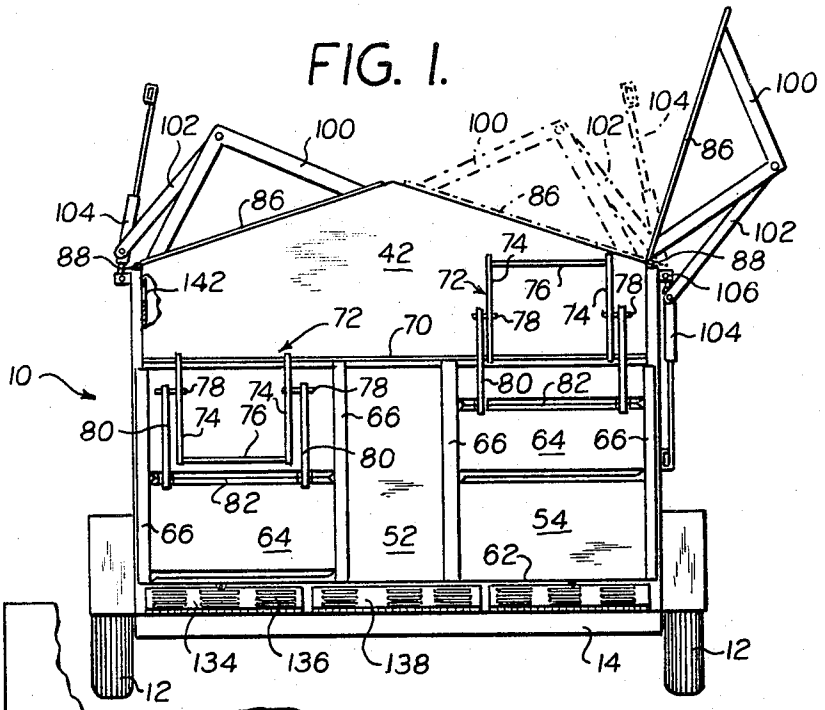
June 4, 1968 A. H. HELLER 3,386,435

VEHICULAR ENCLOSURE FOR MAINTAINING MATERIAL THEREIN AT AN ELEVATED TEMPERATURE

Filed Aug. 1, 1966 2 Sheets-Sheet 1

FIG. 1.



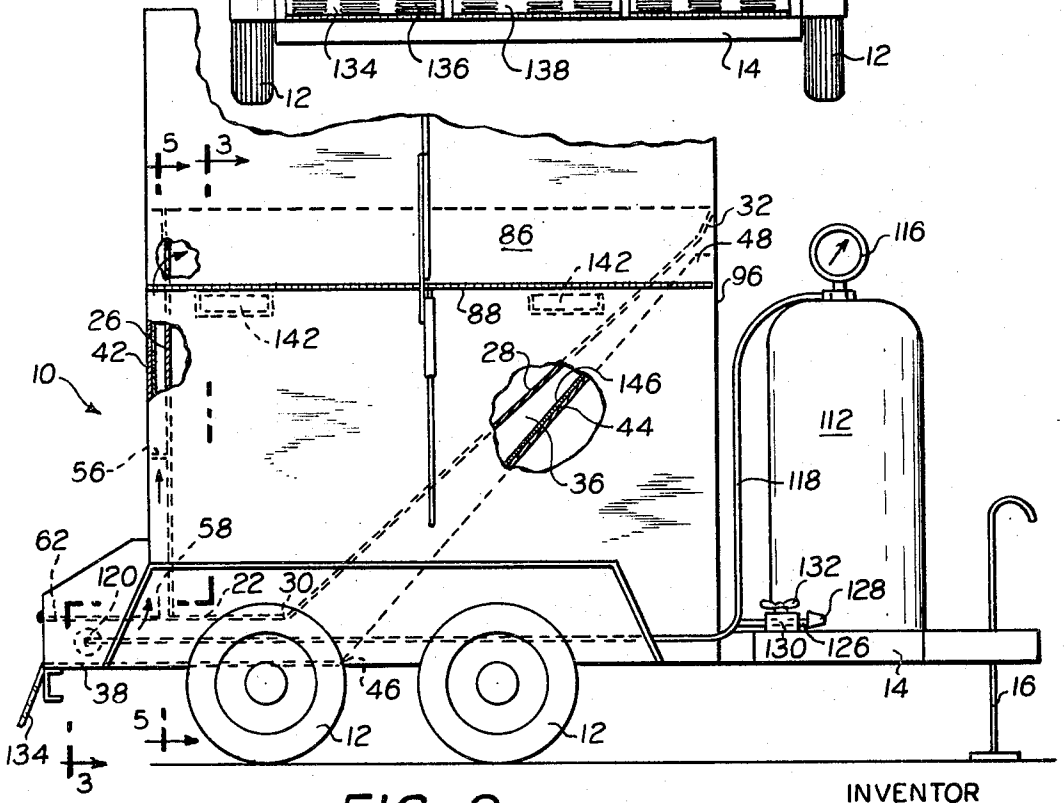


FIG. 2.

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FIG. 3.

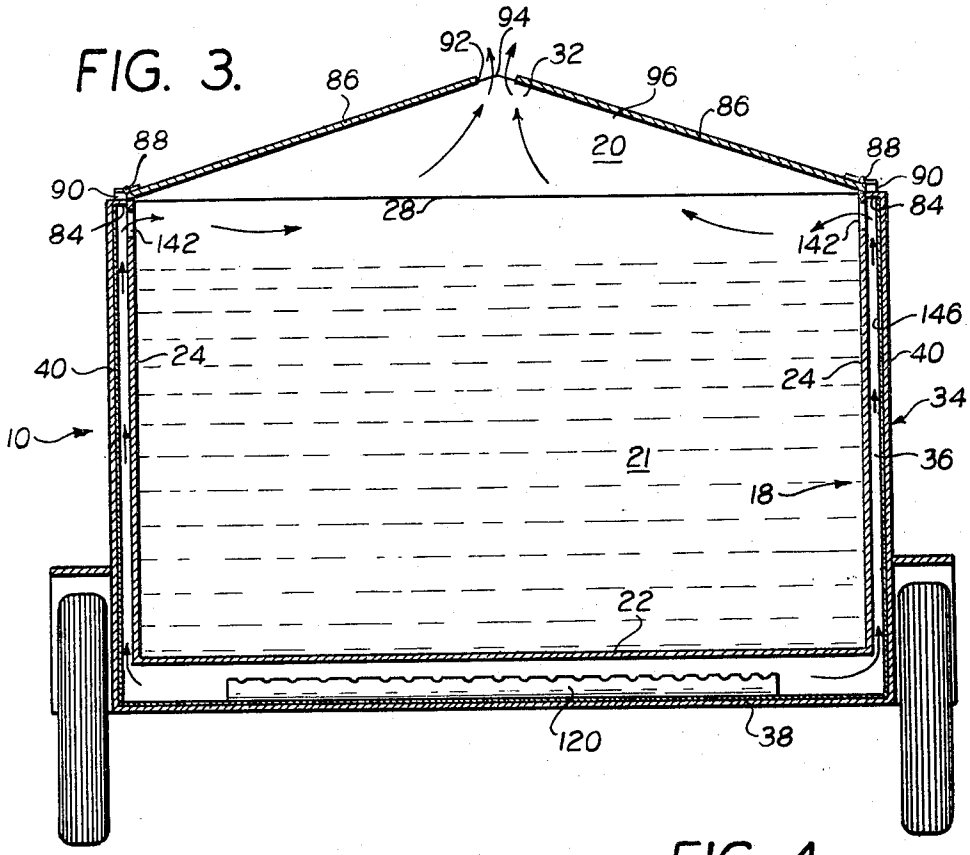


FIG. 4.

