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ABSTRACT: A hydrocarbon tank of the cylindrical vessel and floating roof type comprising at its base, on the tank skirt, fluid inlet nozzles in the form of flattened, ducts disposed near the bottom and provided with vertical curvilinear parallel baffle plates leaving a small gap between their outermost vertical edges and the adjacent tank wall in order to produce a whirling motion in the fluid, and a nozzle of same type connected to the discharge or draining pipe and to a radial duct in the form of a flattened tunnel.

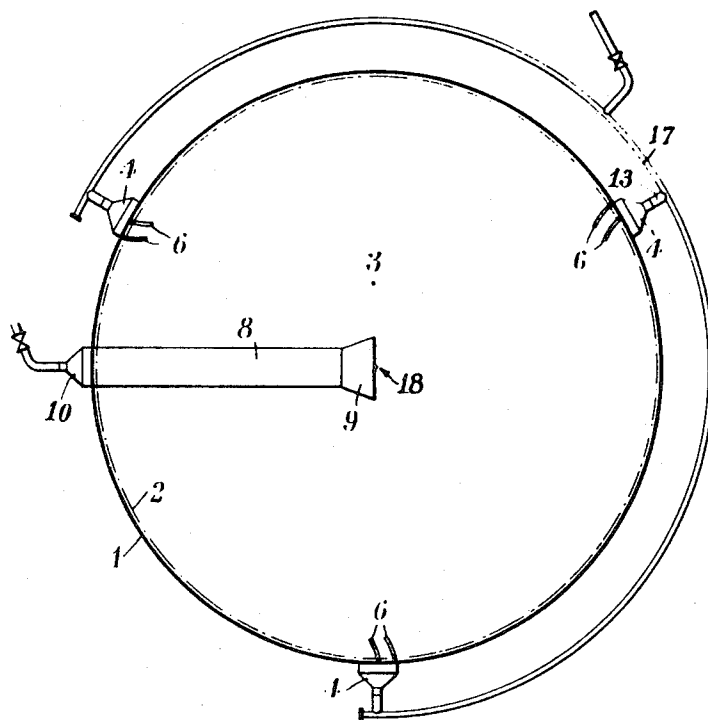


Fig. 1

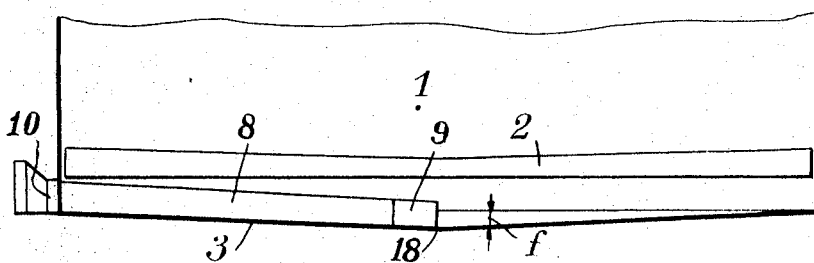


