

United St**Bochard**[11] **3,902,548**[45] **Sept. 2, 1975****[54] CONTAINERS FOR THE TRANSPORT OF RADIOACTIVE MATERIALS**[75] Inventor: **Camille Bochard**, Lyon, France[73] Assignee: **Robatel, S.L.P.I.**, Genas, France[22] Filed: **Nov. 13, 1973**[21] Appl. No.: **415,419****[30] Foreign Application Priority Data**

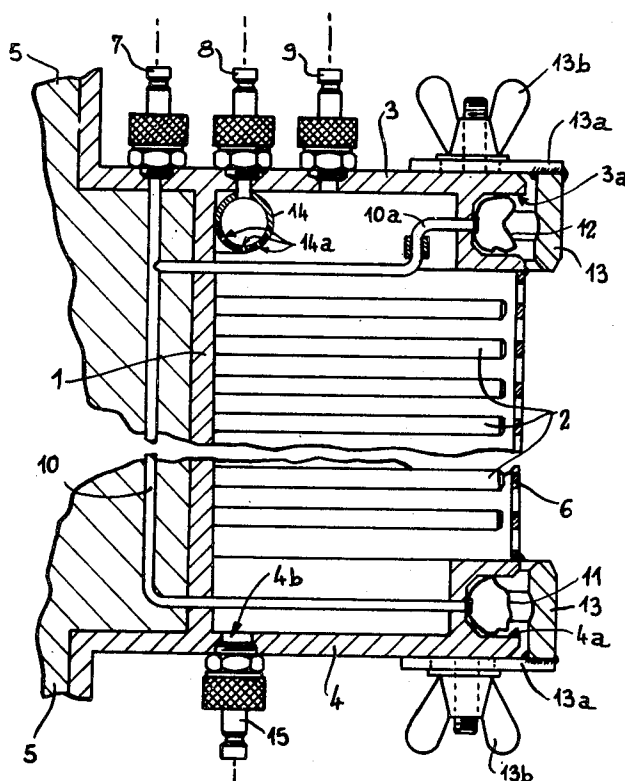
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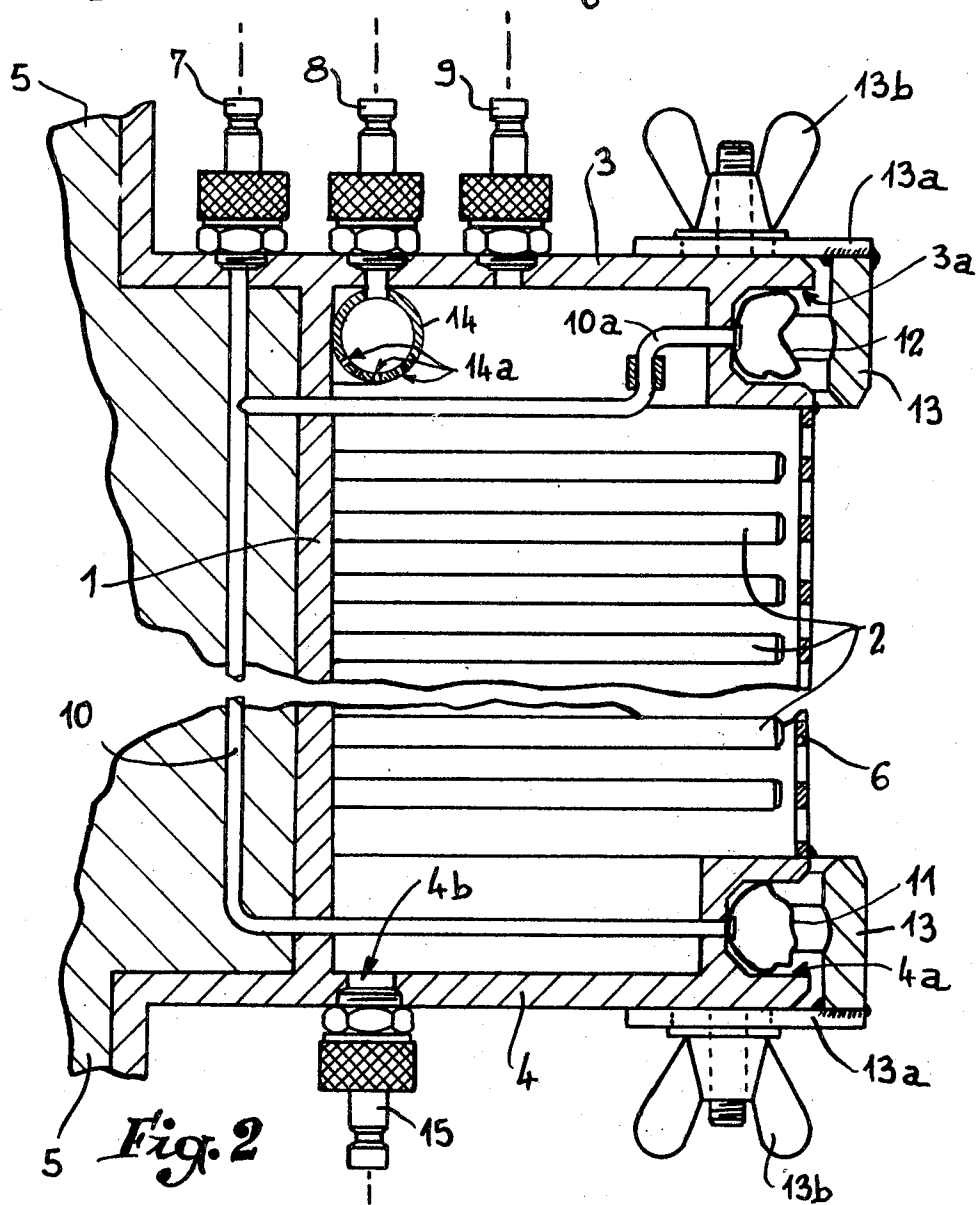
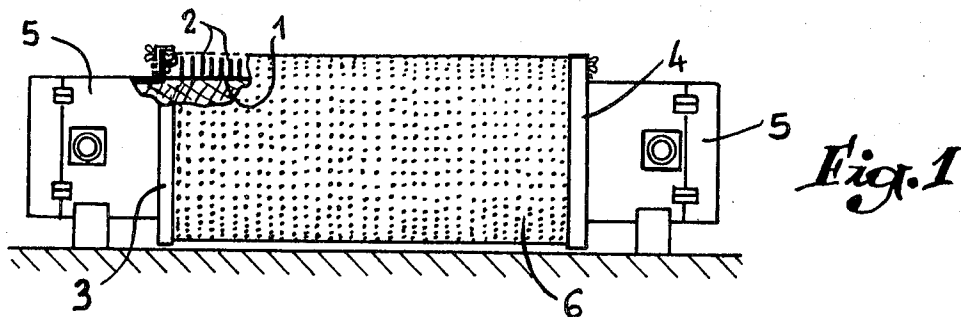
[52] **U.S. Cl.** **165/47; 165/129; 165/137; 250/506; 250/428**[51] **Int. Cl.** **G21f 5/00; G21f 1/02**[58] **Field of Search** **250/428, 432, 506, 507; 252/301 W; 165/129, 47, 134, 137****[56] References Cited****UNITED STATES PATENTS**

