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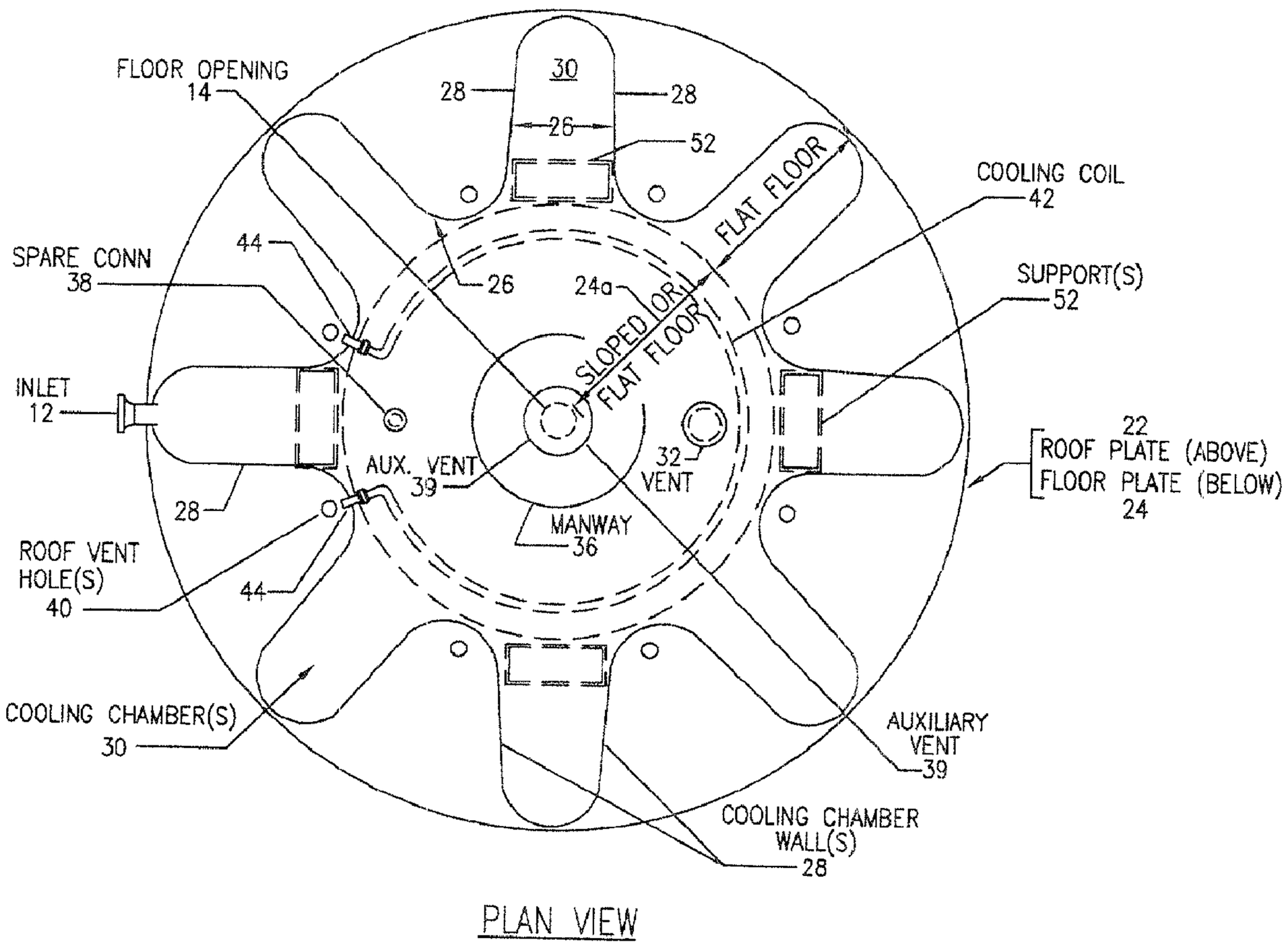
(54) Titre : ENSEMBLE DE CONDENSATION MODIFIE
(54) Title: MODIFIED CONDENSATION ASSEMBLY



PLAN VIEW

(57) Abrégé/Abstract:
A condensation unit haying a peripheral wall defining an open central chamber. The peripheral wall extends circumferentially in a sinusoidal pattern to define a plurality of circumferentially spaced cooling chambers extending radially outwardly from the central

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(57) Abrégé(suite)/Abstract(continued):
chamber for facilitating heat transfer with the ambient. Vapour introduced into the central chamber has unobstructed access to the cooling chambers to promote condensation of the vapor into a liquid. The condensation tank may be located remotely from a storage tank, whether above or below ground, or mar be mounted directly onto the storage tank. Where the condensation unit and storage tank are integral, the vapour may optionally be first introduced into the storage tank and allowed to migrate to the condensation unit to increase condensation capacity. Optionally, a cooling jacket may surround the peripheral wall to hold a cooling medium for added condensing effectiveness.

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ABSTRACT

A condensation unit having a peripheral wall defining an open central chamber. The peripheral wall extends circumferentially in a sinusoidal pattern to define a plurality of circumferentially spaced cooling chambers extending radially outwardly from the central chamber for facilitating heat transfer with the ambient. Vapour introduced into the central chamber has unobstructed access to the cooling chambers to promote condensation of the vapor into a liquid. The condensation tank may be located remotely from a storage tank, whether above or below ground, or may be mounted directly onto the storage tank. Where the condensation unit and storage tank are integral, the vapour may optionally be first introduced into the storage tank and allowed to migrate to the condensation unit to increase condensation capacity. Optionally, a cooling jacket may surround the peripheral wall to hold a cooling medium for added condensing effectiveness.

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TITLE: **MODIFIED CONDENSATION ASSEMBLY**

FIELD OF THE INVENTION

The present invention relates to condensation units for condensing vapours generally associated with the petroleum and other industries.

