

1 FITTING INSTALLATION PROCESS AND APPARATUS
2 FOR A MOLDED PLASTIC VESSEL

3 BACKGROUND OF THE INVENTION

4 1. Field of the Invention

5 This invention relates generally to the field of plastic
6 vessels and specifically to a process for installing a fitting
7 on such a vessel.

8 2. Description of the Related Art

9 Molded vessels have numerous applications for containing
10 fluids. The vessels are made by any of several plastic
11 forming processes, including rotational molding and blow
12 molding. Many of the fluids are contained at high pressure.
13 Therefore, the vessels are reinforced by filaments wound on
14 the outer surface of the vessel, as described, for example,
15 in U.S. Patents Nos. 3,945,578 to Kaminsky and 5,012,950 to
16 Knappe, both incorporated herein by reference.

17 Such vessels need one, and frequently several, ports for
18 filling or emptying the vessel. The ports are commonly
19 provided as a rigid fitting adapted to connect to a hose or
20 pipe. Such fittings can be provided during the molding
21 process. For example, a metal fitting can be held in the mold
22 and the plastic molded around the fitting. This method,
23 however, cannot be used to add a fitting after molding.
24 Moreover, reconfiguring a mold is costly, thus, fittings
25 cannot be located at different locations based on specified
26 applications. U.S. Patent No. 4,685,589 to Benton describes
27 one way of installing a fitting after molding and before
28 winding a vessel. An elastic seal is disposed between the
29 fitting and the vessel.

30 Still, the need remains for a method of fabricating a
31 fitting that allows the fitting to be located after molding

1 of the vessel. The fitting should be firmly secured on the
2 vessel and bonded therewith prior to winding.

3 SUMMARY OF THE INVENTION

4 The present invention provides a method of manufacturing
5 a fluid containing vessel having a fitting. The steps include
6 forming a liner; providing a preformed fitting having a
7 flange; installing an insert in the fitting; and positioning
8 the fitting on a wall of the liner and welding the insert to
9 the wall. Additional steps include filament winding the
10 liner, said filaments capturing the fitting flange against the
11 wall; and cutting a hole through the wall of the liner inside
12 the fitting to create a passage through the fitting and liner
13 wall.

14 Preferably, the fitting defines a passage therethrough,
15 and the insert is installed in the passage. The insert has
16 a flange that engages the fitting to retain the fitting on the
17 liner. The passage communicates with an interior of the liner
18 through the hole. When the liner and insert are made of
19 materials having substantially similar melting temperatures,
20 they are heated to about the same temperature. When the liner
21 and insert have different melting temperatures, they are
22 heated to different temperatures. The liner and insert are
23 made of materials compatible for welding to each other,
24 preferably plastic. The liner is generally cylindrical, and
25 the fitting is located on a generally cylindrical side wall
26 of the liner. The step of welding includes heating the insert
27 and an area of the liner and pressing the insert into the
28 liner to bond therewith.

29 According to one aspect of the invention, the method
30 includes rotationally molding the liner of plastic material
31 having a generally cylindrical shape. The fitting is
32 preformed with the flange and passage therethrough. The
33 insert, of the same material as the liner, is installed in the
34* passage of the fitting, and the insert flange engages the
35 fitting. Heating the insert and an area of the cylindrical
36 wall of the liner where the fitting is to be installed softens

1 the fitting and the area of the wall. The flange of the
2 fitting is installed on the area of the wall and the insert
3 is pressed into the area so as to bond the insert to the wall.
4 Filament winding of the liner captures the fitting flange
5 against the wall. Cutting a hole through the wall of the
6 liner inside the fitting creates a port through the passage.

7 The invention also provides an apparatus for installing
8 a fitting on a molded vessel liner. The apparatus includes
9 means for supporting the fitting and an insert near the liner;
10 a heater; means for positioning the heater between the fitting
11 and the liner for heating the insert and an area of the liner;
12 and means for positioning the fitting on the liner and
13 pressing the insert into the liner to weld the insert to the
14 liner.