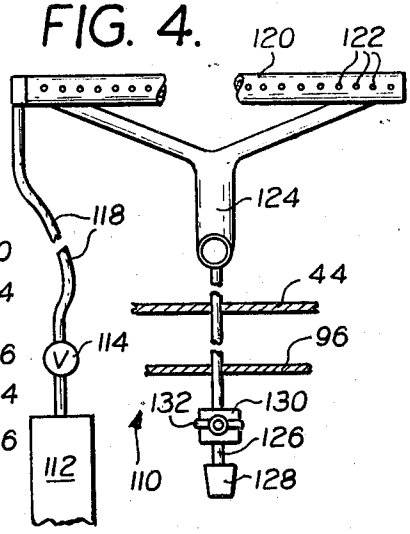
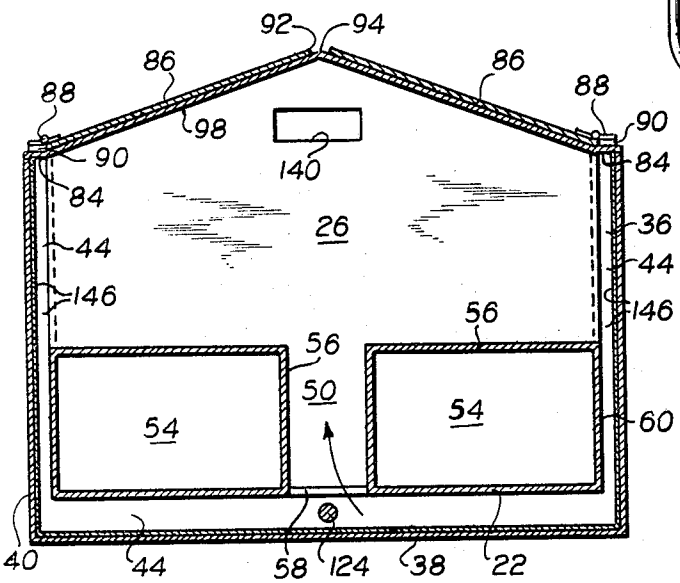


FIG. 5.



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United States Patent Office 3,386,435 Patented June 4, 1968

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VEHICULAR ENCLOSURE FOR MAINTAINING MATERIAL THEREIN AT AN ELEVATED TEMPERATURE

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Filed Aug. 1, 1966, Ser. No. 569,423
10 Claims. (Cl. 126—343.5)

ABSTRACT OF THE DISCLOSURE

A vehiclular enclosure having an interior space for maintaining material therein at an elevated temperature. The enclosure includes means providing heated air to an air space surrounding the interior so that the material is elevated in temperature and a flow of air is created over the material and constantly exhausted therefrom to the surrounding atmosphere.

The present invention relates to the transportation of materials at elevated temperatures.

In particular, the present invention relates to an enclosure which takes the form of a vehicle, such as a trailer, wagon, cart, or the like, and which is capable of traveling to any desired location, either under its own power, or, if it is in the form of a trailer, suitably drawn by another vehicle. At the location to which the enclosure travels, it is possible to use the materials at an elevated temperature at which they are maintained by the vehicular enclosure of the present invention.

The invention relates particularly to a vehicular enclosure which is capable of maintaining ashpalt at an elevated temperature for road-repairing purposes. One of the great problems encountered in the past in road repairs is that any permanent road repairs must necessarily be made during relatively warm atmospheric conditions, as for example, during the summer-time. In the winter, in those regions where it is cold, it has not been possible to make permanent road repairs. In the past, at such times, temporary cold-patch repairs were made, and permanent repairs were put off until the arrival of warmer weather. Yet even during the farm summer months asphalt used for road repairs cools so rapidly within three to four hours it cannot be used.

The primary cause preventing permanent repairs from being made during those parts of the year when the weather is cold is not so much the fact of the lower atmospheric temperatures, per se, but rather the fact that it is not possible to deposit, onto the road, asphalt at the required elevated temperature. Thus, as is well known, asphalt must be at a temperature of approximately 290° F. in order to provide proper permanent road repairs. While it is, of course, possible to load asphalt at this temperature on to a truck at the plant from where the asphalt is initially derived, it was not possible in the past to maintain the asphalt at the proper elevated temperature during travel from the asphalt plant to the location where the road repairs were required. It is particularly during the winter, spring and fall that so much heat escapes, during transportation of the asphalt, that its temperature becomes too low to attempt to make permanent repairs, and thus it had become customary to make only temporary cold patch repairs.

It is therefore a primary object of the present invention to provide a vehicular enclosure which is capable of maintaining a material, such as asphalt, at an elevated temperature, so that in this way problems of the type referred to above will be solved. Thus, in the case of asphalt, with the vehicular enclosure of the present invention it is indeed possible to maintain the asphalt at the required temperature during travel of the vehicle from the asphalt plant to the location where the repairs are required, and thus it becomes possible, without any difficulty, to make permanent road repairs even during the dead of winter. While the invention is particularly suited for handling of asphalt under cold-weather conditions, so as to be capable of producing permanent road repairs at any time of the year, it is to be understood that the vehicular enclosure of the invention can be used wherever there is a need for transportation of material at an elevated temperature.

A further object of the present invention is to provide a vehicular enclosure, of the above general type, which is capable of regulating the temperature at which the materials are maintained.

Also, it is an object of the invention to provide a vehicular enclosure which will make a highly efficient use of heat, so as to provide in an economical manner the required elevated temperatures for the materials which are transported.

In addition, it is an object of the present invention to provide a vehicular enclosure of the above type which is very easy to load and unload and which is relatively simple and inexpensive to manufacture, while at the same time being very robust and rugged enough to withstand the wear and tear encountered in operations such as road-repairing operations.