BACKGROUND OF THE INVENTION

Many industrial and commercial processes create vapourized liquids, particularly hot vapours, which must be condensed into a cooler liquid form for storage and eventual disposal or treatment. In the petroleum industry, for instance, a glycol/water vapour mixture is created at dehydration ("dehy") facilities which should not be released into the atmosphere to avoid pollution of the environment. One accepted method of dealing with the glycol/water vapour is to run the hot vapour through a series of underground pipes to cool and condense the vapour into liquid form, and then to pass the liquid into an underground storage tank. Another accepted method is to run the vapour through an aboveground aerial cooler, or piping having cooling fins, and then passing the condensed liquid into an underground storage facility to avoid freezing of the liquid. These underground storage tanks suffer from several deficiencies, as set out in applicant's Canadian Patent no. 2,196,941. Likewise, the piping creates its own problems. Large lengths of required piping takes up valuable space at facilities, is difficult and costly to install and maintain, and is prone to leakage. Some leaks might not be detected, thereby contaminating the surrounding soil.

The applicant has previously proposed a solution to the above-noted problems by providing a dual containment condensation assembly, as set out in

applicant's Canadian Patent Application no. 2,274,251 and US Patent no. 6,381,979. However, in certain applications where an existing storage tank is still suitable for continued use, it would be desireable to provide a novel stand-alone condensation unit which may be connected remotely to an existing storage tank, or alternately may be retro-fitted thereonto. It would also be desireable to further reduce manufacturing time, material usage and costs, as well as facilitate convenient worker access and coating application to the interior portions of the unit by providing a simplified design with an relatively unobstructed interior which continues to effectively promote relatively rapid condensation of the vapour. In yet another version, the novel condensation unit should be capable of being made integral with a storage tank, where incoming vapour may optionally be first introduced into the storage tank.

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SUMMARY OF THE PRESENT INVENTION

Hence, in one aspect the invention provides an apparatus for urging condensation of a vapour comprising :

a condensation unit having a generally cylindrical peripheral wall portion defining an open central chamber, said peripheral wall extending circumferentially in a sinusoidal pattern to define a plurality of circumferentially spaced cooling chambers extending radially outwardly from said central chamber for facilitating heat transfer with the ambient,

a roof portion capping said wall portion,

a floor portion beneath said wall portion having an outlet for liquid condensed in said unit, and

an inlet for introducing vapour into said central chamber, wherein said introduced vapour has unobstructed access to said cooling chambers to promote condensation of said vapor into a liquid.

In one aspect the condensation unit is located remotely from a storage tank, whether above or below ground.

In another aspect the condensation unit is mounted directly onto the storage tank. Where the condensation unit and storage tank are integral, the vapour may optionally be first introduced into the storage tank and allowed to migrate to the condensation unit to increase condensation capacity.

In yet another aspect, an exterior peripheral cooling jacket surrounds the wall portion of the condensation unit to receive and retain a cooling medium, such as water or other suitable fluid, for added condensing effectiveness.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a transparent elevational view of a condensation unit according to a first embodiment of the present invention;

Figure 2 is a plan view of the unit of fig.1;

Figure 3 shows an optional cooling jacket located peripherally about the condensation unit of fig.1;

Figure 4 is a plan view of the unit of fig.1 with the cooling jacket of fig.3;

Figure 5 is a transparent elevational view of a second embodiment of the unit of the present invention, including the optional cooling jacket ; and

Figure 6 is a plan view of the unit of fig.5 and the optional cooling jacket.

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DESCRIPTION OF PREFERRED EMBODIMENTS

A condensation apparatus, or unit, according to a first embodiment of the present invention is indicated by reference numeral 10 in figs. 1 & 2. In general, the unit is configured to receive a fluid at a vapour inlet 12 and to urge the fluid to separate into gas and liquid components, the liquid component being deposited by gravity through a liquid outlet 14 and stored in a storage tank 50 for future disposal or treatment as required. The storage tank may be of the type shown and described in applicant's Canadian Patent no. 2,196,941 or US Patent no. 5,971,009 for a "Dual Containment Assembly".

The condensation unit of the present invention is designed such that the storage tank may be situated remotely with a pipe or like means therebetween for liquid communication, by gravity or with the aid of a pump or like mechanical means, between the outlet 14 and the inlet of the storage tank. Alternately, the condensation unit may be placed adjacent to the storage tank, preferably atop the storage tank roof (indicated by dashed line 50 in fig. 1) using strategically placed supports 52 or other suitable structural arrangement placed on or about the storage tank. In such case the outlet 14 may be joined directly to the storage tank's vent or inlet 54 for direct liquid transfer. The condensation unit's outlet 14 also serves another purpose in this configuration, namely that of receiving fluid from the storage tank's vent 54 for condensing into liquid in the condensation unit. For illustrative purposes, the fluid in this instance will be a vaporized liquid which may contain some condensed liquids encountered in the petroleum industry, such as vapours from a dehydration unit downstream of a wellhead.

Referring now in more detail to the condensation unit 10, the vapour entering through the inlet 12 is introduced into a large central space or chamber 16 created by the unit's sinusoidally shaped peripheral wall 20. The peripheral

wall forms a gear-like appearance in plan view to increase the condensation unit's inner surface area 26 available for contact with the vapour, and therefore to provide greater cooling capabilities and allow a larger quantity of vapourized liquid to be treated (i.e. condensed) in a given period than a standard tank with just a cylindrical outer profile. The "teeth" of the gear-like shape are formed by radially extending sidewall segments 28 of the peripheral wall to create a series of cooling chambers 30 open to the central space 16 but closed to the ambient. The vapour entering the open space 16 is not directed in any particular direction as there is no second wall inwardly spaced from the peripheral wall as in applicant's earlier designs (see US Patent 6,381,979). Rather, the introduced vapour is able to move unimpeded about the open chamber 16 and into any of the cooling chambers 30 where the vapour may contact the ample inner surface area 26 of the sidewall segments 28 created by the sinusoidal shaped peripheral wall. The heat of the vapour is transferred from the cooling chambers to the relatively cooler ambient through the peripheral wall, serving to cool the condensation unit and promote liquid condensation within.

