

Description

CONTAINER WITH DIRECT-FIRED HEATING PIPE

Technical Field

The present invention relates to a heatable container, especially but not exclusively relates to a heatable container suitable for heating, transporting and storing residue of oil refining, pitch, sulphur or similar products, and in particular relates to a container with a direct-fired heating pipe.

Background of the Invention

At present, container transportation has been applied all over the world, and the degree of containerization of general cargo transportation among developed countries has reached over 80%. Container transportation in China started in 1950s, went through steady development in 1980s, and since 1990s Chinese international container transportation has been given earnest attention by the world shipping business. The definition of container provided by the International Standardization Organization (ISO) is as follows: A container is a transportation device that meets the following requirements: (1) durability with solid strength that is sufficient to be used repeatedly; (2) specially designed for transporting merchandise, without necessity of midway reloading during the transportation in one or more transporting means; (3) provided with apparatus for convenience of loading, unloading and carrying, especially transferring from one transporting means to another; (4) design consideration for convenience of filling up and emptying of cargo; (5) inside volume of 1 cubic meter or more. The meaning of term "container" does not include vehicles or conventional packaging. The use of containers avoids multiple times of loading and reloading of cargo in the transportation process, reduces transportation cost, realizes door-to-door transportation, and enhanced the development of international multimodal transportation.

When the cargo transported in the container is some sticky liquid material such as pitch, residue of oil refining, or sulphur, as these materials easily turn into solid state in room temperature, after being loaded into the container in liquid state and transported over long distances, these materials turned into solid state or a state that is not easy to flow upon arrival of the destination, as a result, it is required to reheat them into liquid state so as to be unloaded from the container.

Chinese patent application publication CN1162688A disclosed a multifunctional sealed oil storage device for oil well in the oil industry, comprising oil-gas pipelines and a storage tank, a U-shaped furnace hearth is provide inside the storage tank, the furnace hearth heats the

storage tank by direct-fired heating. Direct-fired heating means heating by feeding into the container high temperature gas that is produced by burning light oil or natural gas. However, because the U-shaped furnace hearth is double heating pipes and there is a relatively large space between the two heating pipes, the heating is relatively uneven, and the heating efficiency is relatively low.

Summary of the Invention

In order to solve the technical problem in prior art that the heating pipes for heating materials in the container results in uneven heating and low heating efficiency due to their U-shaped design, the present invention provides a container with a direct-fired heating pipe that brings about relatively even heating and high heating efficiency.

In order to solve the above-mentioned technical problem, the following technical solution is provided in the present invention:

A container with a direct-fired heating pipe, comprising a container body, wherein, the container body is provided with a heating port, the heating port has a structure suitable for direct injection heating, a heating pipe is arranged at the heating port and inside the container body, which comprises a heating portion in the form of a coiled pipe and a fume exhaust pipe.

Preferably, the coiled pipe extends within a plane.

Preferably, the heating portion is arranged in the form of a rectangular coiled pipe.

Preferably, the heating portion is positioned near a bottom board of the container without contacting the bottom board.

Preferably, the heating portion is positioned parallel to the bottom board.

Preferably, the heating port is positioned at a lower-left corner or a lower-right corner of an end plate of the container body.

Preferably, the container further comprises a burner installation assembly arranged on the exterior of the heating port.

Preferably, a chimney opening is provided on a roof board of the container, and the fume exhaust pipe extends in a direction away from a bottom board of the container to the

chimney opening.

Preferably, the container body comprises an outer housing body, an inner housing body, and a thermal insulation layer between the outer housing body and the inner housing body, and the outer housing body and the inner housing body are in a rectangular shape.

Preferably, the cross-section of the inner housing body is in a round square shape.

Preferably, an exterior wall of the heating portion of the heating pipe is provided with fins extending outwards to the inner space of the container body.

Preferably, the container further comprises an observation hole on a surface of the container body.

Preferably, the container further comprises a discharge opening and a spare discharge opening arranged on a lateral wall of the container body and close to a bottom of the container body.