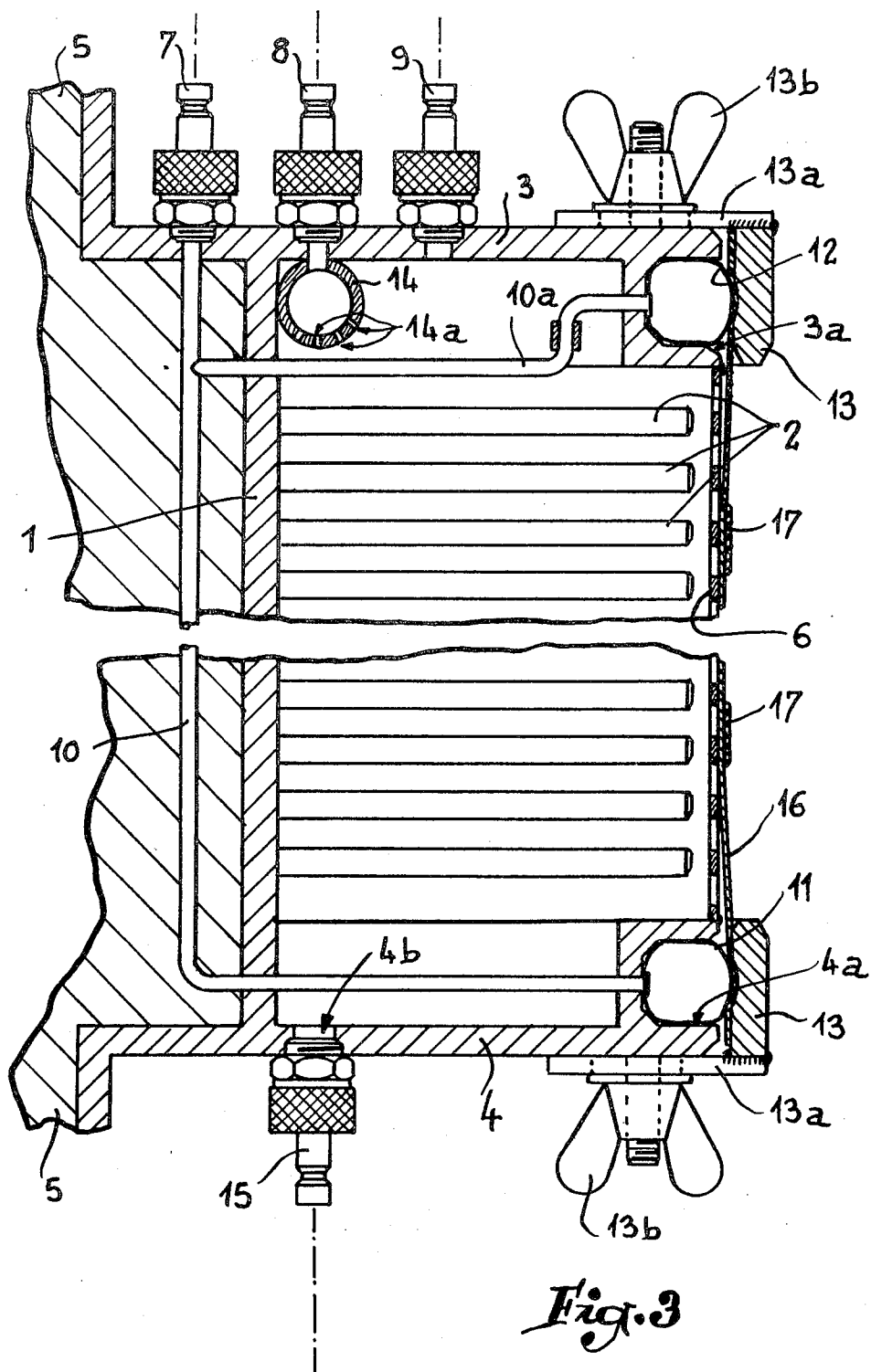
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*Primary Examiner—Albert W. Davis, Jr.**Attorney, Agent, or Firm—Dowell & Dowell***[57] ABSTRACT**