The chamber is capped at the upper end of the peripheral wall 20 by a roof plate member 22 (in the form of a generally flat, circular plate) and on the opposed lower end by a similar floor plate member 24. The wall, roof and floor should be of a structurally strong material which allows heat transfer therethrough and is liquid impervious. Good results should be had using metallic materials, such as corrosion resistant electro-plated or coated steel, with suitable strength and heat-transfer properties, as in applicant's earlier condensing assembly design.

Condensed liquid which falls to the floor 24 should drain into the floor's liquid outlet 14. To promote drainage to the outlet, some or all of the floor may

be sloped toward the outlet, such as the portion 24a beneath the central chamber. The condensation unit does not require heating and/or insulation to prevent the contents from freezing as the heat from the incoming vapour should be sufficient to prevent freezing of condensed liquid as it travels to the outlet 14.

As the vapour tends to rise to the roof, a roof vent 32 extends downwardly through the chamber and has an opening just above the floor 24 to avoid premature escape of vapour and to increase vapour retention time in the unit. A strike plate 34 serves to partially obstruct vapour entrance into the vent's opening. Vapour contacting the strike plate 34 will have a tendency to condense and fall to the floor.

The unit has several other notable features, including: a hinged manway 36 is provided in the roof for access into the unit; an additional or spare capped connection 38 is provided in the roof to allow introduction of fluid from a source other than the ones feeding the inlets 12, 14; an auxiliary vent 39 to allow for over-pressure and vacuum protection equipment mounting; and, a number of exterior vent holes 40 are spaced circumferentially about the roof in each "trough" of the sinusoidally shaped peripheral wall 20 to provide a means of escape for any hot air which might otherwise get trapped beneath the roof between the cooling chambers.

An option in warmer climates, or where excessively hot incoming vapours are expected, is to place one or more cooling coils 42 inside the chamber 16. The coils may be situated just beneath the roof 22 as shown. A refrigerant or other suitable fluid is passed through the tubing from outside the condensation unit 10 (through coil connections 44) to cool off and condense any vapour in the vicinity of the cooling coils within the chamber 16.

A further option is to surround the peripheral wall 20 of the condensation unit with a circumferential cooling jacket 46 as shown in figs. 3 and 4. The cooling jacket forms a fluid tight seal with a radially extending portion of the floor plate 24 so as to receive and a cooling medium, such as water or other suitable fluid, for added condensing effectiveness. The jacket may extend up a portion of the vertical extent of the peripheral wall, or along the entire height as shown in the figures, as required for particular applications or climates. The top of the jacket should be closed with the condensation unit (as shown), although it may be open if desired for a particular application. The roof vent holes 40 should be omitted when the jacket is provided. Cooling jacket inlets/outlets 48 should be provided at suitable locations to fill or drain the jacket, or to allow for circulation of the cooling medium.

Referring now to figs. 5 and 6, a second embodiment of the unit (indicated by 110) is shown which is adapted to be mounted directly onto a storage tank 50. The same reference numerals are used for the same or substantially similar components to the first embodiment. In this second embodiment the supports 52 (of fig.1) are omitted and instead the condensation unit 110 rests directly on the storage tank 50. The condensation unit may be retro-fitted thereon in this manner, or alternately manufactured integrally with the storage tank such that the condensation unit's floor 124 is integral with the storage tank's roof. In any event, an advantage of this version is that a large portion of the floor 124 is omitted to provide a circular central opening 126. The opening 126 provides unobstructed two-way fluid flow, namely for condensed liquid to drop from the condensation unit into the storage tank, and for vapour from the storage tank to rise into the condensation unit. The floor 124 may be sloped toward the opening 126 to direct fluid flow thereto. The opening also allows easier access from the

condensation unit into the storage tank for maintenance personnel (which enter the assembly through the manway 36). The opening 126 may be fitted with a removable cover plate having a liquid outlet to the tank, however this option is not preferred.

The vapour inlet 12 to the condensation unit may be provided with an optional extension 113 through the floor 124 to direct incoming vapour into the top end of the storage tank 50. This option provides several advantages, including: the relatively hot incoming vapour heats the storage tank and helps prevent ice build-up, thus reducing or eliminating the need for excessive additional heating of the storage tank; and, some of the vapour is first condensed to liquid directly in the relatively cooler storage tank before it finds its way through the opening 126 into the condensation unit 110. Hence, this version of the combined condensation unit and storage tank assembly should be capable of handling an increased volume of vapour relative to the first embodiment.

This version of the condensation unit may also be fitted with the optional cooling jacket 46 described earlier. However, in this version the jacket may rest either on a peripheral extension of the floor plate 124 or along an edge of the roof 22 of the storage tank as shown.

In typical use, vapourized liquid enters through the inlet 12 into the open central chamber 16. A small portion of the vapour should condense immediately on the sidewall segments 28 of the first cooling chamber 30a which houses the inlet 12 at the "crest" of the sinusoidal peripheral wall 20. The remaining vapour is retained within the condensation unit and condenses as it moves toward the other cooling chambers 30 and is cooled by, or otherwise comes into contact with, the inner surface 26 of the peripheral wall 20. The condensed liquid falls to

the floor 24 and is directed by gravity to the outlet 14 (in the first embodiment) and eventually into the storage tank. In the second embodiment the condensed vapour flows directly to the storage tank through the shared central opening 126. Also, in the second embodiment the vapour may optionally be initially introduced into the storage tank, from where some or all of the introduced vapour will migrate to the condensation unit 110 through the opening 126 for further condensation as described above for unit 10.

It will be appreciated that although eight cooling chambers 30 are shown for the preferred embodiments, the number may be varied as required for particular applications to continue to provide effective condensation.