15 According to a preferred aspect of the invention, the
16 apparatus for installing the fitting on the molded vessel
17 liner includes a platform. A mounting head is movably mounted
18 on the platform and adapted for supporting the fitting and the
19 insert near the liner, positioning the fitting on the liner,
20 and pressing the insert into the liner. A driver is adapted
21 to move the mounting head. A heat mirror is movably mounted
22 on the platform on a support arm having the heat mirror
23 pivotably mounted thereon. The support arm is adapted for
24 positioning the heater between the fitting and the liner.

25 BRIEF DESCRIPTION OF THE DRAWINGS

26 Fig. 1 shows a partially exploded side elevational view
27 of an apparatus for installing a fitting on a liner and a
28 partial end view of the liner;

29 Fig. 2 shows a top view of the apparatus, assembled
30 fitting, and liner of Fig. 1; and

31 Fig. 3 shows an isometric view of the wound vessel with
32 the fitting installed thereon.

33 DESCRIPTION OF THE PREFERRED EMBODIMENTS

34 Referring to Fig. 1, a molded tank liner 10 for a vessel
35 is made from a suitable polymer, such as polyethylene, by

1 rotational molding, blow molding, or the like. The liner 10
2 is conventional and can have any of a number of shapes and
3 constructions including a side wall 12 that defines an
4 internal volume.

5 A fitting 14 has a flange 16 and a cylindrical passage
6 18 therethrough. The fitting is made of metal, a composite,
7 sheet molding compound, bulk molding compound or other
8 suitable durable material. The fitting 14 can be threaded or
9 otherwise suitable for connecting to another fitting or a
10 conduit. A pair of threaded bores 20 are provided in a face
11 of the fitting 14. An insert 22 has a cylindrical body 24
12 adapted to fit in the cylindrical passage 18 of the fitting
13 14. The insert 22 is preferably molded from a material
14 compatible with the liner 10 and adapted to be bonded
15 therewith by welding, such as polyethylene. The insert 22 is
16 provided with an annular flange 26 for preventing the insert
17 from passing through the passage 18 of the fitting 14. The
18 body defines an edge 27 adapted to be flush with or extend
19 slightly from the flange 16 of the fitting 12. A pair of
20 holes 28 corresponding with the threaded bores 20 are provided
21 through the flange 26.

22 An installation apparatus 30 is adapted to be located
23 near the liner 10 and includes a vertically and laterally
24 adjustable platform 32. The platform is adjustable by manual
25 or powered devices, such as cranks and threaded shafts. A
26 horizontally movable mounting head 34 is supported on a
27 horizontal shaft 36 of a driver, such as a hydraulic or
28 pneumatic cylinder 38, mounted to the platform 32. The
29 cylinder 38 is powered by fluid controlled by a head
30 controller 40.

31 The mounting head 34 has a front face 42 adapted to
32 engage the flange 26 of the insert 22. A pair of holes 44
33 corresponding with the insert holes 28 are provided through
34 the head 34. A pair of bolts 46 are installed through the
35 holes 44, 28 and threaded into the bores 20 to mount the
36 fitting 14 and insert 22 on the mounting head 34.
37 Alternatively, the fitting 14 can be mounted on the head 34

1 by a clamp or other suitable mounting means. The fitting 14
2 is firmly mounted so that the insert flange 26 engages the
3 fitting 14.

4 Referring to Fig. 2, a heater 48, such as a two sided
5 heat mirror, is disposable between the mounting head 34 and
6 the liner 10. A pair of heating spigots 49 conforming to the
7 wall 12 and insert 22 direct and focus heat emanating from the
8 heater 48. Alternatively, the heater can be two separate one-
9 sided heat mirrors or other heating means. The heater can be
10 hand held or supported on a suitable stationary or movable
11 structure. The two sides of the heater 48 are separately
12 controlled by a heater control 51. Preferably, the heater 48
13 is carried on the platform 32 by a pivotable support arm 50
14 and a brace arm 52. The support arm 50 is adapted to pivot,
15 thereby moving the heater 48 to a vertical position providing
16 clearance for the head 34 to move the fitting 14 toward the
17 liner 10. In a horizontal position shown, the heater 48 is
18 held at a constant level and prevented from shifting by the
19 brace arm 52. A rotary grinder 54 having a cutting tool 56
20 powered by a motor 58 is provided on the platform 32 or
21 separately therefrom. A hand held grinder 54 is suitable.

