

SPECIFICATION

TILTING HEATING APPARATUS

BACKGROUND OF THE INVENTION

(i) Field of the Invention

The present invention relates to a tilting heating apparatus which heats/dissolves a heating object on the spot and can be mounted in a vehicle such as a truck, and an on-the-spot heat treatment system for a heating object.

(ii) Description of the Related Art

In a batch type heating apparatus, a drum type heating container is rotated around a central axis of this heating container, an opening portion of the heating container is supported so as to be inclinable in a vertical direction, and heating means such as a burner is arranged at the opening portion of the heating container, thereby heating a heating object in the drum.

As shown in FIG. 5(a), this type of heating container has an opening portion 20, and a bottom surface portion 23' opposed to the opening portion 20 is substantially flatly formed.

When heating, agitation of a heating object G is performed to the bottom surface portion 23' of the heating container by inclining the opening portion 20 side of the heating container 21' and rotating the heating container 21' around a central axis C of the heating container 21', but a heating object G' may not be possibly agitated on the bottom surface portion 23' side of the heating container 21' due to an insufficient input of the heating

object G or an insufficient inclination angle of the heating container 21'.

Further, only a surface is heated by heating of the heating means from the opening portion 20 side, sufficient heating is not performed to the inner part of the heating container 1, and there is produced a temperature difference between a surface side close to the opening portion 20 and an inner side apart from the same due to heating (see FIG. 5(b)).

SUMMARY OF THE INVENTION

In the heating apparatus according to the present invention, a heating object loaded along a bottom surface portion side on an inclined surface formed on the bottom surface portion can be agitated by forming a raised portion on the bottom surface portion of a heating container even if an inclination angle of the heating container is an angle which cannot provide sufficient agitation in the prior art.

Furthermore, when an agitation blade is provided to the heating container, the heating object can be caused to run down from the opening portion to the bottom surface portion of the heating container while being scooped up by rotation of the heating container, thereby achieving a reduction in a heating time and an increase in an input into the heating container.

Moreover, in the heating apparatus according to the present invention, although the drum type heating container may be small or large in size, the heating container can be held so as to be largely tilted in a front-and-back direction even if a large type heating container is adopted.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1(a) is a side cross-sectional view of a heating container in which a raised portion is provided on a bottom surface portion, and (b) shows a conical plate;

FIG. 2 is a side cross-sectional view of a heating container having agitation blades provided thereto;

FIG. 3 is a lateral cross-sectional view of the heating container having the agitation blades provided thereto as seen from a front side;

FIG. 4(a) is a view showing a scooping start position of a heating object by the agitation blades, (b) is a view showing a state in which the heating object is scooped in the agitation blade, and (c) is a view showing a state in which the heating object runs down from the agitation blade;

FIG. 5(a) is a side cross-sectional view of a conventional heating container having a flat bottom surface portion, and (b) is a side cross-sectional view showing an agitation state of the heating container;

FIG. 6 is a side view showing a preferred embodiment of an asphalt-reclaiming apparatus embodying one example of the conveyable heating apparatus of this invention;

FIG. 7 is a back side view of the asphalt-reclaiming apparatus shown in FIG. 1;

FIG. 8 is a side view illustrating an embodiment wherein the asphalt-reclaiming apparatus is housed in a casing;

FIG. 9 is a side view showing another embodiment of an

asphalt-reclaiming apparatus;

FIG. 10 is a side view showing a different embodiment of an asphalt-reclaiming apparatus; and,

FIG. 11 is a back side view of the asphalt-reclaiming apparatus shown in FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description will now be given as to preferred embodiments when a tilting heating apparatus according to the present invention is applied to a tilting heating apparatus which reprocesses and uses peeled asphalt on the work spot.

FIG. 1 shows an example of a drum type heating container 21 supported by a tilting heating apparatus.

This heating container 21 is configured to rotatably support the heating container 21 around a central axis C thereof by using a holding device and support an opening portion 20 of the heating container 21 so as to be capable of being inclined in a vertical direction.

Additionally, a drive device which rotates the heating container 21 and a drive device which tilts the heating container are respectively provided.

Further, heating means such as a burner is arranged at the opening portion 20 of the heating container 21 in order to heat a heating object such as asphalt in the heating container 21.

A raised portion 24 that a substantially central part of a bottom surface portion 23 protrudes toward the inner side of the heating container 21 is provided on the bottom surface portion 23

of this heating container 21.

This raised portion 24 may have a conical shape, a pyramidal shape, or a truncated conical shape or a truncated pyramidal shape that an end portion is cut off.