Some of the many advantages of the present design should now be apparent. By omitting interior walls and baffles, the condensation unit of the present invention reduces manufacturing time and material usage, and thus reduces the per unit cost of each unit. The relatively large unobstructed interior space of the condensation unit facilitates worker access to, and coating of, the interior portions of the unit during construction, and later for any needed maintenance and inspection. A simplified design also reduces potential manufacturing errors. Meanwhile, the novel condensation unit continues to effectively promote relatively rapid condensation of the vapour.

The above description is intended in an illustrative rather than a restrictive sense and variations to the specific configurations described may be apparent to skilled persons in adapting the present invention to specific applications. Such variations are intended to form part of the present invention insofar as they are within the spirit and scope of the claims below. For instance, it will be appreciated that the condensation unit 10 may also be advantageously mounted,

or otherwise connected, to an underground storage tank with an accessible inlet 54, or to other types of above-ground storage tanks.

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WE CLAIM:

1. An apparatus for urging condensation of a vapour comprising :

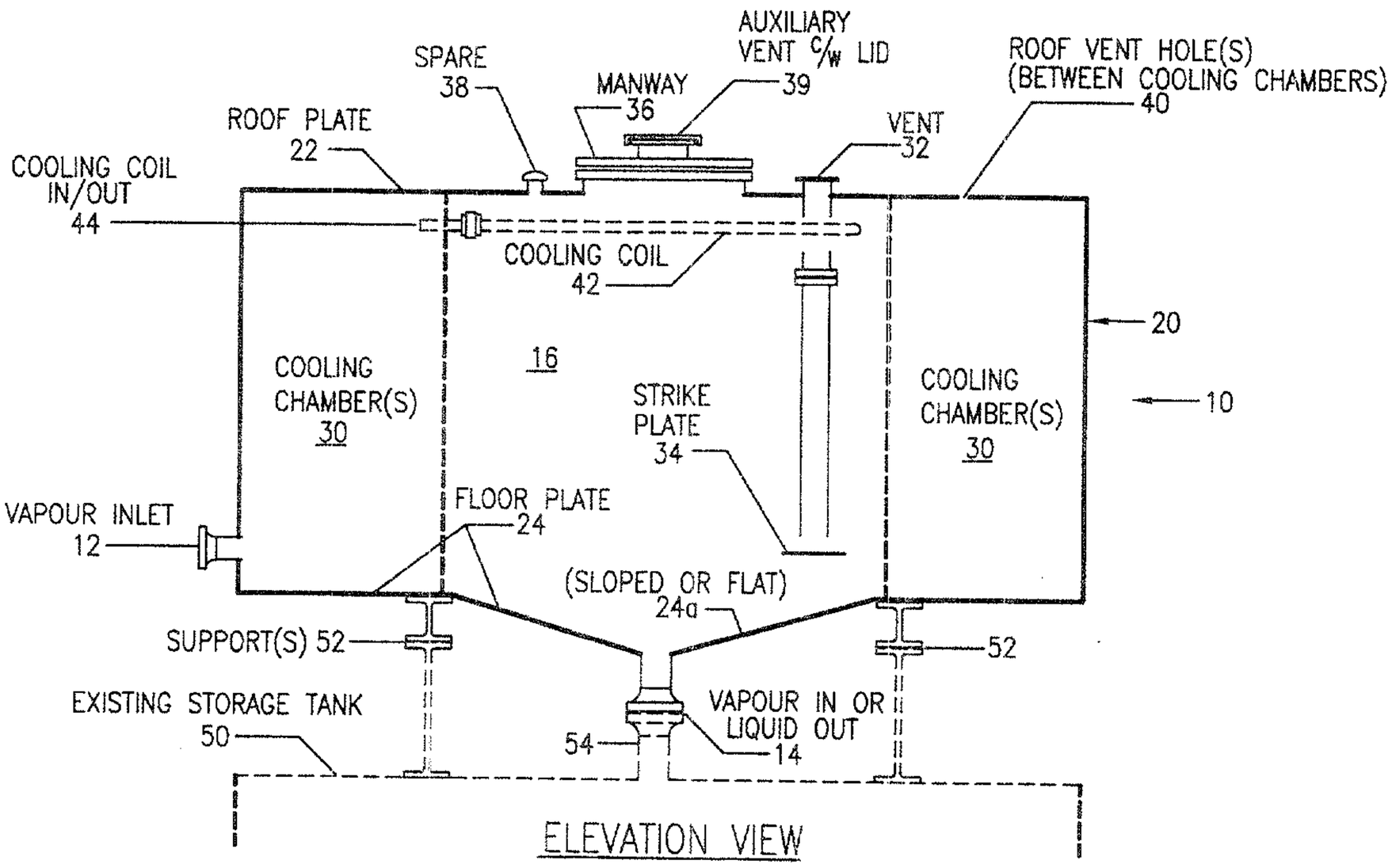
a generally cylindrical peripheral wall portion defining an open central chamber, said peripheral wall extending circumferentially in a sinusoidal pattern to define a plurality of circumferentially spaced cooling chambers extending radially outwardly from said central chamber for facilitating heat transfer with the ambient,

a roof portion capping said wall portion,

a floor portion beneath said wall portion having an outlet for liquid condensed in said apparatus, and