Primarily, the vehiclular enclosure of the present invention includes an inner wall means, which defines a hollow interior space in which the material to be maintained at the elevated temperature is adapted to be situated in engagement with the inner wall means, and an outer wall means which is of the same general configuration as the inner wall means and which is spaced from the latter so as to define therewith a predetermined air space. A heater means communicates with the air space so as to heat the air therein. Finally, the enclosure of the invention includes a flow creating means for creating a flow of air first through the air space, between the inner and outer wall means, and then across the hollow interior space, defined by the inner wall means. In this way a temperature will be created and maintained about the material in the enclosure that is substantially equal to the elevated temperature of the material when it is initially placed into the enclosure so that a loss or transfer of heat from the material is prevented. Therefore, the material always remains at its initial elevated temperature.

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is an elevational, rear-end view of the vehicular enclosure of the present invention;

FIG. 2 is a partly sectional side view of the structure of FIG. 1 as seen from the right side of FIG. 1, parts of the walls of FIG. 2 being broken away to show in section the structure behind these walls, so as to afford a better understanding of the invention;

FIG. 3 is a transverse section taken along line 3—3 of FIG. 2 in the direction of the arrows;

FIG. 4 is a fragmentary schematic plan view of the heating means of the invention; and

FIG. 5 is a transverse section taken along 5—5 of FIG. 2 in the direction of the arrows.

Referring now to the drawings, and to FIGS. 1 and 2 in particular, the vehicular enclosure **10** of the present invention is supported in any suitable way by wheel assemblies **12** so that the enclosure **10** takes the form of a vehicle which can travel to any desired location. At its front end, which is its right end, as viewed in FIG. 2, the enclosure **10** is fixed to a lower, horizontally extending, rigid framework **14** at the front end of which, situated at the right in FIG. 2, can be hooked onto the rear of any

truck, tractor or other automotive vehicle, for example, so that in this way the vehicular enclosure **10** of the invention can be pulled and forms a trailer which is capable of being transported to any desired location. In the position shown in FIG. 2, the vehicular enclosure **10** is shown by itself and is supported, in the attitude it takes during travel, not only by way of the wheels **12** but also by way of a suitable supporting rod **16** which is removed when the front end of the trailer is hooked on to the rear end of a truck, tractor, or the like. The front of the framework **14** also serves to support part of the heating means, as will be apparent from the description below.

Referring to FIG. 3, the enclosure **10** includes an inner wall means **18** which defines a hollow interior space **20** for the enclosure **10**, and within this hollow interior space **20** is located the material **21**, such as asphalt, which is to be transported at an elevated temperature. The inner wall means **18** includes a bottom wall **22** made of any suitable metal and having a high coefficient of thermal conductivity, and the inner wall means **18** also includes a pair of opposed side walls **24**, which extend upwardly from and perpendicularly with respect to the bottom wall **22**, this bottom wall **22** being horizontal while the parallel side walls **24** are vertical. Referring now to FIG. 2, the inner wall means further includes a vertical rear wall **26** which extends upwardly from the bottom wall **22** at the region of its rear end, and, opposed to the rear end wall **26**, the inner wall means **18** includes a front end wall **28** which is inclined in the manner shown in FIG. 2. Thus, the front end wall **28** has a lower end **30** which is situated nearer to the rear end wall **26** than the upper end **32** of the front end wall **28** of the inner wall means **18**. The front end wall **28** extends completely across the space between the side walls **24** and determines with the latter part of the configuration of the hollow interior space **20**.

The enclosure **10** further includes an outer wall means **34** (FIG. 3) which is of the same general configuration as the inner wall means **18** while being spaced therefrom so as to define an air space **36** therebetween. While the outer wall means **34** can also be made of metal, it need not have the high coefficient of thermal conductivity of the inner wall means. This outer wall means **34** includes a bottom wall **38**, which is generally coextensive with the bottom wall **22**, as well as a pair of opposed side walls **40**. Also, the outer wall means **34** includes a rear-end wall **42** (FIGS. 1 and 2) and a front-end wall **44** (FIG. 2) which is opposed to the rear-end wall **42**. It is to be noted that this front-end wall **44** is inclined similarly to the front-end wall **28** of the inner wall means **18**. Thus, the front-end wall **44** of the outer wall means has a lower end **46** nearer to the rear-end wall **42** than its upper end **48**. It is furthermore to be noted, as clearly shown in FIG. 2, that the inclination of the front-end wall **44** of the outer wall means **34** is not precisely the same as that of the front-end wall **28** of the inner wall means **18**. As is shown in FIG. 2, these front-end walls of the inner and outer wall means respectively converge toward each other from their lower toward their upper ends, so that the distance between the walls **28** and **24** gradually diminishes in an upward direction, for a purpose referred to below.

While the front-end walls **28** and **24** extend all the way across the space between the inner side walls **24**, on the one hand, and the outer side walls **40** on the other hand, respectively, the rear-end walls **26** and **42** extend completely across the space between the side walls **24**, on the one hand, and the side walls **40**, on the other hand, respectively, only at upper portions of these rear-end walls, which have a substantially T-shaped configuration. Thus, as may be seen from FIG. 5, the rear-end wall **26** of the inner wall means **18** has a lower leg portion **50**, and the rear-end wall **42** has a very similar configuration being provided also with a lower leg portion **52**, shown in FIG. 1. Lower leg portion **52** is situated in front of and aligned with the lower leg portion **50** of the inner rear-end wall **26**.

Both of these rear-end walls **26** and **42** are formed at their lower corners with cutouts which will define the openings **54** through which the material **21** can be removed from the interior space **20**. The openings **54** are limited along their inner and top portions by substantially L-shaped transverse members **56** which close off the space **36**, at its portion between walls **26** and **42**, from the openings **54**. It is to be noted from FIG. 5 that the inner bottom wall **22** is formed with an opening **58** which is aligned with the space between the walls **26** and **42** and which extends between the inner vertical legs of the L-shaped closure members **56**, so that air can flow from between the bottom walls **22** and **38** upwardly through the opening **58** into the space between the rear walls **26** and **42**. The inner side walls **24** have lower rear extensions **60** (FIG. 5) which extend all the way up to the outer rear-end wall **42** and which have top edges engaging the undersides of the outer, upper ends of the L-shaped members **56**, so that these extensions **60** of the inner side walls define the outer side edges of the discharge openings **54**. The lower inner wall **22** has to the rear of its opening **58** an extension **62** (FIG. 2) forming a shoveling ledge to which a shovel may be applied for receiving material from the interior space **20** and removing it through the openings **54**.