Preferably, the container further comprises a fast discharging device for connecting to the discharge opening or the spare discharge opening, the fast discharging device comprises:
a valve body having a cylindrical cavity with an opening at one end, and formed with a discharge outlet on a lateral wall thereof;
a valve spool for sealing the opening;
a valve rod with one end fixed to the valve spool and the other end extending through a holder inside the valve body and fixed to a handle outside the valve body, the handle being able to be rotated to drive the valve rod to move axially; and
a switch unit, with a communicating tube connected between the discharge outlet and the switch unit.

Preferably, the exterior surface of the sealing element for openings on the container body is provided with a thermal insulation coating.

Compared to the prior art, the aforementioned technical solution of the present invention has the following advantages:

(1) In the container with a direct-fired heating pipe according to the present invention, the heating portion of the heating pipe is configured in the form of a coiled pipe, which increases the contact area between the heating pipe and cargo materials inside the container so that the heating is more evenly distributed, and meanwhile prolongs the dwell time of high

temperature gas within the container so that the heat exchange is more sufficient and the heating efficiency is higher; furthermore, compared to a container that has two heating ports and requires two burner to heat simultaneously, the container with a direct-fired heating pipe according to the present invention only has one heating port and requires only one burner, so that heat loss during the heating process is reduced and half of the fuel is saved, thereby saving energy and protecting the environment.

(2) In the container with a direct-fired heating pipe according to the present invention, the coiled pipe extends within a plane, so that cargo materials within a same plane are heated more evenly, and therefore the cargo materials have better fluidity after turning into fluid and thus are easier to unload.

(3) In the container with a direct-fired heating pipe according to the present invention, the container body comprises an outer housing body, an inner housing body, and a thermal insulation layer between the outer housing body and the inner housing body, wherein, the eight corners of the inner housing body are provided with arc chamfering, which reduces the impact force of cargo materials inside the container towards the eight corners of the container, thereby enhancing the pressure bearing ability of the container and ensuring safe usage of the container.

(4) In the container with a direct-fired heating pipe according to the present invention, the exterior wall of the heating portion of the heating pipe is provided with plate-shaped fins extending outwards to the inner space of the container body, thereby increasing the overall heat exchange area of the heating pipe and further saving the fuel.

Brief Description of the Drawings

To make the contents of the present invention more easily understood clearly, further detailed descriptions of the present invention are presented below, with reference to specific embodiments and in conjunction with appended drawings, wherein:

FIG. 1 is a main view of the container with a direct-fired heating pipe according to the present invention;

FIG. 2 is a top view of the container with a direct-fired heating pipe according to the present invention;

FIG. 3 is a lateral view of the inner housing body of the container with a direct-fired heating pipe according to the present invention;

FIG. 4 is a structural view of the burner installation assembly according to Embodiment 3 of the present invention;

FIG. 5 is a structural view of the fast discharging device according to Embodiment 6 of the

present invention.

The marking numerals in the drawings are explained as follows: 1-arc chamfering, 2-heating port, 31-heating portion, 32-fume exhaust pipe, 11-valve body, 12-valve spool, 13-valve rod, 15-handle, 16-switch unit, 17-communicating tube, 21-first loading board, 22-second loading board, 23-first threaded hole, 25-clamp plate, 26-threaded rod, 27-first flat board, 28-second flat board, 210-mounting unit.

Detailed Description of Embodiments

Embodiment 1

As shown in FIG. 1 to FIG. 3, a container with a direct-fired heating pipe according to this embodiment comprises a container body, the container body comprises an outer housing body, an inner housing body, and a thermal insulation layer between the outer housing body and the inner housing body, wherein, the outer housing body and the inner housing body are in a generally rectangular shape, and the cross-section of the inner housing body is in a round square shape, i.e., the eight corners thereof are respectively provided with an arc chamfering 1, such configuration reduces the impact force of cargo materials inside the container towards the eight corners of the container, thereby enhancing the pressure bearing ability of the container and ensuring safe usage of the container, which meets the requirements for a pressurized vessel. A heating port 2 is positioned at a lower-left corner of an end plate of the container body, the heating port 2 has a structure suitable for direct injection heating, a heating pipe is arranged at the heating port and inside the container body, the heating pipe comprises a heating portion 31 and a fume exhaust pipe 32, the heating portion 31 is configured in the form of a rectangular coiled pipe, and the heating portion 31 is positioned near and parallel to a bottom board of the container, so that the heating is more evenly distributed and the heating efficiency is higher, and, compared to a container that has two heating ports and requires two burners to heat simultaneously, the container with a direct-fired heating pipe according to the present invention only has one heating port and requires only one burner, so that the heat loss during the heating process is reduced and half of the fuel is saved, thereby saving energy and protecting environment. The heating portion 31 is positioned near a bottom board of the container without contacting the bottom board, and furthermore an exterior wall of the heating portion 31 of the heating pipe is provided with plate-shaped fins (not shown in the drawings) extending outwards to the inner space of the container body, thereby increasing the overall heat exchange area of the heating pipe and further saving the fuel. A chimney opening is provided on a roof board of the container, and the fume exhaust pipe 32 extends in a direction away from a bottom board of the container to the chimney opening.