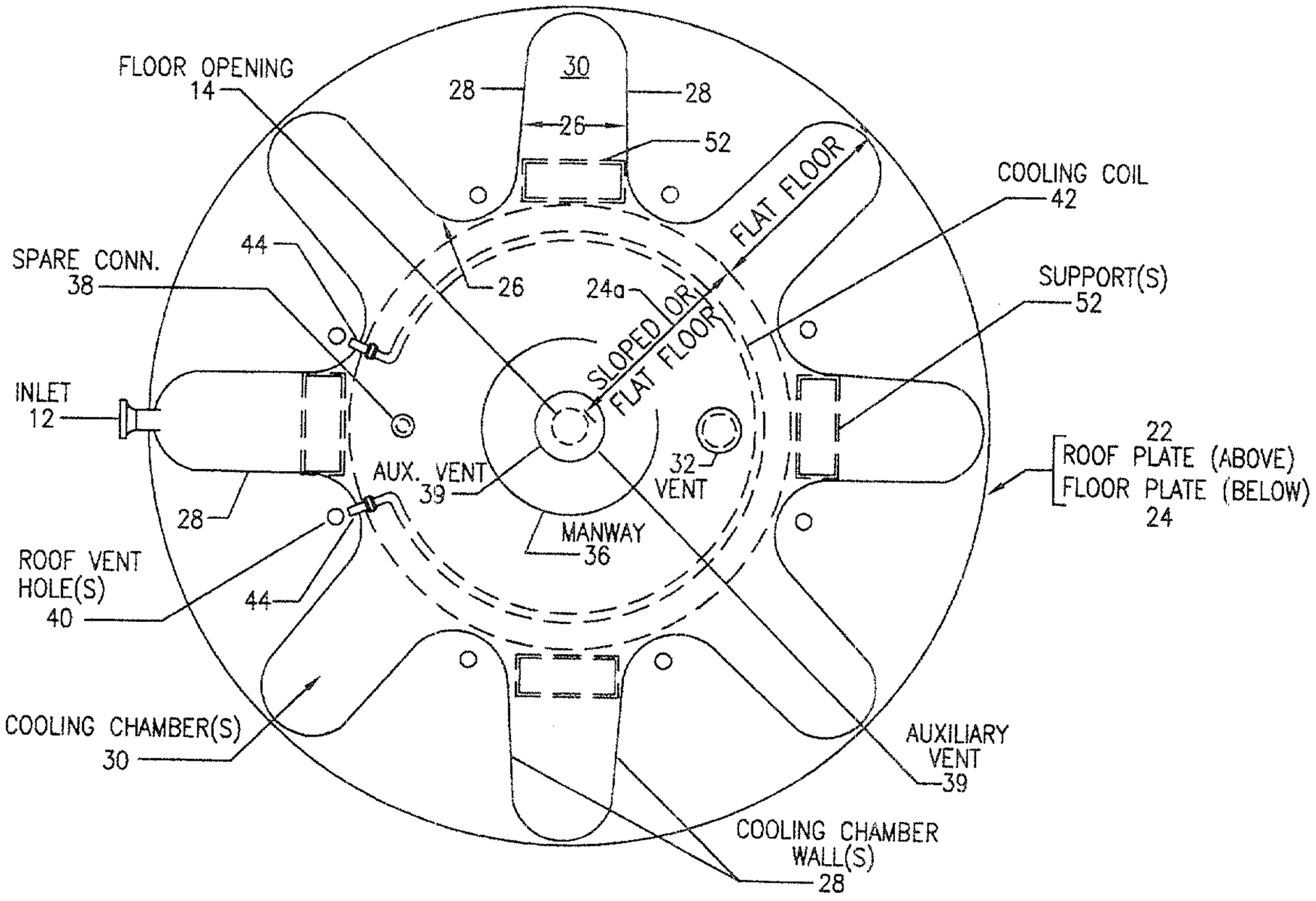
an inlet for introducing vapour into said central chamber, wherein said introduced vapour has unobstructed access to said cooling chambers to promote condensation of said vapor into a liquid.

2. The apparatus of claim 1 further including an exterior cooling jacket located circumferentially about said wall portion to receive a cooling medium for added condensing effectiveness.