Fig. 2

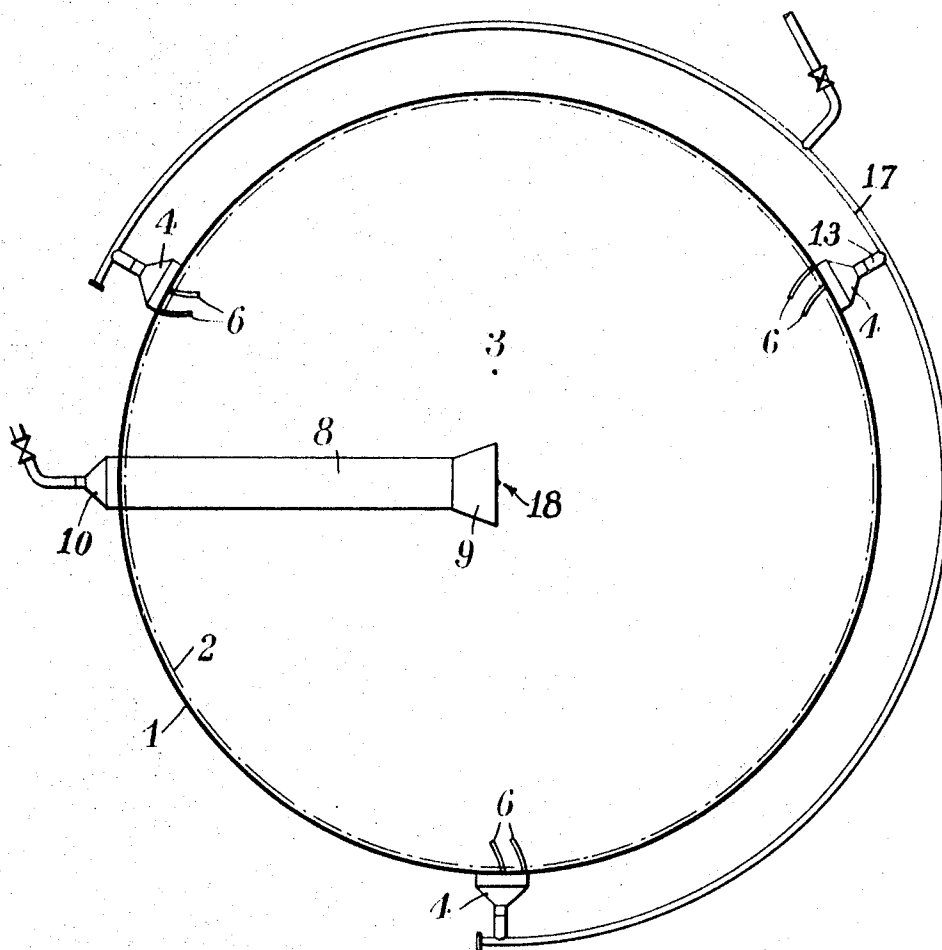


Fig.3

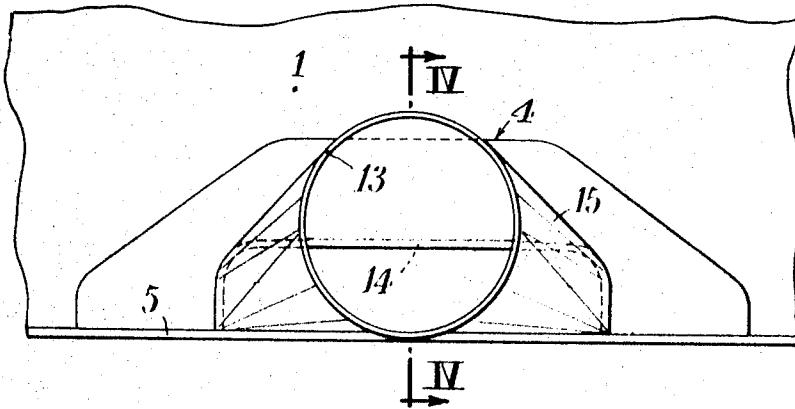


Fig. 4

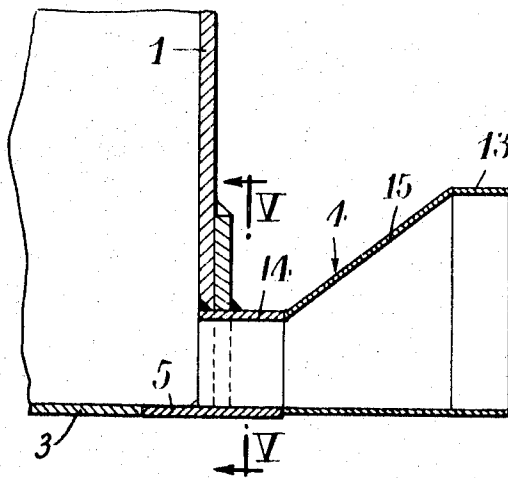


Fig. 5

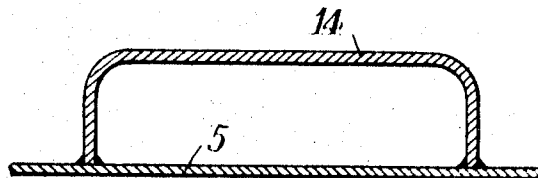


Fig. 6

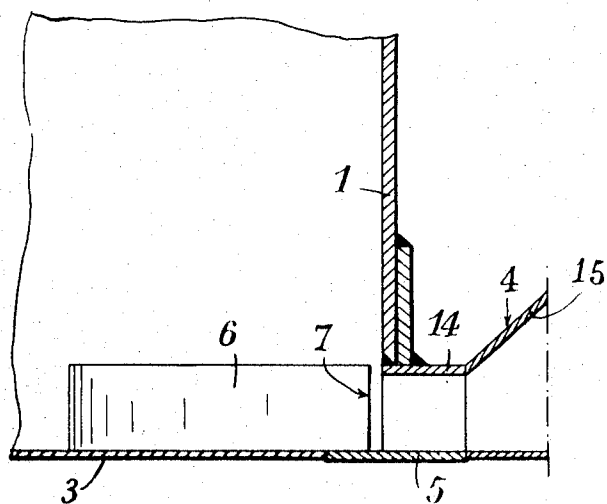
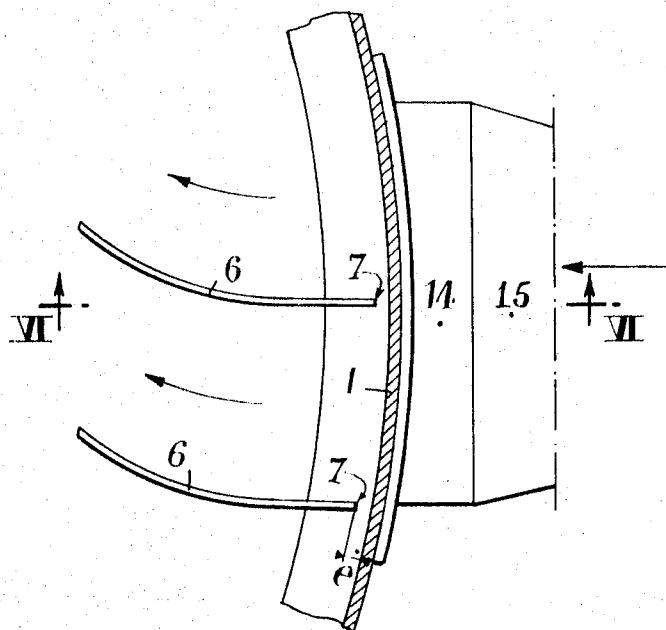
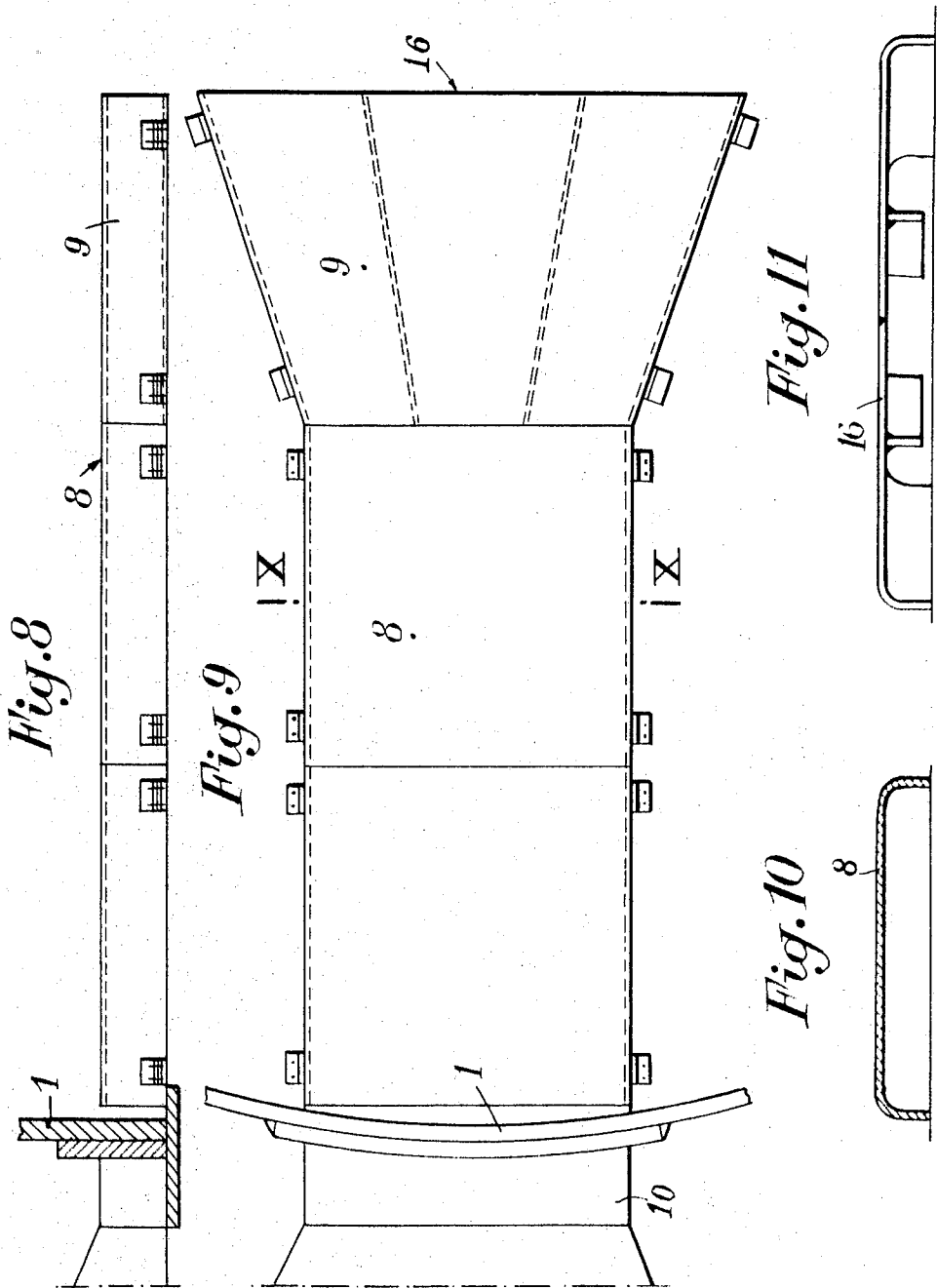