The rear openings **54** through which the material is adapted to be withdrawn from the space **20** are capable of being opened and closed by a pair of vertically slidable doors **64**, respectively (FIG. 1). The doors **64** are slidable in vertically extending guides **66** carried by the outer rear wall **42**. These guides ar simply channels which are fixed to the rear wall **42** and which receive in their hollow interiors the side edges of the doors **64** so that the latter are vertically slidable between the open position shown for the right door **64** in FIG. 1 and the closed position shown for the left door **64** in FIG. 1. The outer rear end wall **42** is substantially T-shaped, conforming to the configuration of the wall **26** shown in FIG. 5, as pointed out above, and although the outer rear wall **42** extends all the way between the outer side walls **40**, its lower leg portion **52** (FIG. 1) extends only down to the rear extension **62** of the inner bottom wall **22**. The inner pair of guide rails **66** extend along the side edges of the lower leg portion **52** of the outer rear wall **42**, while the outer pair of rails **66**, shown in FIG. 1, are fixed to closure strips which close off the rear ends of the air space **36** beneath the upper wider portion of the outer rear end wall **42**, these closure strips being fixed to the pairs of opposed inner and outer side walls and extending across the space **36** at the rear ends thereof which are at the elevation of the openings **54**. The rails **66** extend higher than the openings **54** so that the upper portions of the rails **66** are fixed directly to the outer rear end wall **42** while the lower portions of these rails, which are situated at the elevations of these openings **54**, are fixed to the above closure strips which are not illustrated in the drawings.

In order to raise and lower the doors **64**, the rear end wall **42** fixedly carries a stationary pivot rod **70** which is mounted on any suitable brackets which are fixed to the rear wall **42** at its exterior surface, this pivot rod **70** extending horizontally in the manner shown in FIG. 1. A pair of handles **72** are pivotally carried by the rod **70**, and each handle includes a pair of levers **74** turnable on the rod **70**, the pair of levers **74** of each handle **72** being interconnected at their outer free ends by a transverse rod **76**. Thus, each handle **72** is swingable from the lower position shown for the left door **64** in FIG. 1 to the upper position shown for the right door **64** in FIG. 1. Intermediate their ends each lever **74** carries a pivot pin **78** which is pivotally connected to a link **80**, so that each handle **72** is pivotally connected with a pair of links **80**. The pair of links **80** are in turn pivotally connected to a transverse rod **82** fixedly mounted on each door **64** at its exterior and carried by any suitable brackets. Thus, the

rods 82 of the rear doors 64 respectively support for turning movement the pair of links 80 which are in turn pivotally connected to the handles 72, in the manner shown in FIG. 1. When each handle 72 is swung upwardly from its lower position shown at the left of FIG. 1 to its upper position shown at the right of FIG. 1, it will displace the links 80 upwardly so as to raise the doors to their open position, and in reaching the upper position shown for the right door in FIG. 1, the handle 72 moves through an over-center position in the manner of a toggle joint with the upper ends of the lever 74 resting directly against the outer surface of the rear end wall 42, so that the downward pull of the door 64 which is in its open position will serve to urge the levers 74 against the wall 42 and thus maintain the door in its open position. In order to close the door the operator grasps the rod 76 and turns the handle 72 through its upper dead-center position, after which the door 64 which is to be closed can simply continue by gravity to the closed position shown for the left door 64 in FIG. 1. In this closed position the lower edge of each door 64 engages the extension or shoveling ledge 62 of the inner bottom wall 22.

The upper ends of the air space 36, situated at the regions of the upper ends of the pairs of opposed inner side walls 24 and the outer side walls 40, are closed by horizontally extending closure strips 84 (FIGS. 3 and 5) which are situated between and fixed to the pairs of opposed inner and outer side walls and which extend along the entire length of the vehicular enclosure 10 of the present invention. The front and rear end walls have at their upper ends the peaked configuration apparent from FIGS. 1, 3 and 5, and these upper ends of the front and rear end walls, as well as the upper ends of the side walls, define an opening through which the interior space 20 can be loaded with the material 21 at a location such as the asphalt plant where the asphalt material is initially received in the interior space 20 of the enclosure 10 of the invention.

In order to close this upper end of the enclosure, a pair of doors 86 are provided, and these doors are respectively supported for swinging movement by hinges 88 mounted on suitable blocks 90, respectively, which are carried by the closure strips 84, as shown, for example, in FIG. 5. Thus, the doors 86 are swingable about the axes which are situated directly over the inner pair of opposed side walls 24, extending parallel thereto, and thus the doors 86 are capable of being swung to and from the closed positions thereof shown in FIGS. 3 and 5.

It is to be noted, from FIGS. 3 and 5, that the inner edges 92 of the doors 86 do not engage each other in the closed positions of the doors 86. Instead these inner edges 92 are spaced from each other by a relatively small distance so as to define between themselves a gap 94. The purpose of this gap is referred to below.

At its front upper end the space 36 is closed, as indicated in FIG. 2, by a front end wall 96 of the vehicle, the upper front ends of the inner front wall 28 and outer front wall 44 being fixed directly to this front end wall 96. At its upper edge the front wall 96 has the peaked configuration shown for the wall 28 in FIG. 3, so that the doors 86 at their front edges will rest directly on the upper edges of the wall 96. The extending of the walls 28 and 44 all the way up to the inner surface of the front wall 96 serves to close off the front upper end of space 36. Beneath its upper end, the front of the air space 36 is closed by wall 44, as shown in FIG. 5. The rear end of the space 36, in the regions of the upper ends of the walls 26 and 42 is closed either by way of a suitable closure strip fixed to these walls in the space therebetween or by way of the rear edge portions of the doors 86. It is preferred to provide a closure strip closing off the rear upper end of the space 36, this strip being situated between and fixed to the walls 26 and 42, and thus, it will be noted that FIG. 5 shows such a closure strip 98 extending between the pair of lateral closure strips 84 and fixed to and extending between the walls 26 and 42, although only the wall 26 is apparent in FIG. 5.

In order to be able conveniently to swing the doors 86 to and from their closed positions, the manually operable linkages shown in FIGS. 1 and 2 are provided. Thus, each door has fixedly connected to its outer surface a triangular frame member 100 situated in a vertical plane and pivotally connected at its upper end to a link 102 which is in turn pivotally connected to a manually turnable bar 104 which is pivoted on a suitable bracket 106 fixed to the exterior of each outer side wall 40 adjacent its upper edge. Thus, when each door 86 is in the closed position shown for the left door 86 in FIG. 1, the handle 104 will be situated in an upper position over the door which is closed, extending angularly over the frame 100 and the link 102.

The handle 104 can be swung to the position shown for the right door 86 in FIG. 1, and it will be noted that now the center of gravity of the door is situated to the right of a vertical plane which includes the turning axis of the door provided by the hinge 88 connected thereto, so that by situating the door 86 in its open position, outwardly of the space between the vertical planes which include the swinging axes for the doors provided by the hinges 88, the doors will remain in the open position shown for the right door 86 in FIG. 1, pressing the handles 104 against the exterior side surface of the outer side walls 40, as shown for the door at the right in FIG. 1. The door 86 which is visible in FIG. 2 is shown in its open position, FIG. 2 also illustrating the hinge 88.