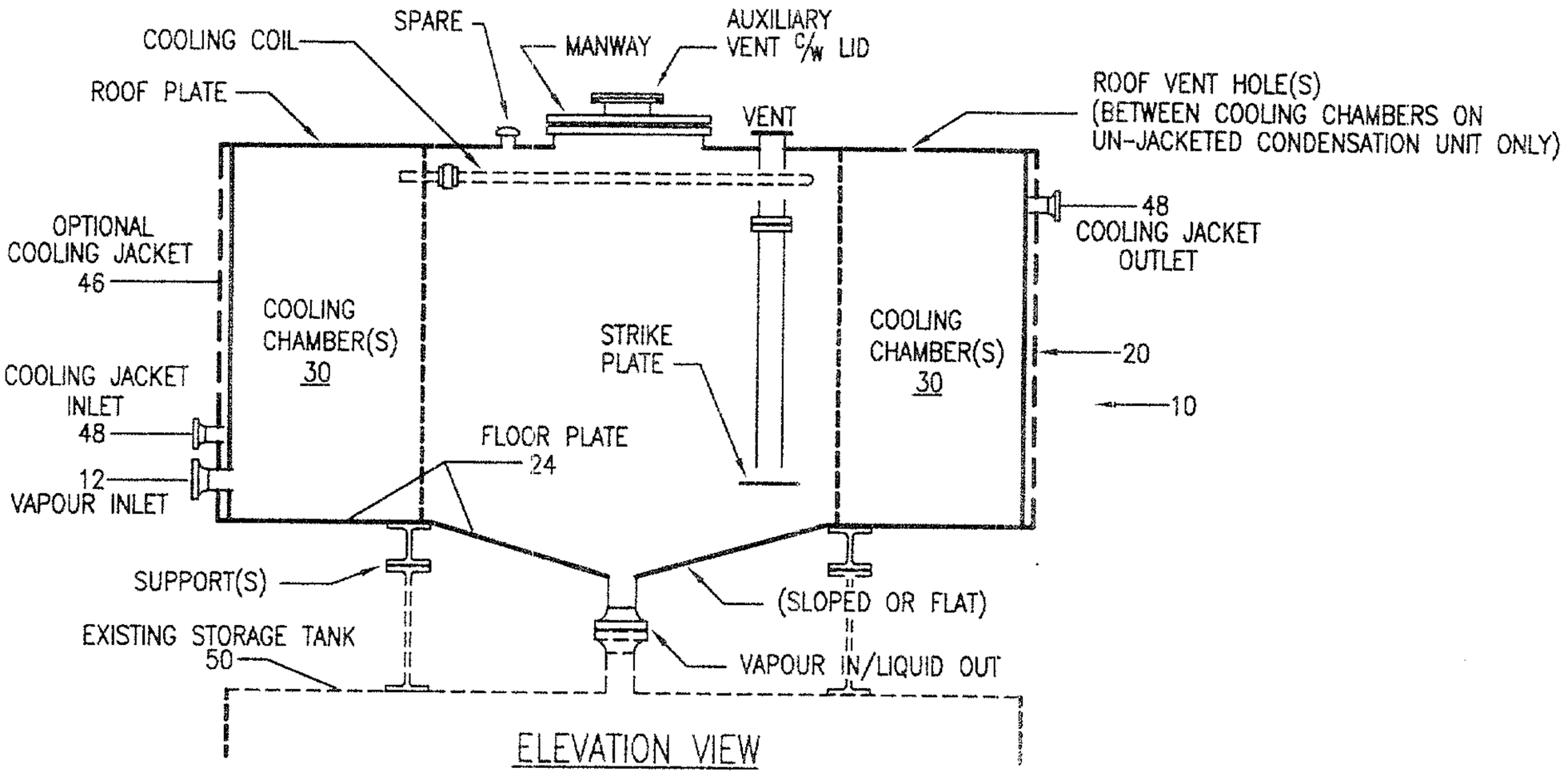
ELEVATION VIEW

(FIG. 1)



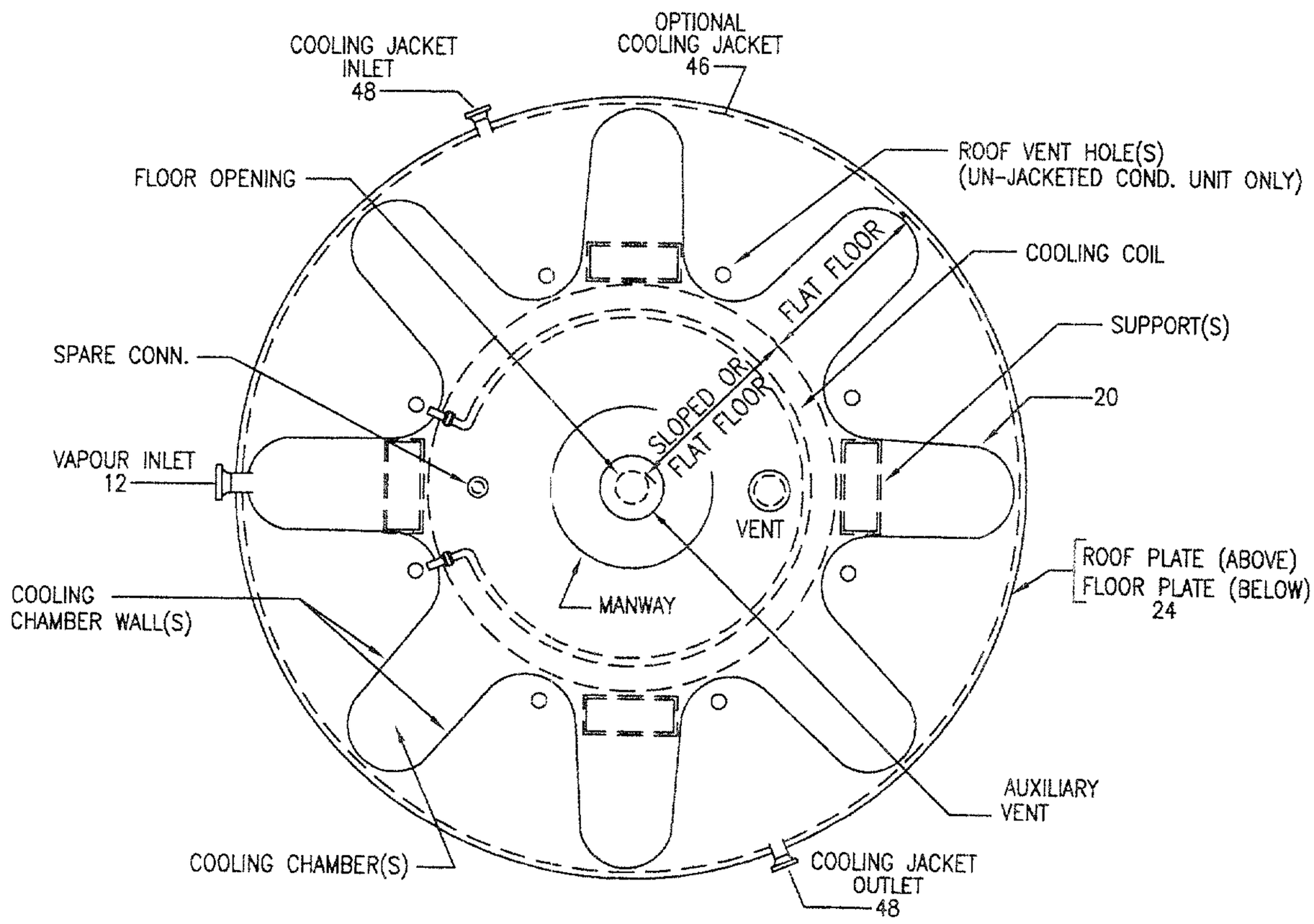
PLAN VIEW

(FIG. 2)