Furthermore, the round square cross-sectional shape of the container with a direct-fired

heating pipe according to this embodiment renders the effective volume of a 20-foot standard tank-type container according to this embodiment to be over 26 cubic meters, which is 2 cubic meters larger than other tank-type containers.

Embodiment 2

The difference of Embodiment 2 from Embodiment 1 lies in that, the container body of the container with a direct-fired heating pipe according to Embodiment 2 has an outer housing body and an inner housing body both in a generally rectangular shape, but the inner housing body is not provided with an arc chamfering at each of its eight corners; the coiled pipe extends within a plane; and the heating port 2 is positioned at a lower-right corner of an end plate of the container body.

In the above-mentioned embodiment, as a preferable implementing way, the heating portion is configured in the form of a rectangular coiled pipe, and as alternatives, the heating portion may also be configured in a round, oval or other shape. In addition, under the condition that the smooth outflow of pitch is ensured, it could be better to arrange the heating portion 31 to be as close to the bottom board of the container as possible, and as long as the heating portion 31 does not contact the bottom board, the objective of the present invention can always be achieved.

Embodiment 3

On the basis of Embodiment 1 and Embodiment 2, the container according to this embodiment further comprises a burner installation assembly arranged on the exterior of the heating port 2. As shown in FIG. 4, the burner installation assembly comprises a burner and a connection fastening device, the burner comprises an incendiary cylinder to be inserted into the heating port of the container when heating, and the connection fastening device is used for fastening the burner onto the heating port of the container. The connection fastening device comprises a hanging component and a clamping mechanism. The hanging component is fixedly connected to the burner, and an end of the hanging component far away from the burner has a higher position than the burner by a certain height, so that, after the burner is fastened onto the heating port, the incendiary cylinder becomes right in front of the heating port to be inserted into the heating port. The hanging component comprises a first loading board 21 and a second loading board 22 that are perpendicular to each other and integrally formed into one piece, the first loading board 21 is formed with a second threaded hole, the incendiary cylinder and the rest of the burner are connected by a bolt, and the burner is hung onto the hanging component by the bolt inserted into the second threaded hole. The hanging component is also provided with a reinforce part. The reinforce part comprises a first flat board 27 and a second flat board 28 that are perpendicular to each other, the first flat board

27 is welded to the first loading board 21 and arranged perpendicular thereto, and the second flat board 28 is welded to the second loading board 22 and arranged perpendicular thereto. The clamping mechanism clamps the flange of the heating port so as to fixedly connect the burner with the heating port, and the clamping mechanism comprises a dynamic clamping unit and a stationary clamping unit to clamp the flange of the heating port between them, as well as a telescopic unit to drive the dynamic clamping unit to move towards the stationary clamping unit. The dynamic clamping unit is a clamp plate 25 formed with a first threaded hole 23; a part of the second loading board 22 close to the clamp plate 25 forms the stationary clamping unit; the telescopic unit is a threaded rod 26 with an external thread, the threaded rod 26 is suitable to be fitted through the first threaded hole 23 and an end of the threaded rod 26 far away from the clamp plate 25 is provided with a twist grip 29, two of the threaded rods 26 are provided and arranged parallel to each other. A mounting unit 210 adapted for the threaded rod 26 to be inserted in is also fixed on the hanging component, the mounting unit 210 is fixed on the second loading board 22, and the inner surface of the mounting unit 210 is provided with internal thread that matches the external thread of the threaded rod 26 to get a connective function.