A container for heat evolving radioactive materials has a metallic outer casing formed with outwardly projecting heat dissipating or cooling members, such as pins or fins, while each of its ends is formed with a flat flange which extends radially beyond the outer ends of the cooling members. A perforated wall extends between the flanges to define with same and with the periphery of the outer casing an annular space within which the cooling members are enclosed. This perforated wall is adapted to support a flexible covering sleeve the ends of which are clamped by inflatable seals between the periphery of the flanges and outer rings removably secured to the latter. Spraying means are provided within the aforesaid space to permit of projecting an uncontaminated liquid on the cooling members to cool the container before and/or while the latter is immersed in a loading and unloading pond with the sleeve mounted in position. The lower flange is provided with liquid collecting and evacuating means and compressed air may be injected into the said space to force the collected liquid outwardly.

4 Claims, 3 Drawing Figures





CONTAINERS FOR THE TRANSPORT OF RADIOACTIVE MATERIALS

The present invention relates to containers for the transport of radioactive materials.

It is known that when these materials evolve a large amount of heat, the metallic outer casing of such containers should be provided with some sort of cooling members, such as fins or pins, generally disposed between an upper and a lower annular flanges which extend radially from the casing. In order to avoid having to clean or to decontaminate these cooling members after the container has been immersed into a loading or unloading pond, it has been proposed to provide a fluid-tight flexible covering sleeve which prevents any contact between the said members and the cooling liquid. Such a covering sleeve thus delimits a closed annular space which must be cooled by means of a water jacket with opposed inlet and outlet openings.