Furthermore, this raised portion 24 may be integrally formed as the bottom surface portion 23 of the heating container 21, but a plate 25 having the above-described shape may be fixed on the flat bottom portion 23.

In the illustrated example, the plate 25 having the conical shape (which may be solid, or may have a shape with only a conical shape having a V-shaped cross section) is fixed on the bottom surface portion 23 by bolting, soldering or the like.

As a result, since the bottom surface portion 23 of the heating container 21 is formed to have a tapered cross section that a substantially central part is highest and gradually lowered toward the outer side by the raised portion 24, a heating object G is caused to slide down by an inclined surface 24a positioned at a lower part of the raised portion 24 with the substantially tapered cross section formed on the bottom portion 23 even if an inclination angle α of the heating container 21 is an angle which cannot provide sufficient agitation in the prior art in heating, thereby sufficiently agitating the heating object.

Moreover, agitation blades 26 are fixed to this heating container 21 as shown in FIGS. 2 and 3.

This agitation blade 26 is a plate having a substantial V shape as seen in plane in the illustrated example, extends to the vicinity of the bottom surface portion 23 from a middle position inwardly apart from the opening portion 20 of the heating container

21, and is fixed to the heating container 21 by bolting, soldering or the like.

Additionally, an inner angle 27 at a bent part where the agitation blade 26 is bent in the substantial V shape as seen in plane faces the outside, and the agitation blade 6 is arranged so as to generate a gap between itself and an inner wall surface of a circumferential wall of the heating container 1.

The gap is set in such a manner that a gap S1 between a piece 6a on the front side in the rotational direction of the heating container 21 and the inner wall surface 22 is wide and a gap S2 between a piece 6b on the rear side in the rotational direction of the heating container 21 and the inner wall 22 is narrow.

In this embodiment, a plurality of (two in the illustrated example) agitation blades 26 are provided at substantially equal intervals in the circumferential direction with respect to the central axis C of the heating container 1.

Since the above-described structure is provided, the piece 26a on the front side in the rotational direction enters at a position shown in FIG. 4(a) with respect to the heating object filled in the heating container 21, and the agitation blade 26 which operates with rotation of the heating container 21 gradually takes in the heating object between the agitation blade 26 and the inner wall surface 22 from the gap S1 at a position shown in FIG. 4(b) and directly scoops it by utilizing the bent part at a position shown in FIG. 4(c).

On the other hand, the heating object runs down from the gap S2 little by little as the piece 6b on the rear side in the rotational direction rises, the heating object is caused to run

down from the gap S1 of the piece 26a on the front side in the rotational direction when the agitation blade 6 passes an uppermost position, and the heating object G between the agitation blade 26 and the inner wall surface 22 is completely discharged (see FIG. 4 (a)).

Further, the heating object G which is held and remains between the pair of agitation blades 26 is scooped by the agitation blade 26 which subsequently advances in accordance with the same procedure, and runs down.

In this manner, the heating object G is agitated from the opening portion 20 side to the bottom surface portion 23 side by the agitation blades 26, and can be heated in a short time.

Furthermore, providing the agitation blades 26 enables agitation of the heating object even if an input of the heating object G into the heating container 1 is increased as compared with the prior art. Therefore, even if an internal dimension of the heating container 21 is reduced due to the raised portion 24, an input of the heating object G can be increased, and hence the operability can be improved.

Moreover, sufficiently performing agitation can cause a temperature of the heating object G on the inner side close to the bottom surface portion 23 side away from the front side close to the opening portion 20 of the heating container 21 to become slightly higher.

Thus, since the heating object G is used from the side close to the opening portion 20 of the heating container 21 in, e.g., an operation to heat and reproduce a peeled asphalt piece on the spot, temperatures of the heating object can be substantially

homogenized during use if the heating object has a higher temperature if the inner side has a higher temperature.

Although the description has been given as to the example in which the two agitation blades are provided at intervals of 180 degrees in the above-described embodiment, one, three or more agitation blades may be provided.

Additionally, it is good enough that the agitation blade has a bent part so as to scoop the heating object in place of a flat surface, and the agitation blade may have a shape which is bent at an acute angle or an obtuse angle or a curved shape.

Referring to FIGS. 6 and 7, the asphalt-reclaiming apparatus comprises a combustion chamber (or heating container) 21 having an opening 20 constituting both an inlet and outlet for raw material, a holding frame 3 rotatably supporting the combustion chamber 21, an oil pressure motor for rotating the combustion chamber 21, a stand 5 pivotally supporting through the holding frame 3 the combustion chamber 21, and an oil pressure cylinder 6 for effecting the inclination of the combustion chamber 21.