In regard to the container with a direct-fired heating pipe according to this embodiment, the burner is fixed to the hanging component so that the burner and the hanging component becomes an integral piece, and after the incendiary cylinder is inserted into the heating port on the container, the movement of the telescopic unit of the clamping mechanism causes the dynamic clamping unit and the stationary clamping unit to clamp the flange of the heating port, thereby firmly fastening the burner and the heating port together. By using this type of burner with the connection fastening device, not only the multiple bolts used for tightening the burner onto the heating port are saved, so that the operation is relatively simple as well as time-saving and energy-saving, but also, when demounting the burner from the heating port after heating by the burner is finished, the demounting of the burner can be done by merely utilizing the cooperation of the telescopic unit with the dynamic clamping unit and the stationary clamping unit, thereby avoiding the risk that hands of operators get scalded due to direct contact with the tightening bolts, so that the usage can be safer. Compared to mounting and demounting of burners of other tank-type containers, the mounting efficiency of the dedicated burner installation assembly of the container with a direct-fired heating pipe according to this embodiment is increased by 75%, and the demounting efficiency thereof is increased by 84.62%.

Embodiment 4

On the basis of any of the aforementioned embodiments, a container with a direct-fired heating pipe according to this embodiment further comprises an observation hole on a

surface of the container body. As a specific embodiment, for a standard container with a length of 6058mm, a width of 2438mm and a height of 2591mm, i.e. a 20-foot standard tank-type container, the round observation hole on its upper surface has an external diameter of 219mm, and an observation hole cap for sealing the observation hole is fixedly connected to the observation hole by three holding bolts.

It should be pointed out that, the observation hole cap of a conventional pitch container is required to keep open during the whole process of heating and unloading, so as to allow air to flow and avoid the risk of high pressure accumulation inside the container tank during the heating process, to avoid negative pressure inside the container tank during the unloading process which would slow the unloading speed, and meanwhile to avoid the problem of too much heat dissipation due to complete opening of the observation hole during the process of heating and unloading. In regard to the container with a direct-fired heating pipe according to this embodiment, the observation hole cap for sealing the observation hole is fixedly connected to the observation hole by three holding bolts, as such, when unloading, compared to other tank-type containers which requires operating on eight holding bolts to open the manhole, the container herein only requires operating on three holding bolts of the observation hole cap, thereby reducing the consumed time by 60% and increasing the operation efficiency. Furthermore, when filling the container, the height of the liquid level can be observed through the observation hole, thereby avoiding the potential safety hazard of scald by splashed pitch or accidental fall of operators on scene because of opening the manhole on the tank top to observe the liquid level.

Embodiment 5

On the basis of any of the aforementioned embodiments, a container with a direct-fired heating pipe according to this embodiment further comprises a discharge opening and a spare discharge opening arranged on a lateral wall of the container body and close to a bottom of the container body. The existence of the spare discharge opening makes it possible that, when the discharge opening is inconvenient for unloading, e. g. the discharge opening is blocked during transportation, the unloading can be carried out through the spare discharge opening, so as to increase the applicability of the container with a direct-fired heating pipe according to this embodiment, which can fulfill requirements of cargo direct heating and unloading under various conditions.

Embodiment 6

On the basis of Embodiment 5, a container with a direct-fired heating pipe according to this embodiment further comprises a fast discharging device for connecting to the discharge opening or the spare discharge opening, as shown in FIG. 5, the fast discharging device

comprises a valve body 11 having a cylindrical cavity with an opening at one end, and formed with a discharge outlet on a lateral wall thereof; a valve spool 12 for sealing the opening; a valve rod 13 with one end fixed to the valve spool 12 and the other end extending through a holder inside the valve body 11 and fixed to a handle 15 outside the valve body 11, the handle 15 being able to be rotated to drive the valve rod 13 to move axially; and a switch unit 16, with a communicating tube 17 connected between the discharge outlet and the switch unit 16.

As the communicating tube 17 is connected between the discharge outlet and the switch unit, the structure is simple and only occupies a small space. When cargo materials leak, the switch unit can quickly close the discharge outlet so as to avoid splashing of high temperature liquid materials or toxic harmful corrosive liquid which would endanger the operators, and the valve spool can seal the discharging mechanism with good sealing performance so as to prevent leakage of liquid cargo materials, i.e. a double function of sealing and quick closing of the discharging mechanism is achieved by the double configuration of valve spool and switch unit.