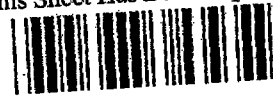
22 In operation, referring to Figs. 1 and 2, the
23 installation apparatus 30 is located near the previously
24 molded liner 10. The heater 48 is moved to its horizontal
25 position and located proximate to a location on the liner 10
26 where the fitting 14 is to be installed. The mounting head
27 34 is moved to a retracted position away from the heater 48.
28 The insert 22 is installed in the passage 18 of the fitting
29 14 so that the insert flange 26 engages the fitting 14. The
30 fitting 14 and insert 22 are mounted on the mounting head 34
31 with the bolts 46. The head 34, insert 22 and fitting 14 are
32 moved to an intermediate position wherein the flange 16 of the
33 fitting 14 and edge 27 of the insert are proximate to the
34 heater 48.

35 The heater 48 is activated to heat the edge 27 of the
36 insert 22 and an area of the wall 12 of the liner 10. The
37 edge 27 and wall 12 are softened or melted to a point at which

1 they can be bonded together. The heater 48 is automatically
2 or manually controllable to properly heat the edge 27 and wall
3 12. The heat required depends on the materials. Opposite
4 sides of the heater 48 can be separately controlled to provide
5 the proper temperature for different insert 22 and liner 10
6 materials. If the application allows, the heater can be
7 automatically controlled to provide adequate heating for
8 successive liners and fittings. The heater 48 is deactivated
9 and the support arm 50 is pivoted to move the heater 48 to its
10 vertical position. The mounting head 34 is moved to an
11 extended position wherein the flange 16 is pressed against the
12 wall 12 and the insert 22 is welded to the wall 12. The
13 fitting 14 is held against the wall under pressure from the
14 cylinder 38 for a sufficient time to bond the insert 22 to the
15 wall 12. The time and pressure depend on the materials and
16 will be apparent to one skilled in the art of plastics. The
17 fitting 14 is held in place without pressure until the insert
18 22 and wall 12 have cooled sufficiently to hold the fitting
19 14. The mounting head 34 is separated from the insert 22 and
20 fitting 14, by removing the bolts 46, and the mounting head
21 34 is retracted. The grinder 54 is then used to remove the
22 portion of the wall 12 inside the insert 22 to cut or grind
23 open the interior of the liner 10 and place the interior of
24 the liner in communication with the passage 18. Finally the
25 liner is filament 60 wound in a conventional manner, as shown
26 in Fig. 3. The filaments 60 pass over and capture the flange
27 16 of the fitting to securely hold the fitting on the liner
28 10. If it is necessary to entirely remove the insert 22, the
29 liner 10 should be filament wound prior to grinding or cutting
30 out the insert 22 and portion of the wall 12. The fitting 14
31 is then suitable for connecting conduits to the vessel.

32 The present disclosure describes several embodiments of
33 the invention, however, the invention is not limited to these
34 embodiments. For example, other devices and fittings, such
35 as sight gauges, flanges, etc. can be installed on other

1 vessels according to the present invention. Other variations
2 are contemplated to be within the spirit and scope of the
3 invention and appended claims.



WHAT IS CLAIMED IS:

1 1. A method of manufacturing a fluid containing vessel
2 having a fitting, comprising the steps of:
3 forming a liner;
4 providing a preformed fitting;
5 installing an insert in the fitting; and
6 positioning the fitting on a wall of the liner and
7 welding the insert to the wall.

1 2. A method according to claim 1, further comprising
2 the step of filament winding the liner, said filaments
3 capturing the fitting against the wall.

1 3. A method according to claim 1, further comprising
2 the step of cutting a hole through the wall of the liner
3 inside the fitting to create a passage through the fitting and
4 the liner wall.

1 4. A method according to claim 2, wherein the fitting
2 defines a passage therethrough, and said insert is installed
3 in the passage.

1 5. A method according to claim 4, wherein the insert
2 has a flange that is engaged with the fitting to retain the
3 fitting on the liner.

1 6. A method according to claim 4, wherein the passage
2 is placed communication with an interior of the liner through
3 the hole.