The combustion chamber 21 is of drum-like shape wherein the middle portion 21a is expanded forming an enlarged cylindrical portion and the both end portions are tapered. This combustion chamber 21 is shown as being postured that the opening thereof is turned toward the front.

The holding frame 3 is comprises an integral body consisting of a rear frame 3a disposed behind the combustion chamber 21 so as to traverse the center of the back surface of the combustion chamber 21, a lower frame 3b extending downward from the both ends

of the rear frame 3a to below the combustion chamber 21, and a pair of lateral frames 3c horizontally extending respectively from the both ends of the rear frame 3a toward both sides of the combustion chamber 21. Namely, the holding frame 3 is shaped as such that both ends of the rear frame 3a are horizontally and forwardly extended so as to form a pair of lateral frames 3c, and the lower frame 3b is extended downward along the bottom wall of the combustion chamber 21 from both sides of the lateral frames 3c or of the rear frame 3a whereby forming at the distal end portion thereof a horizontal closed arch below the peripheral wall of the combustion chamber 21.

On the central portion of the bottom of the combustion chamber 21 is protruded out a axis of rotation P1, the distal end of which is rotatably received on the rear frame 3a of the holding frame 3. This axis P1 is adapted to be rotated by the oil pressure motor 4 mounted on the rear frame 3a for rotating the combustion chamber 21.

On the lower frame 3b is erected a pair of brackets 7a set apart from each other. Guide rollers 7 are rotatably mounted on each of the brackets 7a respectively with the rotating direction of the guide rollers 7 being opposite to the rotational direction of the combustion chamber 21. Namely, these guide rollers 7 are contacted with the middle peripheral wall 21a of the combustion chamber 21 whereby supporting the combustion chamber 21 and at the same time guiding the rotation of combustion chamber 21. Accordingly, the combustion chamber 21 is axially supported by the rear frame 3a and is adapted to be inclined integral with the holding frame 3 while being contacted by the guide rollers 7.

A pair of the lateral frames 3c of the holding frame 3 are provided at the middle portions thereof with pivot pins P2, each extending outward and rotatably mounted on a top portion of the stand 5 thereby allowing the holding frame 3 to be rotated around the pivot pins P2.

The stand 5 is composed of a pair of lateral pedestals 5a, each extending back and forth, a rear pedestal 5b disposed between the proximal ends of the lateral pedestals 5a and integrally connected thereto, and a pair of legs 5c, each extending upward from the middle portion of the lateral pedestals 5a and bearing on its top portion the lateral frame 3c. Namely, on the upper portion of each leg 5c is mounted rotatably the pivot pins P2 of the lateral frame 3c.

Meanwhile, an oil cylinder 6 is pivotally disposed between the lateral pedestal 5a of the stand 5 and the arm 3c' of the lateral frame 3c of the holding frame 3. Namely, the distal end of the expandable rod constituting the oil cylinder 6 is pivotally attached to a distal end of the arm 3c' of the lateral frame 3c, and the proximal end of the expandable rod is pivotally attached to a distal end of the lateral pedestal 5a.

These oil pressure motor 4 and oil pressure cylinder 6 are connected respectively to an oil pump (not shown) so that through the manipulation of switches provided on an operation panel, the rotation or halt of the oil pressure motor 4 and expansion or contraction of the oil pressure cylinder 6 can be effected.

At the occasion of charging the combustion chamber 21 with pieces of asphalt, the expansion rod of the oil pressure cylinder 6

is extended pushing the holding frame 3, thus slanting the combustion chamber 21 upward. After finishing the charging with the asphalt pieces through the opening 20, the combustion chamber is restored through the contraction of the expansion rod to the original standing position, and then the heating of the asphalt pieces is performed by means of burner or microwave generating from a waveguide tube.

During this heating operation, the combustion chamber 21 is rotated by actuating the oil motor 4, the rotation of the combustion chamber 21 being stabilized by the guiding action of the guide rollers 7. With this stabilized rotation of the combustion chamber 21, a uniform and efficient heating of the asphalt pieces can be realized.

When the asphalt pieces are caused to melt sufficiently, the expansion rod of the oil cylinder 6 is contracted to a maximum degree thereby inclining the combustion chamber 21 downward through the rotation of the holding frame 3, thus allowing the molten asphalt to be easily discharged from the opening 20 of the combustion chamber 21.

In the above embodiment, the oil cylinder 6 is provided such that the combustion chamber 21 can be postured in an inclined state at the occasion of throwing asphalt pieces into the combustion chamber 21. However, it is also possible to mount the oil cylinder 6 in such a manner that the opening 20 of the combustion chamber 21 can be turned completely upward (or at an angle of 90 degree upward).