Embodiment 7

On the basis of any of the aforementioned embodiments, a container with a direct-fired heating pipe according to this embodiment further comprises a thermal insulation coating on the exterior surface of the sealing element for openings on the container body. The openings on the container body include a manhole, an observation hole, a heating port, a discharge outlet, a spare discharge opening, a chimney opening, etc., accordingly, the sealing element is a cap or board for sealing the manhole, the observation hole, the heating port, the discharge outlet, the spare discharge opening, the chimney opening, etc., and the exterior surface of the cap or board is provided with a thermal insulation coating to prevent heat inside the container from dissipating through the manhole, the observation hole, the heating port, the discharge outlet, the spare discharge opening, the chimney opening, etc.. Under the condition that the loading location, temperature of loaded pitch, transportation route, time in transit are all identical, it is found by testing that the thermal insulation performance of the container with a direct-fired heating pipe according to this embodiment is enhanced by 40%-50%, thereby getting a full thermal insulation effect.

Apparently, the aforementioned embodiments are merely intended for clearly describing the examples, rather than limiting the implementation ways of the invention. For those skilled in the art, various changes and modifications in other different forms can be made on the basis of the aforementioned description. It is unnecessary and impossible to exhaustively list all the implementation ways herein. However, any obvious changes or modifications derived

from the aforementioned description are intended to be embraced within the protection scope of the present invention.

Claims

1. A container with a direct-fired heating pipe, comprising a container body, wherein, the container body is provided with a heating port (2), the heating port (2) has a structure suitable for direct injection heating, a heating pipe is arranged at the heating port (2) and inside the container body, which comprises a heating portion (31) in the form of a coiled pipe and a fume exhaust pipe (32).
2. The container of claim 1, wherein, the coiled pipe extends within a plane.
3. The container of claim 2, wherein, the heating portion (31) is arranged in the form of a rectangular coiled pipe.
4. The container of claim 3, wherein, the heating portion (31) is positioned near a bottom board of the container without contacting the bottom board.
5. The container of claim 4, wherein, the heating portion (31) is positioned parallel to the bottom board.
6. The container of any one of claims 1-5, wherein, the heating port (2) is positioned at a lower-left corner or a lower-right corner of an end plate of the container body.
7. The container of any one of claims 1-6, wherein, the container further comprises a burner installation assembly arranged on the exterior of the heating port (2).
8. The container of any one of claims 1-7, wherein, a chimney opening is provided on a roof board of the container, and the fume exhaust pipe (32) extends in a direction away from a bottom board of the container to the chimney opening.
9. The container of any one of claims 1-8, wherein, the container body comprises an outer housing body, an inner housing body, and a thermal insulation layer between the outer housing body and the inner housing body, and the outer housing body and the inner housing body are in a rectangular shape.
10. The container of claim 9, wherein, the cross-section of the inner housing body is in a round square shape.
11. The container of any one of claims 1-10, wherein, an exterior wall of the heating portion (31) of the heating pipe is provided with fins extending outwards to the inner space of the container body.
12. The container of any one of claims 1-11, wherein, the container further

comprises an observation hole on a surface of the container body.

13. The container of any one of claims 1-12, wherein, the container further comprises a discharge opening and a spare discharge opening arranged on a lateral wall of the container body and close to a bottom of the container body.
14. The container of claim 13, wherein, the container further comprises a fast discharging device for connecting to the discharge opening or the spare discharge opening, the fast discharging device comprises:
 - a valve body (11) having a cylindrical cavity with an opening at one end, and formed with a discharge outlet on a lateral wall thereof;
 - a valve spool (12) for sealing the opening;
 - a valve rod (13) with one end fixed to the valve spool (12) and the other end extending through a holder inside the valve body (11) and fixed to a handle (15) outside the valve body (11), the handle (15) being able to be rotated to drive the valve rod (13) to move axially; and
 - a switch unit (16) with a communicating tube (17) connected between the discharge outlet and the switch unit (16).
15. The container of any one of claims 1-14, wherein, the exterior surface of the sealing element for openings on the container body is provided with a thermal insulation coating.