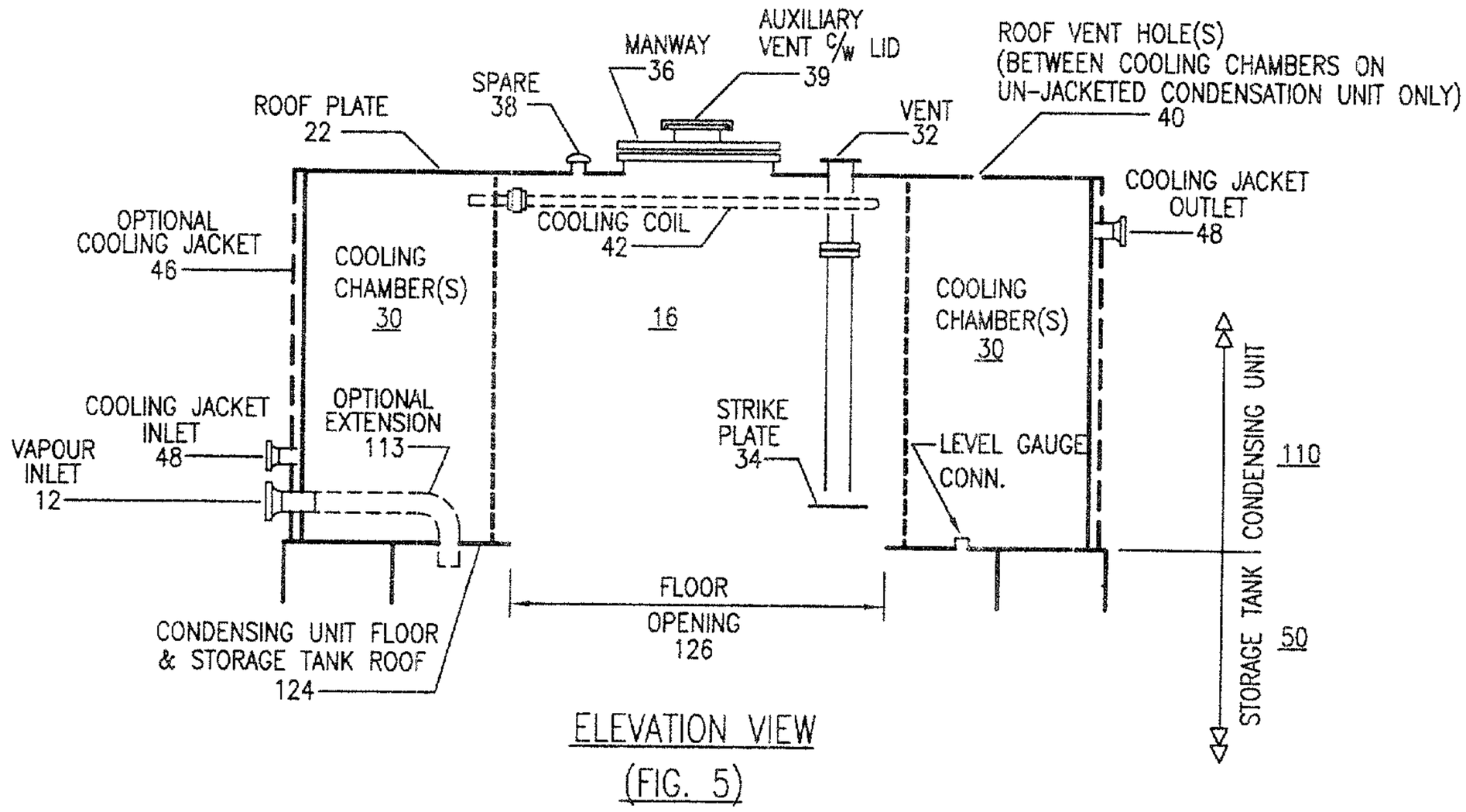
ELEVATION VIEW

(FIG. 3)