When the container equipped with its flexible covering sleeve is immersed into the pond, hydrostatic pressure acts on this sleeve which may thus be damaged, more particularly along the relatively sharp edges of the cooling fins or on the tips of the cooling pins. In order to avoid this inconvenience the annular space delimited by the cover is generally previously filled with water, the latter being injected upwardly to prevent the formation of air bubbles. This operation is of course delicate and time-consuming, more particularly in the case of large containers.

It is the object of the present invention to avoid this drawback.

According to the invention, in a container of the kind above referred to a perforated peripheral wall extends between the flanges of the metallic outer casing so as to form a rigid inner supporting surface for the flexible covering sleeve when the latter is submitted to the hydrostatic pressure within a loading or unloading pond. Any damage to the flexible covering sleeve is thus fully avoided even if the annular space delimited by the said cover has not been previously filled with water.

The water jacket which has hitherto been provided in order to absorb heat from the cooling members carried by the metallic outer casing of the container may thus be dispensed with and replaced by spraying means provided in the space defined by the said outer casing, the said flanges and the said peripheral wall for spraying water on the said cooling members in order to dissipate heat therefrom, the lower flange having appropriate outlet means for the water collected from the said spraying means. Such a procedure only requires a limited quantity of water and does not delay the loading or unloading operations.

In the accompanying drawings:

FIG. 1 is a side view with parts in section illustrating a container for heat evolving radioactive materials according to the invention, this container being illustrated at the horizontal position.

FIG. 2 is a fragmental longitudinal section of this container at the vertical position.

FIG. 3 is a view similar to FIG. 2, but wherein the flexible covering is disposed on the perforated peripheral wall of the container.

The container illustrated comprises in the conventional manner a metallic outer casing 1 having a large number of cooling pins 2 which project radially therefrom between two longitudinally spaced annular

flanges 3 and 4 disposed in the vicinity of the end heads 5 of the container.

In accordance with the present invention flanges 3 and 4 are connected with each other by a substantially rigid perforated peripheral wall 6 secured in position by any appropriate means, as for instance by welding, as shown. Owing to its perforations this wall does not hinder free circulation of ambient air between pins 2 which thus effectively dissipate the heat generated by the radioactive materials within the container whatever may be the position of the latter. It will further be noted that wall 6 forms a safety screen for the operators who can no more be accidentally injured by pins 2, as also for the said pins which are protected against impacts.

Flange 3, which corresponds to the open end of the container, i.e., the upper end when the latter is to be immersed vertically for the loading or unloading operations, carries three male quick-coupling elements 7, 8 and 9 of conventional construction. The first one 7 is connected by a conduit 10 with an inflatable clamping seal 11 disposed in a peripheral groove 4a provided in the lower flange 4, and also by a branch conduit 10a with another inflatable clamping seal 12 similarly disposed in a peripheral groove 3a of the upper flange 3. Each flange 3 or 4 is surrounded by a ring 13, having inwardly projecting lugs 13a which are removably secured to the outer side of the flange as for instance by means of nuts 13b screwed on appropriate screw-threaded gudgeons carried by the said flange. It will be observed that the inner diameter of each ring 13 is somewhat larger than the outer diameter of the corresponding flange so as to leave a narrow annular intermediate space.

The second coupling element 8 communicates with an annular spray pipe 14 disposed against the inner side of the upper flange 3. The perforations 14a of this pipe are directed downwardly in such manner that when the coupling element 8 receives water under pressure, the water jets issuing from these perforations strike the cooling pins 2. The lower flange 4 is formed with an outlet 4b which communicates with a downwardly projecting male quick-coupling element 15 through which water collected on flange 4 may be discharged.

The coupling element 9 communicates freely with the annular space defined by casing 1, flanges 3 and 4, and peripheral wall 6. This coupling element is adapted to receive air or other gas under sufficient pressure to expel water through outlet 4b and coupling element 15.

The operation is as follows:

Assuming the container has already been loaded (in a manner to be described below) with radioactive materials evolving a large amount of heat per unit of time, this heat is transmitted to the outer casing 1 and to the cooling pins 2, and it is dissipated in the ambient air which circulates around these pins through the perforations of the peripheral wall 6. It is however obvious that this dissipation of heat requires a relatively high thermal gradient between the pins and the incoming air; in other words pins 2, and consequently casing 1 and the core of the container itself, are at a relatively high temperature.