The shape of the holding frame 3 is not restricted to that

shown in the drawings. A guiding groove having a U-sectional shape may be provided on the middle peripheral wall 21a of the combustion chamber 21 so as to assure the engagement thereof with the guide rollers. The structure of the stand 5 is not restricted to any particular shape but can be fabricated in any manner as long as it is capable of rotatably supporting the holding frame 3.

Further, if the combustion chamber 21 of this asphalt-reclaiming apparatus is housed within a casing, any accidental contact of an operator with the combustion chamber can be prevented thereby improving the operational safety. FIG. 8 illustrates an embodiment where a casing 10 for housing the combustion chamber 21 is provided to the asphalt-reclaiming apparatus. In this case, a door is attached to the front side of the casing 10 so that the throwing of asphalt pieces into or the withdrawal of the molten asphalt from the combustion chamber 21 may be carried out by opening the door. The door may be provided with a holder 8 so as to allow a burner or a waveguide tube 9 to be held therein.

The casing 10 may be constructed such that it functions also as a stand by rotatably supporting the rotatable axis of the holding frame 3.

The burner or waveguide tube (for microwave heating) may be attached to the casing or combustion chamber through a holder which is detachably fixed to the casing or combustion chamber. Alternatively, the burner or the waveguide tube of a microwave may be attached through a holder to a cover for closing the opening of the combustion chamber. In any case, the distal end of the burner or

waveguide tube is directed to the opening of the combustion chamber 21.

FIG. 9 shows another embodiment which illustrates a modified and simplified lateral frame of this invention.

A pair of the lateral frames 3c of the holding frame 3 are provided at the distal end portions thereof with pivot pins P2, each extending outward and rotatably mounted on a top portion of the stand 5 thereby allowing the holding frame 3 to be rotated around the pivot pins P2.

Meanwhile, an oil cylinder 6 is pivotally disposed between the rear pedestal 5b of the stand 5 and the rear frame 3a of the holding frame 3. Namely, the distal end of the expandable rod constituting the oil cylinder 6 is pivotally attached to a portion of the rear frame 3a near the oil pressure motor 4, and the proximal end of the expandable rod is pivotally attached to a portion of the rear pedestal 5b which is positioned directly below the portion of the rear frame 3a to which the distal end of the expandable rod is attached.

Other construction details are the same as those of the previous embodiment.

FIG. 10 to FIG. 11 show another embodiment.

In this embodiment, a holding frame 30 comprising a rear frame 31 is disposed behind the combustion chamber 21 in such a manner as to traverse near the center of the back surface of the combustion chamber 21. And a pair of lateral frames 32 formed integrally with the rear frame 31 and extending respectively toward both lateral sides of the combustion chamber 21.

The lateral frame 32 having a lever member 34 extending upward from a middle portion of said lateral frame 32, and a stand 50 pivotally connected to a middle portion of said lever 32, and said stand 50 comprises a pair of polygonal frames including a forward frame portion 51 provided with a bracket, and the stand 50 is pivotally connected at pivot P2' via said bracket to a middle portion of said lever arm 34.

The oil pressure cylinder 36 is disposed between a distal end portion of said lever 34 and a base portion of said stand 50.

Other construction details are the same as those of the previous embodiment.

In the above embodiments, an oil cylinder is employed as an inclining means. However, it is also possible to employ as an inclining means other kinds of fluid pressure cylinders, a set of gears or an expandable link system which is adapted to cause the holding frame to be inclined from the bottom side of the holding frame.

The heating apparatus according to this invention is not limited to the use for heating pieces of asphalt, but may be employed for heating various kinds of materials including waste materials to be discarded from industries.

According to the conveyable heating apparatus of this invention, the combustion chamber is rotatably supported by means of a stand and holding frame, and the inclination of the combustion chamber upward or downward is effected by displacing the holding frame with respect to the stand by actuating the fluid (oil) pressure cylinder, the combustion chamber being inclined together

with the holding frame.

As explained above, the conveyable heating apparatus of this invention is simple in construction and easy in operation for rotating and inclining a combustion chamber so that it is possible to provide a conveyable heating apparatus which is small in size, high in reliability and low in manufacturing cost.

WHAT IS CLAIMED IS:

1. A tilting heating apparatus comprising: a heating container; a heating container holding member which can rotate the heating container around a central axis of the heating container without restraint and supports an opening portion of the heating container so as to be capable of tilting in a vertical direction; and heating means which is arranged at the opening portion of the heating container, the tilting heating apparatus heating a heating object in the heating container,

wherein a raised portion with a substantially tapered cross section that a substantially central part of a bottom surface portion of the heating container protrudes toward an inner side of the heating container is provided to the heating container.

