PORTABLE DOUBLE-WALLED FUEL TANK

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ABSTRACT
A double-walled tank for the transport of fluid, the tank includes a rigid fluid impervious substantially cylindrical inner container concentrically nested within a rigid correspondingly substantially cylindrical outer container, the inner and outer containers having end walls sealing the containers. A grapple mount is mounted to an upper side of an outer surface of the outer container at a substantially medial position substantially medially along the outer container. A lower side of the outer container, opposite the upper side, is reinforced. The grapple mount may include a rigid plate mounted atop the upper side of the outer container at the medial position. An anti-surge baffle is mounted across, so as to extend between and into engagement with, an upper side of the inner container adjacent the baffle mount and a lower side of the inner container adjacent the reinforced lower side of the outer container.
PORTABLE DOUBLE-WALLED FUEL TANK

FIELD OF THE INVENTION

This invention relates to a double-walled fuel tank, which is constructed so as to be readily transportable over rough terrain to a remote timber-harvesting site or relocatable on such a site by log handling equipment such as, for example, a grapple machine.

BACKGROUND OF THE INVENTION

Timber harvesting is generally carried out at sites which are initially remote and accessible only by very rough skid roads. Harvesting equipment such as feller-bunchers and grapple skidders are utilized in transporting cut logs and whole trees from even more remote and inaccessible locations to the skid roads. Such harvesting equipment, by way of example, and other equipment used generally in this timber-harvesting environment, need to be supplied with an adequate supply of fuel for their continuous and efficient operation.

Presently, small quantities of fuel are carried in tanks of limited fuel capacity by four-wheel-drive trucks or the like to a remote timber-harvesting site. Even the transportation of these small quantities of fuel by this method requires a fairly smooth roadway be provided, generally free of felled timber, logging debris and excessive gradients.

Of further concern is the need to relocate the fuel within a cutting site to keep it in general proximity to the harvesting equipment as it works through a harvesting area. Generally, the cutting and harvesting of timber and the movement of associated equipment will produce a terrain unsuitable for travel by any vehicle other than articulated, high ground clearance grapple skidders or the like.

There is a need under such timber harvesting conditions to provide a fuel tank of sufficient fuel capacity and manufactured with the strength and durability to be transported by a grapple machine or the like to and around a remote timber-harvesting site. Such a fuel tank, therefore, will provide all ancillary equipment necessary for pumping the fuel from the tank to the timber harvesting equipment as well as safety equipment necessary for suppression of accidental fire.

SUMMARY OF THE INVENTION

The double-walled fuel tank of the present invention may be manufactured from ¼-inch thick mild steel and comprise an inner cylindrical fuel-containing receptacle or tank and an outer cylindrical protective sheath.

The inner fuel-receptacle is concentrically nested within the protective outer sheath by means of a plurality of radially outwardly extending spacers, for example mild steel spacers, extending between the outer surface of the fuel tank and the inner surface of the protective outer sheath. End spacers extend fore and aft of the respective end walls of the inner fuel tank and are suitably apertured at intervals along their length to permit liquid to drain by gravity to the lower portion of the outer sheath. The outer sheath has fore and aft end walls mounted to the end spacers so as to be spaced outwardly from the respective end walls of the inner fuel tank.

Outer sheath may have a bulkhead spaced forwardly from its aft end wall to provide a storage compartment for retaining such equipment as batteries, an electrical motor, fuel hoses, fire suppression equipment and the like which are readily accessible through an access hatch provided in the aft end wall. The storage compartment may be secured by a door, hinged at an end to the aft end wall of the outer sheath and which may be supported in an open position by gas shocks or the like. The bulkhead wall of the outer sheath may be mounted to the respective ends of the corresponding end spacers on the fuel tank. A drain plug is provided in the aft end wall to allow draining of liquid from the storage compartment.

Axially aligned separate fuel filler pipes are provided on the upper surface of both the inner fuel tank outer protective sheath near the aft end of the fuel tank. Similarly, axially aligned drainage plugs are provided in the respective lower surfaces of the fuel tank and the protective outer sheath.

The inner fuel tank may have an internal anti-surge baffle mounted mediately of the fore and aft ends of the receptacle, which inhibits imbalance due to fluid movement during transportation.

A fuel shut-off valve passes through both the aft end of the fuel-containing receptacle and the storage compartment bulkhead. Such valve is normally closed and is opened when current from the battery power is connected to operate a fuel pump to discharge fuel to the timber harvesting equipment.

The double-walled fuel tank has fore and aft supporting skids, an exterior, lower reinforcement collar positioned medially of its ends, an upper grapple platform and fore and aft grapple positioning brackets located in proximity to the upper grapple platform.

