CLAIMS

1. A closed-head drum (10) from thermoplastic plastics material, having a liner (22) composed of a thin-walled plastics material film, comprising a cylindrical drum wall (12), a disk-shaped lower base (14), and a disk-shaped upper base (16) in which two bung connectors (18,20) which are closable by means of a bung closure are disposed, wherein the one bung connector is configured as a filling and retrieval bung connector (18), and the other bung connector is configured as a ventilation and aeration bung connector (20), one respective filling and retrieval liner connector (24) and one ventilation and aeration liner connector (26) of the liner (22) being in each case fastened in said bung connectors (18,20), wherein the bung closure for the ventilation and aeration bung connector (20) is configured in multiple parts and has at least one lower adapter ring (28) and an upper union or ring nut (48) which both are in each case provided with one centric passage opening (50,70), and furthermore has a centric bung plug (64) which is screw-fitted into the centric passage opening (68) of the adapter ring (28), wherein the adapter ring (28) is fixedly welded to the upper end of the ventilation and aeration bung connector (26) of the liner (22), and by way of a flange ring (46) of the screw-fitted ring nut (48) is fixed in the ventilation and aeration bung connector (20) of the closed-head drum (10),

characterized by the following features:

- both bung connectors (18,20) are configured as identically-sized standardized 2" bung connectors having an internal thread (BCS 70 x 6 closure) and a sealing bed (38) lying therebelow;

- the bung closure for the filling and retrieval bung connector (18) is configured as a commercially available standardized 2" bung plug having an external thread (BCS 70 x 6 closure) and a sealing ring lying therebelow, said sealing ring sealing against the sealing bed (38) in the filling and retrieval bung connector (18);

- the filling and retrieval bung connector (18), below the internal thread at the tightest passage point of said filling and retrieval bung connector (18) in the connector neck (40), has a smoothed, annular flat weld bed inner surface (42) to which the upper end of the filling and retrieval liner connector (24) of the liner (22) is fixedly welded;

- the bung plug screw-fitted into the centric passage opening (68) of the adapter ring (28) is configured as a commercially available standardized ¾" bung plug (64) having an external thread and an sealing ring (66) lying therebelow;

- the flange ring (46), engaged across by the screw-fitted ring nut (48), of the adapter

ring (28), on the lower side thereof, on the external periphery has an encircling sealing ring (60), and seals the drum interior against the sealing bed (38) below the internal thread in the ventilation and aeration bung connector (20).

2. The closed-head drum (10) as claimed in claim 1,
characterized in that
the screw-fitted ring nut (48) from above is covered by a snap-fitted or clinch-fitted safety cap (52) which is likewise provided with a centric passage opening (54) and by way of said passage opening (54) permits free access to the ¾" bung plug (64) that is screwed-fitted so as to be centric in the adapter ring (28).

3. The closed-head drum (10) as claimed in claim 1 or claim 2,
characterized in that
the sealing ring (60) on the lower side encircling the external periphery of the adapter flange ring (46) seals the intermediate air space between the liner surface and the drum interior against the sealing bed (38) arranged in the ventilation and aeration bung connector (20) below the internal thread.

4. The closed-head drum (10) as claimed in any one of the preceding claims,
characterized in that
in the case of a released or unscrewed ring nut (48), the adapter ring (28), conjointly with its sealing ring (60) which runs around the underside of the flange ring (46), and including the tightly screw-fitted centric ¾" bung plug (64), is configured so as to be capable of being lifted upward by means of a pulling tool (72) that is guided through a vacuum bell jar (70), and an annular gap (76) is configured between the sealing ring (60) and the sealing bed (38), through which a vacuum can be pulled in the intermediate air space between the liner surface and the drum internal wall by means of a vacuum pump that is connected to the vacuum bell jar (70).

5. The closed-head drum (10) as claimed in any one of the preceding claims,
characterized in that
the adapter ring (28), including the tightly screwed-fitted centric ¾" bung plug (64), by means of the pulling tool (72) that is guided through the vacuum bell jar (70), is guidable downward, and the circumferential sealing ring (60) on the underside of the adapter flange

ring (46) is configured so as to be capable of being pressed in a firm and gas-tight manner onto the sealing bed (38) disposed in the ventilation and aeration bung connector (20) below the internal thread, and is permanently fixed in a gas-tight position by the tightly screw fitted ring nut (48) upon vacuum formation, said vacuum formation causing the liner surface to bear against the drum internal wall in an almost complete or planar manner.