Fig. 7





FLOATING ROOF HYDROCARBON TANK

BACKGROUND OF THE INVENTION

This invention relates to improvements in or relating to floating roof tanks containing notably raw and crude hydrocarbon products.

In conventional constructions, due to the arrangement of the filling and draining pipes at the bottom of the tank, the floating roof cannot descend below a predetermined level of the order of 3 or 4 feet, so that a high-viscosity liquid is deposited on the tank bottom and cannot be drained off by using the conventional suction piping.

SUMMARY OF THE INVENTION

The improvements provided by the present invention are such that it is possible to leave in the tank a very small quantity of product estimated to represent about 2 percent of the total tank capacity.

To this end, one fraction of the tank capacity is filled by using pipes or nozzle tubes of the type having their outlets positioned very close to the bottom and which, according to the tank diameter, may be one, two or three in number, or even more, with a total height not in excess of 12 inches. Moreover, these bottom inlet pipes are provided with specially designed deflectors or baffle plates adapted to impart a gyratory motion to the incoming liquid which causes the sediments contained in the liquid to be put in suspension and collected near the central area of the tank bottom.

To accentuate this concentration of heavier particles in the central portion of the bottom and avoid the accumulation of deposits against the vertical sidewalls, said deflectors or baffle plates are arranged in a manner leaving a gap between them and said vertical walls.

On the other hand, the liquid product is drained off the tank by suction through a central duct of flattened or rectangular cross sectional contour connected to a bottom outflared spout.

Preferably, the tank bottom has a conical configuration with the apex below the base and of a height depending on the tank diameter.

Thus, the floating roof can descend to a very low position limited only by the vertical dimension of the tank bottom piping, i.e. about 12 inches. At the same time, as a consequence of the filling, a whirling motion is imparted to the liquid, the heavier particles are put in suspension and discharged by the central suction constituting the vortex center experience confirms theoretical calculation in that the tank can be drained completely while preserving the buoyancy of the floating roof.

BRIEF DESCRIPTION OF THE DRAWING

A typical form of embodiment of the invention will now be described more in detail with reference to the accompanying drawing illustrating diagrammatically by way of example a floating roof tank structure constructed according to the teachings of this invention. In the drawing:

FIG. 1 is a vertical diametral section showing the floating roof of a tank in its lowermost position;

FIG. 2 is a diagrammatic plane view of the structure without the roof;

FIG. 3 is an elevational view of a feed pipe;

FIG. 4 is a vertical section taken along the line IV—IV of FIG. 3;

FIG. 5 is another section taken along the line V—V of FIG. 4 and showing a feed pipe;

FIG. 6 is a vertical section taken along the line VI—VI of FIG. 7, the latter showing a fragmentary plane view of the outlet of the feed pipe leading into the tank;

FIG. 8 is an elevational view of a discharge or draining pipe;

FIG. 9 is a plane view of the draining pipe of FIG. 8;

FIG. 10 is a section taken along the line X—X of FIG. 9; and

FIG. 11 is an end view of the tunnel inlet.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The tank illustrated by way of example in the drawing comprises a cylindrical container or vessel 1 in which a floating roof 2 is adapted to slide down to a lowermost position very close to the tank bottom 3 when the tank is empty. The minimum distance between the floating roof and the tank bottom is usually 3 to 4 feet in conventional tank structures but in this case it is reduced to about 10 inches by virtue of the particular construction of the bottom and inlet and draining piping systems which are described hereinafter.