1 7. A method according to claim 1, wherein the insert
2 is engaged with the fitting to retain the fitting on the
3 liner.

1 8. A method according to claim 1, wherein the liner and
2 insert are made of materials having substantially similar





-9-

3 melting temperatures and the step of welding includes heating
4 an area of the liner and insert to about the same temperature.

1 9. A method according to claim 1, wherein the liner and
2 insert are made of materials having substantially different
3 melting temperatures and the step of welding includes heating
4 an area of the liner and insert to different temperatures.

1 10. A method according to claim 1, wherein the liner and
2 insert are made of materials compatible for welding to each
3 other.

1 11. A method according to claim 1, wherein the liner and
2 insert are made of plastic.

1 12. A method according to claim 1, wherein the liner is
2 generally cylindrical.

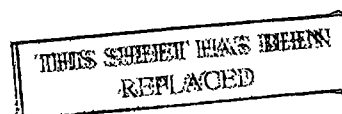
1 13. A method according to claim 12, wherein the fitting
2 is installed on a generally cylindrical side wall of the
3 liner.

1 14. A method according to claim 1, wherein the step of
2 welding includes heating the insert and an area of the liner
3 and pressing the insert into the liner to bond therewith.

1 15. A method of manufacturing a fluid containing vessel
2 having a fitting, comprising the steps of:
3 forming a liner;
4 providing a preformed fitting having a flange;
5 installing an insert having a flange in the fitting,
6 said insert flange engaging the fitting;
7 positioning the fitting on a wall of the liner and
8 welding the insert to the wall, the insert flange retaining
9 the fitting on the liner;
10 filament winding the liner, said filaments capturing
11 the fitting flange against the wall; and



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-10-

12 cutting a hole through the wall of the liner inside
13 the fitting to create a port through the fitting.

1 16. A method of manufacturing a fluid containing vessel
2 having a port, comprising the steps of:
3 rotationally molding a liner of plastic material
4 having a generally cylindrical shape;
5 providing a preformed fitting having a flange and
6 a passage therethrough;
7 installing an insert of the same material as the
8 liner in the passage of the fitting, said insert having a
9 flange engaging the fitting;
10 heating the insert and an area of a cylindrical wall
11 of the liner where the fitting is to be installed to soften
12 the fitting and the area of the wall;
13 locating the flange of the fitting on the area of
14 the wall and pressing the insert into the area so as to bond
15 the insert to the wall;
16 filament winding the liner, said filaments capturing
17 the fitting flange against the wall; and
18 cutting a hole through the wall of the liner inside
19 the fitting to create a port through the passage.

1 17. An apparatus for installing a fitting on a molded
2 vessel liner, comprising:
3 means for supporting the fitting and an insert near
4 the liner;
5 a heater;
6 means for positioning the heater between the fitting
7 and the liner for heating the insert and an area of the liner;
8 and
9 means for positioning the fitting on the liner and
10 pressing the insert into the liner to weld the insert to the
11 liner.

1 18. An apparatus according to claim 17, further
2 comprising means for removing material of the liner to place



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-11-

3 an interior of the vessel in communication with the fitting.

1 19. An apparatus according to claim 17, wherein the
2 means for supporting the fitting and insert and the means for
3 positioning the fitting comprise a movable mounting head.

1 20. An apparatus according to claim 19, further
2 comprising a powered driver for moving the mounting head.

1 21. An apparatus according to claim 17, wherein the
2 heater comprises a two sided heat mirror.

1 22. An apparatus according to claim 21, wherein the two
2 sides of the heat mirror are separately controllable.

1 23. An apparatus according to claim 17, wherein the
2 means for positioning the heater comprises a support arm on
3 which the heater is pivotably mounted.

1 24. An apparatus for installing a fitting on a molded
2 vessel liner, comprising:
3 a platform;
4 a mounting head movably mounted on the platform and
5 adapted for supporting the fitting and an insert near the
6 liner, positioning the fitting on the liner, and pressing the
7 insert into the liner;
8 a driver adapted to move the mounting head;
9 a heat mirror movably mounted on the platform; and
10 a support arm having the heat mirror pivotably
11 mounted thereon and adapted for positioning the heater between
12 the fitting and the liner.

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