When the container is to be unloaded it should first be cooled to an appropriate temperature. For this purpose, the container being maintained at the vertical position of FIGS. 2 and 3, water under pressure is injected into the coupling element 8 by means of an appropriate hose. This water is sprayed on pins 2 by pipe 10 and it

rapidly absorbs the amount of heat accumulated in the container. Water collected on the lower flange 4 is discharged through outlet 4b and element 15. This cooling operation is quickly effected and it only requires a relatively small quantity of water. It is besides to be noted that the water thus injected into element 8 may have been brought to a low temperature in order to increase its cooling power and to reduce the cooling time. Some water may of course escape through the perforations of the peripheral wall 6 but it corresponds to a small percentage of the quantity injected and it does not constitute a problem in actual practice.

When the container has been cooled to the desired temperature, admission of water through element 8 is momentarily stopped, the outer rings 13 are removed and a water-tight flexible covering sleeve, such as indicated at 16 in FIG. 3, is disposed on the perforated peripheral wall 6. This sleeve may be made of any appropriate synthetic material. Its length or height should be substantially equal to the vertical distance between the outer sides of flanges 3 and 4 in such manner that its ends may extend on the periphery of the said flanges 3 and 4. Rings 13 are then re-mounted in position and compressed air is injected into element 7. Seals 11 and 12 are thus inflated and they clamp in fluid-tight manner the upper and the lower edges of sleeve 16 against the inner side of rings 13. This fixation of the covering sleeve 16 may be reinforced by adhesive strips such as 17 which maintain the said sleeve in engagement with wall 6 at spaced intervals.

Water is then again injected into element 8 in order to cool pins 2, the temperature of which has not markedly increased during the relatively short time required for mounting sleeve 16. A discharge hose is connected with the lower coupling element 15 and air is injected into coupling element 9 in order to expel through this hose water collected on the lower flange 4.

The container is then immersed into the unloading pond, the outlet end of the discharged hose being maintained above the water level therein. The container may thus be opened and unloaded in the usual manner while remaining effectively cooled and without its cooling pins 2 being in contact with the contaminated water of the pond due to the presence of the covering sleeve 16. Once the unloading operation effected, the container is removed from the pond and it is sufficient to clean or decontaminate its end portions together with the outer sides of its flanges 3 and 4, which raises no difficulty owing to the practically smooth character of the exposed surfaces of these parts.

When an empty container is to be loaded the procedure required remains as above described with however this difference that the container need not be cooled before being immersed into the pond since it then contains no heat evolving material.

I claim:

1. A fluid cooled container for heat evolving radioac-

tive materials, comprising:

- a. a hollow metallic casing having first and second ends;
- b. first and second peripheral flanges fixed to said casing near its ends and each extending outwardly from the surface of the casing;
- c. multiple cooling members attached to the surface of the casing and operative to dissipate heat collected by the casing into said fluid, the cooling members extending outwardly from said surface between said flanges;
- d. a perforated wall surrounding said casing and fixed to said first and second flanges to form a substantially rigid outer contour for the container, said perforated wall defining with said casing surface an intermediate space between the flanges, the cooling members being contained within said space and the ambient fluid normally circulating among said cooling members through the wall;
- e. spraying means in said intermediate space and disposed to spray cooling liquid onto said cooling members;
- f. outlet means operative to discharge from said space liquid introduced by said spraying means; and
- g. means to cover and enclose said perforated wall when said container is to be immersed into a loading or unloading pond, including a flexible impervious sleeve shaped to overlie said wall between said flanges, and means to seal said sleeve to said flanges.

2. A container as claimed in claim 1, wherein said outlet means extend through said second flange, and said first flange includes inlet means extending there-through to inject gas under pressure to force liquid introduced by said spraying means from said space through said outlet means when said perforated wall is enclosed by said sleeve.

3. A container as claimed in claim 1, wherein said means to seal the sleeve to said first and second flanges comprise first and second rings shaped to extend around the peripheries of the flanges over the opposite end edges of the sleeve, and clamping means operative to clamp said edges of the sleeve between the rings and flanges and seal the sleeve ends to the flanges.

4. A container as claimed in claim 3, wherein said rings are shaped to overlie grooves recessed in the outer peripheral edges of said flanges adjacent to the ends of said perforated wall with the sleeve ends disposed between the flanges and the rings; inflatable seal means disposed in said grooves; and conduit means extending into the container and coupled to said inflatable seal means and operative when pressurized to inflate the latter into sealing engagement with said flexible sleeve.

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