6. The closed-head drum (10) as claimed in any one of the preceding claims,
characterized in that
the external surface of the liner (22) is slightly adhesively bonded in a detachable manner to the internal surface of the drum wall.

7. The closed-head drum (10) as claimed in claim 6,
characterized in that
the external surface of the liner (22) is bonded in a detachable manner to the internal surface of the drum wall with an improved adhesive effect.

8. The closed-head drum (10) as claimed in any one of the preceding claims,
characterized in that
the centrically disposed ¾" bung plug (64), in the case of a tightly screw-fitted ring nut (48) for filling the closed-head drum (10) with liquid filling material in an automatic filling system by means of a pressurized filler pipe and for retrieving the liquid filling material in an automatic emptying system by means of a vacuum suction pipe through the opposite filling and retrieval bung connector (18), is freely accessible through the safety cap (52) provided with the centric passage opening (54), and is configured so as to be capable of being un-screwed and screw-fitted again manually by means of a screwdriver tool or automatically by means of a robotic screwdriver.

9. A liner (22) for inserting into a closed-head drum as claimed in any one of the preceding claims,
characterized by,
a cylindrical internal wall (30), a disk-shaped lower base (34), and a disk-shaped upper base (32) in which two liner connectors (24,26) are disposed, wherein the one liner connector has a larger diameter than the other liner connector and serves as a filling and retrieval connector (24), and the other liner connector (26) serves for ventilation and

aerating when filling or emptying, respectively, the liner and the closed-head drum (10) with liquid filling material, wherein the upper end of said bung connector (26) having a smaller diameter is fixedly welded to an adapter ring (28) which has a radially projecting flange ring (46), a circumferential sealing ring (60) being disposed on, or fastened to, respectively the underside of said flange ring (46).

10. The liner (22) as claimed in claim 9,
characterized in that
the liner connectors (24,26) by way of a radially inwardly directed welded flange periphery are welded from the internal side to the liner wall of the liner upper base (32) and are rolled from the inside to the outside in such a manner that all existing film cutting edges are covered in relation to filling-material contact and no film cutting edge, neither the film cutting
edge on the welded flange periphery of the welded liner connectors (24, 26) nor the film cutting edge on the internal-side delimitation of the passage openings in the liner wall, comes into contact with the filled liquid filling material.

11. The liner (22) as claimed in claim 9 or claim 10,
characterized in that
the welded liner connectors (24,26) have the same multiple-layer film construction as the liner wall (30,32,34).

12. The liner (22) as claimed in any one of claims 9 to 11,
characterized in that
the liner connector (24) having the larger diameter, prior to insertion into the closed-head drum (10), has a length of at least double the diameter of said liner connector (24), and at the free end thereof is welded shut or is closed in a gas-tight manner.

13. The liner (22) as claimed in any one of claims 9 to 12,
characterized in that
the liner connector (24) having the larger diameter, upon insertion into the closed-head drum (10), is cut to an appropriate length and in the filling and retrieval bung connector (18), directly below the internal thread thereof, is radially welded onto a weld bed internal surface (42) in the connector neck (40).

14. A method for producing a closed-head drum (10) as claimed in one of preceding claims 1 to 8, having a liner (22) as claimed in one of preceding claims 9 to 13, **characterized by** the following method steps:

- providing a commercially available standard closed-head drum (10) having two 2" bung connectors having 70 x 6 closures, and a commercially available 2" bung plug (44) for a 70 x 6 closure, and a commercially available ¾" bung plug (64) for a 70 x 6 closure, wherein the one 2" bung connector having the 2" bung plug (44) serves as a filling and retrieving bung (18) for the liquid filling material, and the other 2" bung connector serves as a ventilation and aeration bung (20) for the filling volume in the interior of the liner (22) and for the intermediate air space between the external surface of the liner (22) and the drum internal wall;