The structure of the invention further includes a heating means 110 shown in its entirety in a schematic, partly fragmentary manner in FIG. 4, part of the heating means also being visible in the remaining figures. The heating means 110 of the invention is an infra-red ray heater and includes a suitable pressurized tank 112 which carries a combustible gas and which can be controlled by manipulation of a valve 114, shown schematically in FIG. 4. FIG. 2 illustrates a pressure gauge 116 carried by the tank 112 of combustible gas. Through a flexible conduit 118 the interior of the tank 112 communicates with a burner 120 which can simply take the form of a hollow tube closed at its end and provided along its upper edge with a row of burner openings 122 through which the gas can escape so as to burn at these openings, and a grid (not shown) above the openings causing the flame to produce an infra-red heat. The flexible conduit 118 communicates with the inner space of the burner pipe 120 in a fluid-tight manner at the left end of this pipe 120, as viewed in FIG. 4. The tank 112 is mounted in any suitable way on the platform provided by the frame 114 which extends forwardly beyond the front wall 96 of the enclosure 10.

The burner 120 extends transversely across the space between the inner and outer bottom walls 22 and 38, in the manner shown in FIG. 3, and it simply rests on the outer bottom wall 38 within the space 36. In the position shown in FIG. 2 the burner 120 is situated between the rear extension of the wall 38, which extends rearwardly beyond the wall 42, and the shoveling ledge extension 62 of the inner bottom wall 22.

As is shown schematically in FIG. 4, the ends of the burner 120 are respectively fixed to the ends of a relatively rigid Y-frame member 124 which at its end distant from the burner 120 is fixed to an elongated rod 126 which extends through suitable openings in the walls 44 and 96, as indicated in FIG. 4. This rod 126 terminates beside the tank 112 in a handle 126 by means of which the entire rod 126 can be longitudinally shifted so as to shift the burner 120 to a selected location in the space 36 between the inner and outer bottom walls, and in this way it is possible to situate the burner 120 at a predetermined location with respect to the opening 58. The conduit 118 extends through openings in the walls 44 and 96 similar to those through which the rod 126 extends, and because

of the flexible nature of the conduit **118** it needs not slide through the openings in these walls.

Forwardly of the wall **96** the rod **126** passes through a suitable glide sleeve **130** fixed on the platform **14** and carrying at its upper end a wing screw **132** which can be loosened so as to permit manual shifting of the rod **126** and thus adjustment of the position of the burner **120**. Once the adjustment of the position of the burner **120** is completed, the wing screw **132** is tightened so as to maintain the burner at its adjusted position in the air space **36**.

The lower rear end of the air space **36** is closed by a swingable door member **134** shown in its open position in FIG. 2 and in its closed position in FIG. 1. As is apparent from FIG. 1, the door **134** is provided with a plurality of vent openings **136** through which air can enter into the space **36** beneath the shoveling ledge **62** and above the rear extension of the bottom wall **38**. The door **134** is releasably retained in its closed position shown in FIG. 1 in any suitable way, and the entire door can be swung into the open position so that the burner **120** can be ignited upon opening of the valve **114**, or the door **134** can have a turnable central section giving access to the burner for igniting the same, after which this turnable central section can be turned back to its position in the same plane as the remainder of the door **134**. Thus, FIG. 1 shows an independently swingable central section **138** carried by and forming part of the door **134**.

The structure of the invention further includes a flow-creating means for creating a predetermined flow of air in order to maintain the material **21** at an elevated temperature in a highly efficient manner. This flow-creating means includes the vented rear door **134** through which air enters into the space **36**. In addition, the flow-creating means includes an upper portion of the inner rear end wall **26** which is formed with a vent opening **140**. In addition, this flow-creating means includes a pair of upper vent openings **142** formed in upper portions of each inner side wall **24** adjacent the upper edge thereof and adjacent to the front and rear ends thereof, respectively. Finally, the flow-creating means of the invention includes the inner edge portions **92** of the door **86** which define the gap **94** between themselves. Thus, the flow-creating means of the invention creates a flow of air past the burner **120**, so as to be heated by the latter, and then upwardly through all parts of the air space **36** between the inner and outer pairs of opposed walls which are formed by the inner pairs of side walls and end walls and the outer pairs of side walls and end walls, and when reaching the upper end of the space **36** the heated air will necessarily flow through the vent openings **140** and **142** into the space **20** over the material **21** therein to flow over and swirl enveloping about the material **20** and out through the gap **94**. Each of the vent openings **140** and **142** can be provided with suitable louvres which are capable of being turned so as to adjust the size of the vent openings.

The converging relationship of the walls **28** and **44** shown in FIG. 2 has a Venturi effect creating a faster flow of air at the region of the pair of front vents **142** so that in this way the faster flow of air compensates for the greater distance of the front end of the space **20** from the burner **120**.

In addition, in accordance with the present invention, the heating means includes not only the structure shown in FIG. 4 but also a coating **146** covering the entire inner surface of the outer wall means. Thus, this coating **146** covers the inner surface of the front end wall **44** as well as the rear end wall **42**, it covers the upper surface of the outer bottom wall **38**, and it covers the inner surface of the opposed side walls **40**. This coating **146** is in the form of a reflective aluminum paint which is directly applied to the inner surface of the outer wall means. This coating has the property of reflecting infra-red rays at 90° angles, which is to say perpendicularly away from the reflective coating **146**, so that as a result heat which otherwise would pass through the outer wall means, unnecessarily heating the same and becoming wasted, is instead reflected back to the inner wall means which because of its high coefficient of thermal conductivity makes excellent use of this reflected heat and adds it to the heat directly derived by contact with the heated air in the space **36**, so that in this way an extremely efficient heating of the material **21** is derived through the inner wall means, not only as a result of the properties of the inner wall means itself but also as a result of the reflection of heat by the coating **146**. It has been found that as a result of this expedient practically no heat is lost through the outer wall means to the outer atmosphere.

It is to be noted that those portions of the outer side walls **40** which extend to the right, as viewed in FIG. 2, beyond the outer front end wall **44** extend all the way up to the rear end wall **96** to define with the latter a dead space situated beneath the wall **44** between the latter and the front end wall **96** as well as between those extensions of the walls **40** which extend forwardly beyond the wall **44**. Either of the walls **40** or the front end wall **96** may be formed with a suitable door giving access to this dead space, and this space may be used to store accessories, tools, or the like. While this dead space represents part of the vehicle **10** which cannot be used to contain material **21**, nevertheless it has been found advantageous to provide the arrangement shown in FIG. 2 since with the inclined front end walls the material flows more readily to the rear outlet openings **54**. In addition, the thickness of the body of material which must be heated gradually diminishes toward the front of the vehicle where the body of material has portions which are situated at greater distances from the heating means, which will generally be situated toward the rear of the vehicle so as to receive the air at least approximately at a time when it initially enters into the space **36** through the vents **136** of the wall **134**. Therefore, at those regions which are more distant from the burner the inclined walls **28** and **44** provide a lesser thickness of material to be heated, so that in this way also maintaining of the material uniformly at the desired temperature is achieved. It is emphasized that it is not essential to situate the burner **120** rearwardly of the opening **58**. It is also desirable under certain circumstances to situate the burner forwardly of the opening **58**, as for example, in the case where it is desirable to apply a slow regulated gradual cooling, which is brought about by passing upwardly through the space **36** an air which is not heated to the intense extent that is provided by situating the burner **120** at the location shown in FIG. 2, where substantially all of the air will initially be heated upon entering the space **36**.