Gussets affixed between the fore end tank supporting skid and outer sheath are apertured to permit attachment of chains or the like which may be secured to the body of a transporting mechanism such as a grapple machine to restrict yaw of the tank during transport. In addition, loops manufactured from a chain link or the like may be provided at each of the grapple positioning brackets to afford a safety chain connection point between the tank and suitable attachment points located on the grapple jaws.

The portable double-walled fuel tank in accordance with one embodiment of the invention may be generally characterized as including:

(a) an outer, generally horizontally disposed cylindrical sheath, which comprises the outer protective wall of the fuel tank, manufactured, by way of example, from ⅛-inch thick mild steel or the like material with fore and aft end walls which defined an internal cavity.

(b) An internal bulkhead positioned forwardly from the aft end wall of the outer sheath which defines a smaller cavity or storage compartment, wherein external access is provided to the storage compartment through a secureable door or access hatch provided in the aft end wall of the sheath.

(c) Fore and aft skids secured beneath the outer cylindrical sheath support it in an elevated aspect relative to the ground surface.
(d) A lower reinforcement collar, generally surrounding the lower segment of the outer sheath, intermediate its ends, extends generally upwardly to the mid line.

(e) A grapple platform and fore and aft grapple positioning brackets are located on the upper side of the cylindrical sheath

(f) An inner fuel receptacle concentrically nested within the protective outer sheath by means of a plurality of radially outwardly extending mild steel spacers extending between the outer surface of the fuel containing receptacle and the inner surface of the protective outer sheath. The spacers generally extend fore and aft of the inner fuel receptacle.

(g) An internal anti-surge baffle is provided medially of the fore and aft ends of the fuel-receptacle to structurally reinforce the tank where it is gripped by a grapple while being carried, the baffle having upper and lower apertures or cut-outs which inhibit surging, for example due to a pressure differential on either side of the baffle, and which allows substantially unrestricted flow of liquid during pumping of liquid from the tank.

In summary, the present invention maybe characterized in one aspect as a double-walled tank for the transport of fluid, the tank including a rigid fluid impervious substantially cylindrical inner container concentrically nested within a rigid correspondingly substantially cylindrical outer container, the inner and outer containers having end walls sealing the containers. A grapple mount is mounted to an upper side of an outer surface of the outer container at a substantially medial position substantially medially along the outer container. A lower side of the outer container, opposite the upper side, is reinforced. The grapple mount may include a rigid plate mounted atop the upper side of the outer container at the medial position.

An anti-surge baffle is mounted across, so as to extend between and into engagement with, an upper side of the inner container adjacent the baffle mount and a lower side of the inner container adjacent the reinforced lower side of the outer container. The baffle has an upper aperture in an upper side of the baffle adjacent the upper side of the inner container. The baffle has a lower aperture in a lower side of the baffle adjacent the lower side of the inner container. The lower aperture is defined between lower extremities of the baffle mounted to the lower side of the inner container. The lower extremities of the baffle extend along in supporting contact with an inner surface of the lower side of the inner container so as to be coextensive with distal ends of grapple arms of a grapple engaging the grapple mount so as to extend the grapple arms of the grapple around a grapple line extending substantially from the substantially medial position and extending around the outer container from the upper side to the lower side of the outer container.

A radially spaced apart array of rigid stringers extend along the inner and outer containers in a substantially cylindrical gap between the inner and outer containers. The array of rigid stringers are mounted to, so as to extend between, into engagement with, the inner and outer containers so as to rigidly space apart the inner and outer containers. At least one stringer of the array of rigid stringers is sandwiched on opposite lateral sides of the inner and outer containers between the inner container and the reinforced lower side of the outer container.

In one embodiment the end walls are single-walled end walls providing a common end wall on each end of the inner and outer containers, and the reinforced lower side of the outer container includes a rigid reinforcing collar mounted to and around the lower side of the outer container. Advantageously the reinforcing collar extends partially along the length of the outer container so as distribute compression loads from the grapple arms along the stringers sandwiched between the inner container and the lower side of the outer container.

The baffle may be a rigid circular plate having a first cutout at an upper end thereof forming the upper aperture, and having a second cutout at a lower end thereof forming the lower aperture. The first and second cutouts may in one embodiment be substantially semi-circular and symmetrical about a vertical plane bisecting the inner and outer containers. The second cutout advantageously may be larger in cutout area than the first cutout. For example, the second cutout may extend substantially one quarter of the vertical inside diameter of the inner container. The first cutout may be an air passage. The second cutout may be a fluid passage in fluid communication between opposite ends of the inner container on corresponding opposite sides of the baffle.