2. The tilting heating apparatus according to claim 1, wherein the raised portion is formed by fixing a plate having a conical shape to the bottom surface portion of the heating container.

3. The tilting heating apparatus according to claim 1 or 2, wherein an agitation blade formed of a plate which is bent at a middle position as seen in plan is fixed inside the heating container, an inner angle of the bent part faces the outside, a gap is provided and arranged between the agitation blade and an inner wall surface of a circumferential wall of the heating container, and the agitation blade scoops up the heating object in the heating container from the gap and causes the heating object to run down

when tilting and rotating the heating container.

4. The tilting heating apparatus according to claim 3, wherein a plurality of agitation blades are provided at substantially equal intervals in a circumferential direction with respect to the central axis of the heating container.

5. The tilting heating apparatus according to claim 1, wherein said heating container holding member consisting of a rear frame disposed behind the combustion chamber in such a manner as to traverse the center of the back surface of the combustion chamber and a pair of lateral frames formed integrally with the rear frame and extending respectively toward both lateral sides of the combustion chamber,

a rotatable shaft extending from the bottom of the combustion chamber for revolving the combustion chamber, the rotatable shaft being adapted to be rotated by a driving device,

a stand pivotally supporting the lateral frames of the holding frame, and

an inclining means disposed between the stand and the holding frame for inclining the combustion chamber upward or downward,

said holding frame comprising an integral body comprising a rear frame disposed behind the combustion chamber so as to traverse the center of the back surface of the combustion chamber, a lower frame extending downward from the both ends of the rear frame to below the combustion chamber, and a pair of lateral frames horizontally extending respectively from the both ends of the rear

frame toward both lateral sides of the combustion chamber, said lower frame being provided thereon with a guide roller contacting with the peripheral wall of the combustion chamber so as to uphold the combustion chamber.

6. The tilting heating apparatus according to claim 5, wherein said stand comprises a pair of lateral pedestals, each extending back and forth, a rear pedestal disposed between and integrally connected to proximal ends of the lateral pedestals, and a pair of legs, each extending upward from the lateral pedestals and bearing on its top portion said lateral frame.

7. The tilting heating apparatus according to claim 6, wherein the inclining means comprises a fluid pressure cylinder, and

wherein said rear frame is provided with a driving device, and the fluid pressure cylinder for inclining the combustion chamber is disposed in such a manner that an upper end of the fluid pressure cylinder is pivotally attached to a portion of the rear frame near the driving device and an lower end of the fluid pressure cylinder is pivotally attached to the rear pedestal.

8. The tilting heating apparatus according to claim 6, wherein the inclining means comprises a fluid pressure cylinder, and

wherein said lateral frame is extended forward beyond the supporting portion of said stand, and said fluid pressure cylinder

is mounted between a distal end portion of said lateral frame and one of said lateral pedestals.

9. A tilting heating apparatus according to claim 1, wherein said heating container holding member consisting of a rear frame disposed behind the combustion chamber in such a manner as to traverse the center of the back surface of the combustion chamber and a pair of lateral frames formed integrally with the rear frame and extending respectively toward both lateral sides of the combustion chamber,

a rotatable shaft extending from the bottom of the combustion chamber for revolving the combustion chamber, the rotatable shaft being adapted to be rotated by a driving device,

a stand pivotally supporting the lateral frames of the holding frame,

an inclining means disposed between the stand and the holding frame for inclining the combustion chamber upward or downward, and

wherein said stand comprises a pair of lateral pedestals, each extending back and forth, a rear pedestal disposed between an integrally connected to proximal ends of the lateral pedestals, and a pair of legs, each extending upward from the lateral pedestals and bearing on its top portion said lateral frame.

10. A tilting heating apparatus according to claim 1, wherein said heating container holding member consisting of a rear frame disposed on a side thereof opposite said open top, in such a manner as to traverse near the center of the back surface of

the combustion chamber and a pair of lateral frame members formed integrally with the rear frame and extending respectively toward both lateral sides of said combustion chamber,

said at least one of said lateral frame members having a middle portion and a lever extending upward from said middle portion of said at least one of said lateral frame members,

a shaft extending from the bottom of the combustion chamber for revolving the combustion chamber, the shaft being adapted to be rotated by a driving device,

a stand pivotally connected to said middle portion of said lever, and

a fluid pressure cylinder disposed between a distal end portion of said lever and a base portion of said stand.

11. A tilting heating apparatus according to claim 10ss, wherein said stand comprises a pair of polygonal frames including a forward frame portion provided with a bracket, and said stand being pivotally connected via said bracket to said middle portion of said lever.