The manner in which the structure of the invention is used is believed to be apparent from the above description. When the vehicle arrives at the plant, the doors **86** are opened and the material **21** is loaded into the enclosure **10**, both of the doors **64** being closed at this time. Before the material **21** is received in the hollow interior space **20** defined by the inner wall means **18**, the burner **120** has been ignited so that the material introduced into the space **20** does not engage cold walls. Instead it engages walls which have been preheated to a given temperature which will serve to maintain the material **21** at the selected temperature. As soon as the material is loaded the doors **86** are closed, and from past experience it is known how to adjust the location of the burner **120** as well as how to adjust the louvres or the like which control the passage of the heated air through the vents **140** and **142**, so that in this way while the vehicular enclosure **10** of the invention travels to the required location, the burner **120** keeps burning while air flows through the openings **136** of the rear wall **134** into the space **36** and past the burner **120** to be heated thereby, after which the heated air flows upwardly through the space **36** and out through the vents **140** and **142** in the manner described above. It is to be noted that this flow will con-

tinuously take place because of the tendency of the hot air to rise. Thus, the heated air which reaches the hollow space **20** above the material in this latter space will of course flow out through the gap **94** to the outer atmosphere thus drawing additional air into the space **36** through the openings **136** and up through the space between the inner side wall means **18** and outer side wall means **34**. The heat is of course reflected from the outer wall means to the inner wall means by the coating **146**, and in addition there is a direct heating of the material **21** at its upper surface by way of the heated air which issues from the vents **140** and **142** to flow along the upper surface of the material before reaching the discharge gap **94** defined between the edges **92** of the doors **86**. The hot air issuing through the vent **140** flows longitudinally from the rear toward the front along the central upper portion of the material, while the air coming into the space **20** from the vents **142** flows transversely across the top of the material, so that in this way even the upper exposed surface of the material is maintained at an elevated temperature, so as to prevent a lowering of the temperature at the upper exposed surface of the material. Such a lowering of the temperature would provide an undesirable diminishing of the temperature of the body of the material in its interior due to travel of the heat from the hot interior to the exposed upper surface of the body of material **21**, whereas the expedient of directing the hot air directly over the surface of the material to a very large extent prevents this undesirable flow of heat out of the material **21**.

It thus becomes possible with the structure of the invention to maintain a material **21** for a long period of time at the required elevated temperature, and when the vehicle **10** reaches the desired location, the operator can open first one of the doors and then the other of the doors so as to discharge the hot material from the vehicular enclosure **10** of the invention to any desired location. The use of a pair of doors **64** with a pair of openings **54** is also preferred since in this way, even during the removal of the material, a large part thereof is not exposed to the outer atmosphere, and thus even during removal of material from the enclosure the material is maintained to a very large extent at the required elevated temperature. Of course, when opening one of the doors **64** it is perfectly possible for the operator to loosen the nut **132** and readjust the position of the burner **120** as well as to adjust the valve **114**, so as to provide additional heat, if required, to maintain the material at the required elevated temperature during removal thereof through one of the openings **54**. Thus, through all of these adjustments, namely adjustments of the valve **114** and the handle **128**, enabling the position of the burner **120** to be adjusted, and the adjustments of the louvres at the vents **140** and **142**, is possible to maintain with a very high degree of accuracy, the material **21** at the required temperature.

When the pressure gauge **116** indicates that there is insufficient gas in the tank **112** to maintain the required flame at the burner **120**, the operator closes the valve **114** and disconnects the tank **112** and replaces it with a new tank which may be stored in the dead space in front of the wall **44** so as to be readily available whenever required. Furthermore, elements such as the supporting rod **16** shown in the right of FIG. 2 may be stored in this dead space so as to be available for supporting the enclosure **10** when it reaches the required location, so that in this way once the enclosure **10** of the invention has been transported to the desired location, the truck, tractor, or the like which has pulled the vehicular enclosure to the required location can leave it at this location and be used for other purposes.

What is claimed is:

1. A vehicular enclosure adapter to contain material which is to be maintained at an elevated temperature, comprising inner wall means defining a hollow interior space in which material is adapted to be located in engagement with said inner wall means, outer wall means having a configuration conforming generally to that of said inner wall means, said outer wall means being spaced from said inner wall means and defining a predetermined air space therewith, heating means communicating with said air space for heating the air therein, flow-creating means operatively connected with said inner and outer wall means for creating a flow of air through said air space and from the latter across at least an upper portion of said hollow interior space so that air flowing through said air space is heated by said heating means to heat the material in said hollow interior space through said inner wall means and then the heated air, by flowing across at least said upper portion of said hollow interior space, directly engages the material in said interior space at an upper surface of the material for additionally heating the latter, and the top of said hollow interior space being constantly open to the surrounding atmosphere for the normal exhaust of the air flowing across the upper portion of said hollow interior space and therefrom to the surrounding atmosphere.

2. The combination of claim **1** and wherein said flow-creating means includes an inlet for admitting air into said air space and an outlet carried by said inner wall means at said upper portion of said hollow interior space for discharging heated air into said hollow interior space.

3. The combination of claim **2**, and wherein an upper door means is carried by at least one of said wall means for movement between an open position giving access to said hollow interior space through said upper portion thereof and a closed position substantially closing off said upper portion of said hollow interior space from the outer atmosphere, said door means in said closed position thereof leaving said constant opening through which air, which passes across the upper portion of the hollow interior space, can escape to the outer atmosphere.

4. The combination of claim **1**, and wherein a heat-reflecting means is carried by said outer wall means at an inner surface thereof which is directed toward said inner wall means for reflecting heat away from said outer wall means to said inner wall means for additionally heating the latter.

5. The combination of claim **1**, and wherein an adjusting means is operatively connected with said heating means for adjusting the position thereof with respect to said air space.

6. The combination of claim **1**, and wherein each of said wall means includes a bottom wall, a pair of opposed side walls extending upwardly from said bottom wall, and a pair of opposed end walls extending upwardly from said bottom wall, said heaing means being situated between said bottom walls, and said bottom walls respectively having rear ends in the region of which said heating means is situated, closure means extending between and connected to said pairs of opposed walls in the region of upper ends thereof for closing said air space at an upper portion thereof, and said flow-creating means including a rear wall extending between said bottom walls in the region of said rear ends thereof and formed with inlet vents through which air enters into said air space to flow past said heating means therein, said flow-creating means including upper portions of at least one of said pairs of opposed walls formed with outlet vents through which heated air flows from said air space into said hollow interior space defined by said inner wall means.