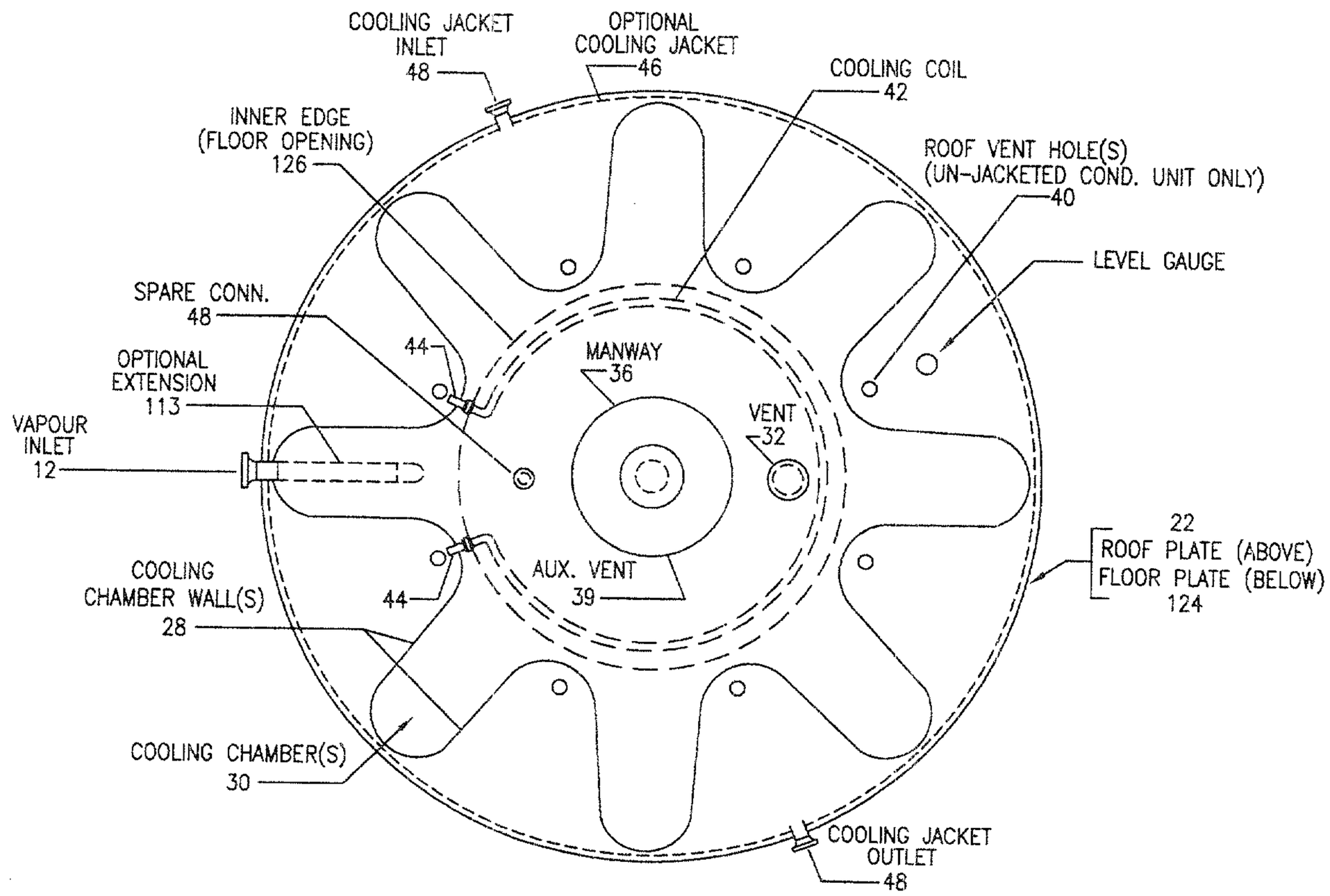


PLAN VIEW

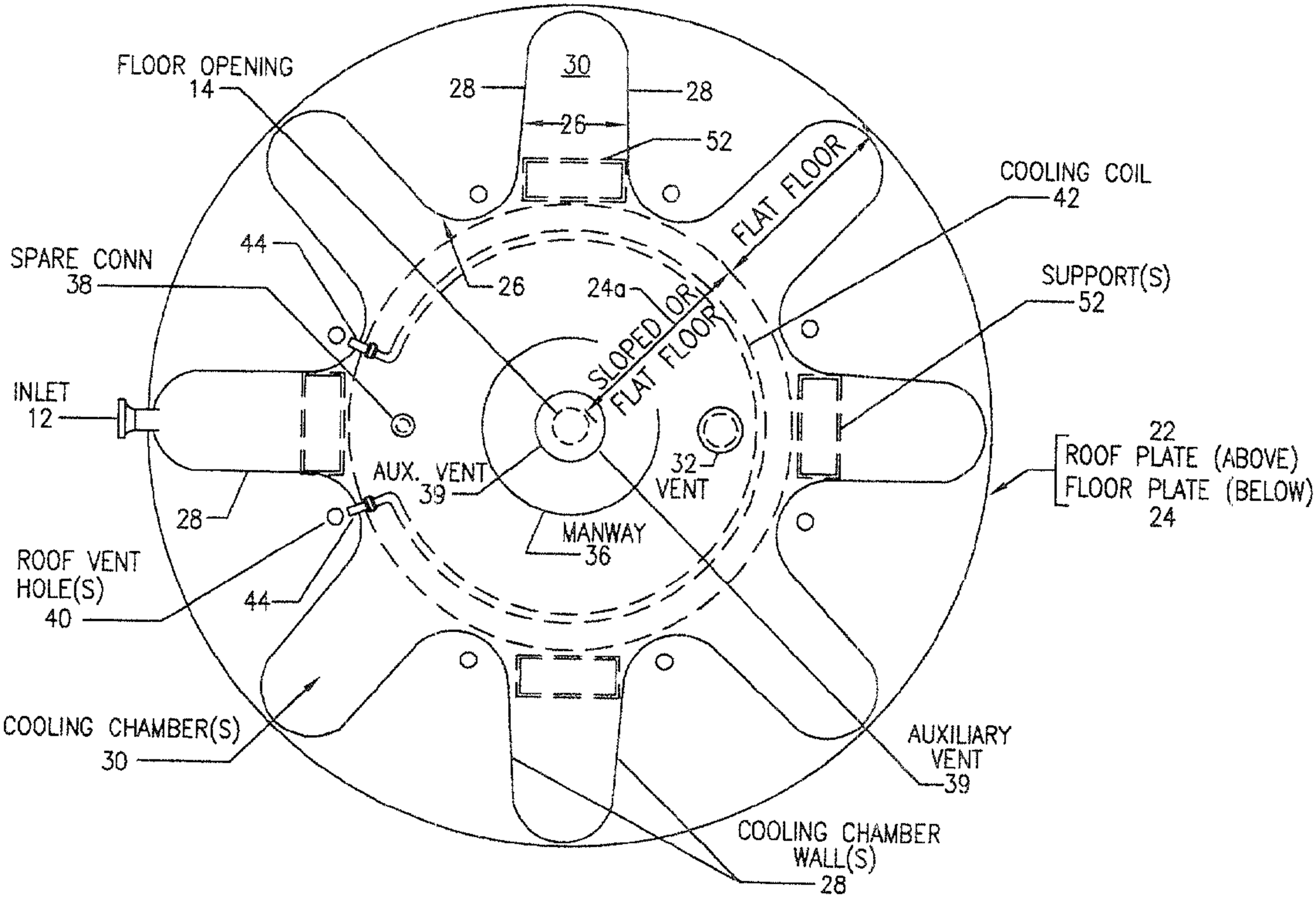
(FIG. 4)



ELEVATION VIEW
(FIG. 5)



PLAN VIEW
(FIG. 6)


FLOOR OPENING
14
30
28
28
26
52
COOLING COIL
42
FLAT FLOOR
SPARE CONN
38
44
26
24a
SLOPED OR
FLAT FLOOR
SUPPORT(S)
52
INLET
12
22
ROOF PLATE (ABOVE)
FLOOR PLATE (BELOW)
24
AUX. VENT
39
32
VENT
28
MANWAY
36
ROOF VENT
HOLE(S)
40
44
COOLING CHAMBER(S)
30
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39
COOLING CHAMBER
WALL(S)
28

PLAN VIEW