The array of rigid stringers may include eight elongate rigid members in radially spaced apart array about a longitudinally extending substantially centroidal axis through the inner and outer containers. The radially spaced apart array of stringers may be substantially equally radially spaced apart, and five of the eight rigid members may be sandwiched between the lower side of the inner container and the reinforced lower side of the outer container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1, is a perspective view of the fuel tank being transported by a grapple machine.

FIG. 2 is a perspective view of the fuel tank

FIG. 3 is a sectional view taken on line 2-2 of FIG. 1, with the inner tank partially broken away for clarity.

FIG. 4 is an enlarged sectional view taken on line 3-3 of FIG. 1.

FIG. 5 is an enlarged view of the gussets at the forward end of the tank.

FIG. 6 is an enlarged view of grapple positioning bracket.

FIG. 7 is an enlarged view of a portion of FIG. 2.

DETAILED DESCRIPTION OF EMBODIMENT OF THE INVENTION

With reference to the drawing figures, wherein similar characters of reference denote corresponding parts in each view, the fuel tank 10 of the present invention generally comprises a horizontally disposed outer cylindrical sheath 12 having fore and aft ends 14 and 16 respectively which define an internal cavity 20. Bulkhead 24 is positioned forwardly from aft end wall 16 of outer sheath 12 thereby defining a storage compartment 26. A securing door 30 or
access hatch is provided in aft end wall 16. Door 30 is hinged at one end such as at 32 and has closure means such as hasp 34 at the opposite end. Lug 34a positioned on aft end wall 16 engages hasp 34 to effect secure closure. Door 30 may be supported in an open position by means of gas shocks 38 suitably secured between door 30 and aft end wall 16. A removable drain plug 42 is provided so that storage compartment 26 may be kept free from moisture or accidentally spilled fuel. A protective outer tank filler pipe 44 and cup 44a are provided adjacent bulkhead 68.

Fore and aft skids 46 and 46a respectively are secured beneath outer cylindrical sheath 12 as by welding or the like and support it in an elevated aspect relative to the ground surface.

A lower reinforcement collar 50, is positioned generally intermediate ends 14 and 16 of sheath 12 and surrounds the lower segment of outer sheath 12, extending generally upwardly to mid line bisecting sheath 12 along its length.

A grapple platform 52 and fore and aft grapple positioning brackets 54 and 54a respectively are located on the upper side of cylindrical sheath 12, intermediate its end and are used by a grapple machine operator for the proper placement of the lifting grapple 56 as may be viewed in FIG. 1. Brackets 54 may have welded thereto a link of 4-inch chain 58 or the like to accommodate a safety chain attached to the grapple 56.

An inner fuel receptacle or tank 66 is nested concentrically within outer sheath 12 by a radially spaced apart array of longitudinally extending stringers or spacers 68 radially spaced for example on radial lines C. Tank 66 may be manufactured from 1/8 inch mild steel material and spacers 68 may be manufactured from one half inch mild steel material or the like. Spacers 68 generally contain spaced apart drainage apertures 70 along their length so that any moisture accumulating between exterior cylindrical sheath 12 and inner fuel-receptacle 66 may be drained by gravity through drainage apertures 70 so as to be drained from sheath 12 through plug 74. A separate drainage plug 78 is provided for inner fuel receptacle 66. Plug 78 is preferably axially aligned with drainage plug 74 in outer sheath 12. The spacers generally extend fore and aft of the respective end walls 82 and 84 of inner fuel receptacle 66 so that a protective void surrounds inner tank 66.

An internal anti-surge baffle 86 is provided medially of the fore and aft ends of the fuel-receptacle 66, which reduces dynamic imbalance due to fluid movement during transportation. An upper cutout 86a eliminates any pressure differential occurring on either side of the baffle as fuel is pumped from receptacle 66 while lower cutout 86b allows unrestricted flow of liquid during pumping from the tank. Cutouts 86a and 86b also reduce the weight of the baffle while leaving the structural reinforcement provided by the baffle around the grapple line B, that is, where grapple 56 grips sheath 12.

A fuel shut-off valve 88 passes through both the aft end 84 of the fuel-containing receptacle 66 and the storage compartment bulkhead 24. Valve 88 is normally closed and is opened when current from battery power associated with fuel pump operation is actuated.

Gussets 92 welded to skid 46 near the fore end of the tank contain apertures 96 which permit connection of a chain 100 which is passed upwardly and around the tank and crossed over the tank and connected to the skidder on opposite sides of the tank to increase tank stability during transportation over uneven ground.