- providing a liner (22) having two dissimilarly sized liner bung connectors (24,26), wherein the larger bung connector is provided for the 2" bung connector having the 70 x 6 closure and is configured so as to be somewhat longer and so as to have a free end that is welded shut, while a hollow sleeve-type adapter ring (28) having a lower sealing ring (60) is welded to the end of the shorter, somewhat smaller bung connector, each liner bung connector (24, 26) being so arranged and located on the liner that when inflation of the liner once placed within the drum takes place through the gassing and degassing liner connector (26), the other connector (24) is able to emerge from the filling and retrieval bung (18);

- rolling up the liner (22) so as to form a slim roll (36), wherein the welded adapter ring (28) is disposed on the top of the roll (36);

- inserting the slim roll (36) through the ventilation and aeration bung (20) and fixing the adapter ring (28) by means of a ring nut (48) which encircles the adapter ring (28) and which has a centric passage opening (50) and which has an external thread for the 70 x 6 closure in the 2" bung connector of the ventilation and aeration bung (20), wherein the adapter ring (28) with the lower sealing ring (60) seals the intermediate air space between the external surface of the liner (22) and the drum internal wall in the 2" bung connector (20);

- blowing compressed air into the ventilation and aeration bung (20) until the liner (22) is fully inflated and the welded-shut larger liner bung connector (24) pokes out of the opposite filling and retrieving bung (18);

- cutting off the welded-shut free end of the larger liner bung connector (24), and inverting the liner bung connector toward the outside, over the 2" bung connector (18) of the closed-head drum (10);

- radially welding the liner connector (24) below the internal thread in the 2" bung connector (18), and cutting off the surplus and/or projecting liner connector (24) to an exact fit above the annular welding surface (42) below the internal thread,

- placing a vacuum bell jar (70) onto the ventilation and aeration bung (20) and, with a released ring nut (48) and a lifted adapter ring (28), by means of a vacuum pump that is connected to the vacuum bell jar (70) suction all of the air from the intermediate air space between the external surface of the liner (22) and the drum internal wall, and extracting a vacuum until the external surface of the liner (22) bears in a fully planar manner on the drum internal wall;

- tightening the ring nut (48) and compressing the adapter ring (28) with the lower sealing ring (60) in the 2" bung connector (20), for permanently maintaining the vacuum between the liner and the drum internal wall;

- screw-fitting the 2" bung plug (44) into the 2" bung connector (18) of the filling and retrieving bung, and screw-fitting the ¾" bung plug (64) into the sleeve-type adapter ring (28) provided with an internal thread (56).

15. The method as claimed in claim 14,
characterized in that
for secured covering, a safety cap (52) having a centric passage opening (54) is placed onto the 2" bung connector (20), so as to prevent any unintentional release or unscrewing of the ring nut (48) and an associated loss of the vacuum.

16. The method as claimed in claim 14,
characterized in that
during the extraction of the vacuum through the ventilation and aeration bung connector (20), compressed air is blown through the opposite filling and retrieval bung connector (18) into the interior of the liner (22) such that the liner film of the liner (22) is pushed in a fully planar manner onto the internal wall of the closed-head drum (10) and all of the intermediate space air is squeezed out.

17. The method as claimed in any one of claims 14 to 16,
characterized in that
the blown-in compressed air for thermally activating the liner film is blown in as hot air such that the external side of the liner film develops an adhesive effect and adheres to the internal

wall of the closed-head drum (10) or sticks thereto in a detachable manner.

18. A method of retrieving a liner from the closed head drum (10) as claimed in one of preceding claims 1 to 8,
characterized in that
for retrieving the liner (22) from the drum interior, with a released ring nut (48) and a lifted adapter ring (28), compressed air is blown through the annular gap between the adapter sealing ring (60) and the bung-connector sealing bed (38) into the intermediate air space between the liner surface and the drum internal wall, such that the liner surface that adheres to the drum internal wall and/or is adhesively bonded thereto is released.

19. The method as claimed in claim 18,
characterized in that
a vacuum in the interior of the liner (22) is extracted through the filling and retrieval bung connector (18) until said liner has been fully released from the drum internal wall.

20. The method as claimed in claim 18 or claim 19,
characterized in that
the liner connector (24) welded in the filling and retrieval bung connector (18) is first cut off directly below the annular welding surface (42) and is pulled out somewhat from the bung connector (18) and is tightly closed, and the entire liner (22) conjointly with the adapter ring (28) is thereafter pulled out of the drum interior through the opposite ventilation and aeration bung (20).