7. The combination of claim **6**, and wherein said pair of opposed side walls are formed with said vents at said upper portion of said hollow interior space.

8. The combination of claim **7**, and wherein a pair of doors are respectively pivotally connected to one of said pairs of opposed side walls for movement between open positions giving access to the interior space through an upper portion thereof and closed positions where said pair of doors are situated adjacent to but spaced slightly from

each other to form between themselves said constant opening through which air can escape to the outer atmosphere from said hollow interior space.

9. The combination of claim **6**, and wherein each of said pairs of opposed end walls includes a rear end wall and a front end wall, and said front end walls being inclined and having lower ends nearer to said rear end walls than upper ends thereof, said rear end walls being formed with openings through which the material can be removed from said hollow interior space, and door means cooperating with the latter openings for covering and uncovering the latter so as to close and open said hollow interior space at said openings of said rear walls.

10. The combination of claim **9**, and wherein said bottom walls respectively have rear extensions extending rearwardly beyond said rear end walls and said heating

means being situated in the region of said extensions, said rear wall which extends between said bottom walls and is formed with said inlet vents being situated rearwardly of said rear end walls.

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REEXAMINATION CERTIFICATE (42nd)

United States Patent [19]

Heller

[11] **B1 3,386,435**

[45] Certificate Issued **Jan. 18, 1983**

[54] **VEHICULAR ENCLOSURE FOR MAINTAINING MATERIAL THEREIN AT AN ELEVATED TEMPERATURE**

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Reexamination Request

No. 90/000,109, Nov. 13, 1981

Reexamination Certificate for:

Patent No.: **3,386,435**
Issued: **Jun. 4, 1968**
Appl. No.: **569,423**
Filed: **Aug. 1, 1966**

[51] **Int. Cl.**[3] **E0IC 19/45**
[52] **U.S. Cl.** ..... **126/343.5 A**; 126/343.5 R
[58] **Field of Search** ..... 126/343.5 R, 343.5 A

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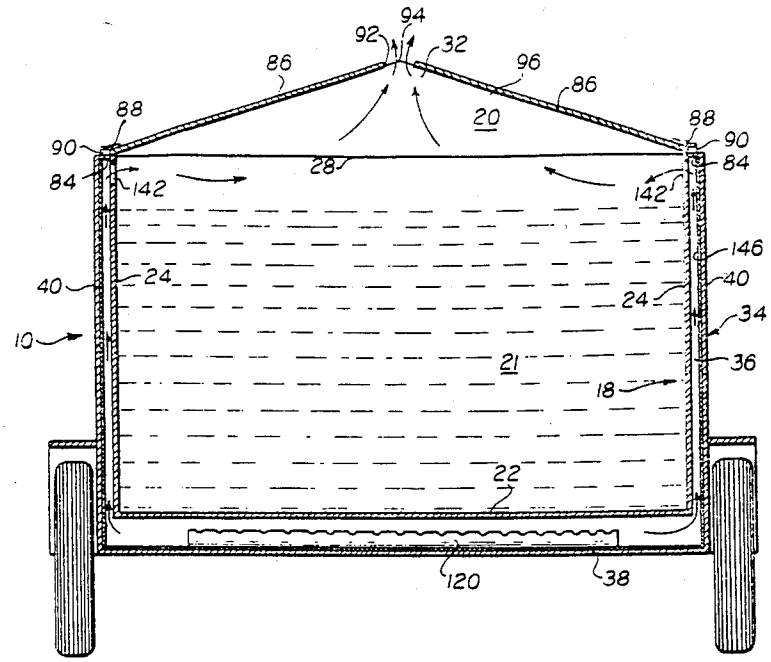
Primary Examiner—Larry Jones

[57] **Abstract**

A vehicular enclosure having an interior space for maintaining material therein at an elevated temperature. The Enclosure includes means providing heated air to an air space surrounding the interior so that the material is elevated in temperature and a flow of air is created over the material and constantly exhausted therefrom to the surrounding atmosphere.



REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307.

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

ONLY THOSE PARAGRAPHS OF THE SPECIFICATION AFFECTED BY AMENDMENT ARE PRINTED HEREIN

Column 1, lines 34–47.

The invention relates particularly to a vehicular enclosure which is capable of maintaining [ashpalt] *asphalt* at an elevated temperature for road-repairing purposes. One of the great problems encountered in the past in road-repairs is that any permanent road repairs must necessarily be made during relatively warm atmospheric conditions, as for example, during the summer-time. In the winter, in those regions where it is cold, it has not been possible to make permanent road repairs. In the past, at such times, temporary cold-patch repairs were made, and permanent repairs were put off until the arrival of warmer weather. Yet even during the [farm] *warm* summer months asphalt used for road repairs cools so rapidly within three to four hours it cannot be used.

Column 3, lines 36–75.

The enclosure **10** further includes an outer wall means **34** (FIG. 3) which is of the same general configuration as the inner wall means **18** while being spaced therefrom so as to define an air space **36** therebetween. While the outer wall means **34** can also be made of metal, it need not have the high coefficient of thermal conductivity of the inner wall means. This outer wall means **34** includes a bottom wall **38**, which is generally coextensive with the bottom wall **22**, as well as a pair of opposed side walls **40**. Also, the outer wall means **34** includes a rear-end wall **42** (FIGS. 1 and 2) and a front-end wall **44** (FIG. 2) which is opposed to the rear-end wall **42**. It is to be noted that this front-end wall **44** is inclined similarly to the front-end wall **28** of the inner wall means **18**. Thus, the front-end wall **44** of the outer wall means has a lower end **46** nearer to the rear-end wall **42** than its upper end **48**. It is furthermore to be noted, as clearly shown in FIG. 2, that the inclination of the front-end wall **44** of the outer wall means **34** is not precisely the same as that of the front-end wall **28** of the inner wall means **18**. As is shown in FIG. 2, these front-end walls of the inner and outer wall means respectively converge toward each other from their lower toward their upper ends, so that the distance between the walls **28** and [24] *44* gradually diminishes in an upward direction, for a purpose referred to below.

While the front-end walls **28** and [24] *44* extend all the way across the space between the inner side walls **24**, on the one hand, and the outer side walls **40** on the other hand, respectively, the rear-end walls **26** and **42** extend completely across the space between the side walls **24**, on the one hand, and the side walls **40**, on the other hand, respectively, only at upper portions of these rear-end walls, which have a substantially T-shaped configuration. Thus, as may be seen from FIG. 5, the rear-end wall **26** of the inner wall means **18** has a lower leg portion **50**, and the rear-end wall **42** has a very similar configuration being provided also with a lower leg portion **52**, shown in FIG. 1. Lower leg portion **52** is situated in front of and aligned with the lower leg portion **50** of the inner rear-end wall **26**.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claims **1**, **2**, **4** and **5**, having been finally determined to be unpatentable, are cancelled.