The feed manifold 17 supplying the inlet pipes 13 which, in the example illustrated, are three in number with a diameter of about 3 to 4 feet, are connected to three "tank bottom" nozzles 4 having a height of about 10 inches, which open into the vessel. These nozzles consist each for example of a sheet metal assembly comprising an elongated rectangular end section 14 welded to the peripheral annular member 5 and to the reinforced skirt 1 of the tank. Each member 14 is connected through an outflared portion 15 of the filling pipe 13, that is, a portion having a height decreasing gradually from this pipe to said nozzle. Registering with each pipe outlet and welded to the bottom 3 are baffle plates 6 curved in the same direction and preferably parallel.

In order to prevent the heavier particles from accumulating at the vertical edge of these baffle plates 6, a gap *e* is left between this edge and the inner face of wall 1 of the tank (FIG. 7).

Thus, a twofold advantageous result is obtained: on the one hand, the floating roof can be lowered down to the upper level of nozzles 4, that is, about 12 inches above the bottom, and on the other hand the heavier particles or sediments are collected centrally of the tank bottom.

The nozzles 4 may have a circular cross-sectional contour, as illustrated in FIG. 3, but if desired other shapes may be used, provided that it will not cause any throttling of the liquid flow and will reserve a minimum space above the tank bottom.

The tank is drained by using a central suction device consisting of a flattened pipe or radial tunnel 8 extending from the center of the tank bottom where it has substantially the shape of an outflared spout 9, this tunnel 8 being connected outside the vessel 1 to a tapered outlet nozzle 10 of same type as the filling nozzle (FIGS. 8 and 9).

The tunnel 8 will be directed with due consideration for the direction of flow of the fluid, in order to minimize any interference with the whirling motion of the liquid during the filling operation.

The cross-sectional contour of said tunnel 8 and of the outlet aperture 16 of its outflared spout 9 may be designed as shown by way of example in FIGS. 10 and 11.

With this structure, the lower the floating roof, the greater the suspension effect exerted on the sediments contained in the hydrocarbon products, for given an equal output the cross-sectional passage area is smaller.

Moreover, the bottom of this tank, as shown in FIG. 2, has a slightly tapered cross-sectional shape, with the apex 18 disposed beneath the base and a height *f* depending on the tank diameter.

Under these conditions, the tank can be drained nearly completely, the floating roof constantly remaining in suspension.

Of course, the number and design of the nozzles and pipes, and their positions with respect to the tank may vary to a certain extent without departing from the basic principles of this invention.

What I claim is:

1. A tank having a vertical cylindrical sidewall, a bottom wall with an annular peripheral portion extending radially outwardly from and peripherally of said sidewall and a floating roof, notably for the storage of crude hydrocarbon products, said tank being provided with a filling means comprising inlet pipes connected to inlet nozzles disposed along the outer

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periphery and at the bottom of the cylindrical wall, said inlet nozzles being constructed in the form of flattened ducts positioned near the bottom wall, vertical curvilinear and parallel baffle plates positioned radially inwardly of and in the discharge path of each of said nozzles and leaving a small passage between their outer vertical edges and the vertical sidewall of the tank, at least one outlet nozzle also disposed at the periphery of and at the bottom of the tank, and a radial tunnelliike flattened duct opening into the central portion of the bottom of said tank at one end and into said last-mentioned nozzle at the other end.

2. A tank according to claim 1, wherein said inlet nozzles

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each consist of a sheet metal assembly comprising an elongated end portion having its greater dimension extending circumferentially of the tank sidewall and being welded to the annular peripheral portion of the tank bottom wall and to a reinforcing skirt element at the bottom of the vertical sidewall, and a portion flaring in a direction radially inwardly of the tank for connecting the elongated end portion to the inlet pipe.

3. Tank according to claim 1, wherein the tank bottom has an inverted conical configuration with the apex lower than the base and a height depending on the tank diameter.

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