

6. Elevated storage tank as claimed in claim 3, said outwardly extending flanges constituting the floors of balconies, a series of ground columns secured to said shell in a zone below the lower of said outwardly extending flanges, and a tower from the ground to the bottom of said shell having a slip joint connection therewith and thus being free from contributing to the support of said tank.

7. Elevated storage tank as claimed in claim 3, said outwardly extending flanges constituting the floors of balconies, a series of ground columns secured to said shell in a zone below the lower of said outwardly extending flanges, and a tower from the ground to the bottom of said shell having a slip joint connection therewith and thus being free from contributing to the support of said tank, said tower constituting a housing for servo-devices such as pipes and a ladder.

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