Spacers 68, because they are rigid stringers running the length of the gap between tank 66 and sheath 12, strengthen the structures and thereby allow the use of lighter material in the walls. For example, the walls of the tank and sheath may be of one eighth inch thick mild steel, replacing a previous single walled design employing walls having a thickness of one quarter inch mild steel. The weight added over the previous design includes the weight due to the weight of the stringers 68, reinforcement collar 50 and baffle 86. The structure thus not only provides the increased safety of a double-walled design, that is inadvertent puncturing of the outer wall does not necessarily also breach the inner wall, but also provides both increased structural strength in the mid-area in proximity to grapple line B where clamping forces D are applied by grapple 56, but also provides for control of surging from end to end of fuel within the tank 66. The stringers (spacers 68) and wide surfaced rigid collar 50 distribute the forces applied by the grapple arms of grapple 56 and transfer the forces into the plane of baffle 86, even if the grapple arms are not exactly co-planar with the baffle due to slippage of the grapple or mis-alignment by the operator. In particular the lower ends 86c extend downwardly so as to be adjacent the ends of the grapple arms of grapple 56 so that all of the compression forces from the grapple are transferred to the web, that is, the contiguous solid structure of the baffle.

As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

What is claimed is:

1. A double-walled tank for the transport of fluid comprising:

   a rigid fluid impervious substantially cylindrical inner container concentrically nested within a rigid correspondingly substantially cylindrical outer container, said inner and outer containers having end walls sealing said containers,

   a grapple mount mounted to an upper side of an outer surface of said outer container at a substantially medial position substantially medially along said outer container, a reinforced lower side of said outer container opposite said upper side,

   an anti-surge baffle mounted across, so as to extend between and into engagement with, an upper side of said inner container adjacent said baffle mount and a lower side of said inner container adjacent said reinforced lower side of said outer container,

   wherein said baffle has an upper aperture in an upper side of said baffle adjacent said upper side of said inner container, and wherein said baffle has a lower aperture in a lower side of said baffle adjacent said lower side of said inner container, said lower aperture defined
between lower extremities of said baffle mounted to said lower side of said inner container, wherein said lower extremities extend along in supporting contact with an inner surface of said lower side of said inner container so as to be coextensive with distal ends of grapple arms of a grapple engaging said grapple mount so as to extend the grapple arms of the grapple around a grapple line extending substantially from said substantially medial position and extending around said outer container from said upper side to said lower side of said outer container,
a radially spaced apart array of rigid stringers extending along said inner and outer containers in a substantially cylindrical gap between said inner and outer containers, said array of rigid stringers mounted to, so as to extend between, into engagement with, said inner and outer containers so as to rigidly space apart said inner and outer containers, at least one stringer of said array of rigid stringers sandwiched on opposite lateral sides of said inner and outer containers between said inner container and said reinforced lower side of said outer container.

2. The device of claim 1 wherein said end walls are single-walled end walls providing a common end wall on each end of said inner and outer containers.

3. The device of claim 1 wherein said reinforced lower side of said outer container includes a rigid reinforcing collar mounted to and around said lower side of said outer container.

4. The device of claim 3 wherein said reinforcing collar extends partially along the length of said outer container so as distribute compression loads from the grapple arms along said stringers sandwiched between said inner container and said lower side of said outer container.

5. The device of claim 4 wherein said grapple mount includes a rigid plate mounted atop said upper side of said outer container at said medial position.

6. The device of claim 1 wherein said baffle is a rigid circular plate having a first cutout at an upper end thereof forming said upper aperture, and having a second cutout at a lower end thereof forming said lower aperture.

7. The device of claim 6 wherein said first and second cutouts are substantially semi-circular and symmetrical about a vertical plane bisecting said inner and outer containers.

8. The device of claim 6 wherein said second cutout is larger in cutout area than said first cutout.

9. The device of claim 8 wherein said second cutout extends substantially ¼ of the vertical diameter of said inner container.

10. The device of claim 8 wherein said first cutout is an air passage and wherein said second cutout is a fluid passage in fluid communication between opposite ends of said inner container on corresponding opposite sides of said baffle.

11. The device of claim 1 wherein said array of rigid stringers includes eight elongate rigid members in radially spaced apart array about a longitudinally extending substantially centroidal axis through said inner and outer containers.

12. The device of claim 11 wherein said radially spaced apart array are substantially equally radially spaced apart and wherein five of said eight rigid members are sandwiched between said lower side of said inner container and said reinforced lower side of said outer container.

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