The patentability of claims **7–10** is confirmed.

Claims **3** and **6** are determined to be patentable as amended:

3. *A vehicular enclosure adapted to contain material which is to be maintained at an elevated temperature, comprising inner wall means defining a hollow interior space in which material is adapted to be located in engagement with said inner wall means, outer wall means having a configuration conforming generally to that of said inner wall means, said outer wall means being spaced from said inner wall means and defining a predetermined air space therewith, heating means communicating with said air space for heating the air therein, flow-creating means operatively connected with said inner and outer wall means for creating a flow of air through said air space and from the latter across at least an upper portion of said hollow interior space so that air flowing through said air space is heated by said heating means to heat the material in said hollow interior space through said inner wall means and then the heated air, by flowing across at least said upper portion of said hollow interior space, directly engages the material in said interior space at an upper surface of the material for additionally heating the latter, and the top of said hollow interior space being constantly open to the surrounding atmosphere for the normal exhaust of the air flowing across the upper portion of said hollow interior space and therefrom to the surrounding atmosphere, and wherein said flow-creating means includes an inlet for admitting air into said air space and an outlet carried by said inner wall means at said upper portion of said hollow interior space for discharging heated air into said hollow interior space,* [The combination of claim 2,] and wherein an upper door means is carried by at least one of said wall means for movement between an open position giving access to said hollow interior space through said upper portion thereof and a closed position substantially closing off said upper portion of said hollow interior space from the outer atmosphere, said door means in said closed position thereof leaving said constant opening through which air, which passes across the upper portion of the hollow interior space, can escape to the outer atmosphere.

6. *A vehicular enclosure adapted to contain material which is to be maintained at an elevated temperature, comprising inner wall means defining a hollow interior space in which material is adapted to be located in engagement with said inner wall means, outer wall means having a configuration conforming generally to that of said inner wall means, said outer wall means being spaced from said inner wall means and defining a*

predetermined air space therewith, heating means communicating with said air space for heating the air therein, flow-creating means operatively connected with said inner and outer wall means for creating a flow of air through said air space and from the latter across at least an upper portion of said hollow interior space so that air flowing through said air space is heated by said heating means to heat the material in said hollow interior space through said inner wall means and then the heated air, by flowing across at least said upper portion of said hollow interior space, directly engages the material in said interior space at an upper surface of the material for additionally heating the latter, and the top of said hollow interior space being constantly open to the surrounding atmosphere for the normal exhaust of the air flowing across the upper portion of said hollow interior space and therefrom to the surrounding atmosphere, [The combination of claim 1,] and wherein each of said wall means includes a bottom wall, a pair of opposed side walls extending upwardly from said bottom wall, and a pair of opposed end walls extending upwardly from said bottom wall, said [heaing] *heating* means being situated between said bottom walls, and said bottom walls respectively having rear ends in the region of which said heating means is situated, closure means extending between and connected to said pairs of opposed walls in the region of upper ends thereof for closing said air space at an upper portion thereof, and said flow-creating means including a rear wall extending between said bottom walls in the region of said rear ends thereof and formed with inlet vents through which air enters into said air space to flow past said heating means therein, said flow-creating means including upper portions of at least one of said pairs of opposed walls formed with outlet vents through which heated air flows from said air space into said hollow interior space defined by said inner wall means.

New claims **11–15** are added and determined to be patentable.

11. *A vehicular enclosure adapted to contain asphaltic material comprising means for maintaining the material at a relatively constant temperature of about 290°F and below the melting point of the material for a relatively long period of time, further comprising inner wall means defining a hollow interior space in which material is adapted to be located in engagement with said inner wall means, outer wall means having a configuration conforming generally to that of said inner wall means, said outer wall means being spaced from said inner wall means and defining a predetermined air space therewith, heating means communicating with said air space for heating the air therein, flow-creating means operatively connected with said inner and outer wall means for creating a flow of air through said air space and from the latter across at least an upper portion of said hollow interior space so that air flowing through said air space is heated by said heating means to heat the material in said hollow interior space through said inner wall means and then the heated air, by flowing across at least said upper portion of said hollow interior space, directly engages the material in said interior space at an upper surface of the material for additionally heating the latter, and the top of said hollow interior space being constantly open to the surrounding atmosphere for the normal exhaust of the air flowing across the upper portion of said hollow interior space and therefrom to the surrounding atmosphere.*

12. *A vehicular enclosure adapted to contain asphaltic material which is to be maintained at an elevated temperature, comprising inner wall means defining a hollow interior space in which material is adapted to be located in engagement with said inner wall means, outer wall means having a configuration conforming generally to that of said inner wall means, said outer wall means being spaced from said inner wall means and defining a predetermined air space therewith, heating means producing relatively uniform heat and communicating with said air space for heating the air therein without direct contact between said heating means and said inner wall means so that the material is maintained at a temperature below the melting point, flow-creating means operatively connected with said inner and outer wall means for creating a flow of air through said air space and from the latter across at least an upper portion of said hollow interior space so that air flowing through said air space is heated by said heating means to heat the material in said hollow interior space through said inner wall means and then the heated air, by flowing across at least said upper portion of said hollow interior space, directly engages the material in said interior space at an upper surface of the material for additionally heating the latter, and the top of said hollow interior space being constantly open to the surrounding atmosphere for the normal exhaust of the air flowing across the upper portion of said hollow interior space and therefrom to the surrounding atmosphere.*

13. *The combination of claim* **12,** *wherein said heating means produces infra-red heat.*

14. *A vehicular enclosure adapted to contain asphaltic material which is to be maintained at an elevated temperature, comprising inner wall means defining a hollow interior space in which material is adpated to be located in engagement with said inner wall means, outer wall means having a configuration conforming generally to that of said inner wall means, said outer wall means being spaced from said inner wall means and defining a predetermined air space therewith, heating means communicating with said air space for heating the air therein, flow-creating means operatively connected with said inner and outer wall means for creating a flow of air through said air space and from the latter across at least an upper portion of said hollow interior space so that air flowing through said air space is heated by said heating means to heat the material in said hollow interior space through said inner wall means and then the heated air, by flowing across at least said upper portion of said hollow interior space, directly engages the material in said interior space at an upper surface of the material for additionally heating the latter, said flow-creating means including said inner wall means being formed near the upper portion thereof with a plurality of spaced apart, relatively small outlet vents through which heated air flows from said air space into said hollow interior space defined by said inner wall means, and the top of said hollow interior space being constantly open to the surrounding atmosphere for the normal exhaust of the air flowing across the upper portion of said hollow interior space and therefrom to the surrounding atmosphere.*

15. *The combination of claim 14, wherein said heated air flows through said small outlet vents both laterally and transversely across the upper portion of said hollow interior space.*

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