CLAIMS

1. A device (10) for stabilizing a powder bed (2) employing low pressure for an additive manufacturing method, comprising:

   - a container (1) which is open on at least one side, comprising a bottom, at least one side wall and a container opening;
   - a filter (3) in or above the bottom and/or in the at least one side wall, wherein an area occupied by the filter (3) corresponds to the area of the bottom or the area of the side wall and wherein the filter (3) is substantially impermeable to the powder comprising the powder bed (2); and
   - a connection (4) at the bottom and/or at the side wall of the container (1) or on a side of the filter (3) facing away from the container, wherein the connection (4) is suitable for connection to a suction pump,

   so that a powder bed (2) disposed in the container (1) is compressed against the filter (3) and stabilized by a low pressure produced by the suction pump.

2. The device (10) as claimed in claim 1, wherein the bottom or the filter (3) disposed above the bottom is disposed flush with and at right angles to the side wall or to the filter in the side wall.

3. The device (10) as claimed in claim 1 or claim 2, wherein the container (1) comprises two side walls disposed in a parallel manner to each other and at least one filter (3) which is flush with each of the side walls and substantially at right angles to mutually opposing areas of the side walls and which can

be moved freely between the side walls while retaining its orientation.

4. The device (10) as claimed in one of the preceding claims, further comprising:

   - a compression device which can be connected to or attached to the container opening, which can be used to exert pressure on the powder bed (2) via a pressurized gas.

5. The device (10) as claimed in claim 4, wherein the compression device is selected from a pump, a compressor and/or a compressed gas cylinder.

6. The device (10) as claimed in one of the preceding claims, wherein the filter (3) is constructed as a conveyor belt which is disposed to move transversely to the opposing side walls.

7. The device (10) as claimed in claim 6, wherein the filter (3) formed as a conveyor belt is displaceable at right angles to a conveying direction.

8. The device (10) as claimed in claim 6 or claim 7, wherein the filter formed as a conveyor belt can be moved step-by-step in a conveying direction.

9. The device (10) as claimed in claims 1 to 8, wherein the filter (3) can be moved in the container (1) relative to a container opening, in particular away from the container opening or towards the container opening.

10. The device (10) as claimed in claims 1 to 9, wherein the container opening is an upper opening of the

container (1) and the filter (3) can be lowered step-by-step in steps of a specific size.

11. The device (10) as claimed in claim 10, wherein the filter (3) can be lowered in such a manner that a distance from the filter (3) to a plane which is substantially defined by an opening cross-section of the container opening changes uniformly over the whole area occupied by the filter (3).

12. The device (10) as claimed in one of the preceding claims, further comprising a suction pump to evacuate the powder bed.

13. The device (10) as claimed in one of the preceding claims, wherein an arrangement of channels or recesses in the bottom of the container (1) ensures that, when the filter (3) has been lowered fully to the bottom of the container, evacuation of the powder bed (2) through the filter (3) occurs uniformly over the area occupied by the filter (3).

14. The device (10) as claimed in one of the preceding claims, wherein uniform evacuation of the powder bed (2) through the filter (3) is ensured by means of a funnel shape for the filter (3) and/or the bottom.

15. The device (10) as claimed in one of the preceding claims, wherein the powder bed (2) surrounds at least a section of a component which has been built up at least partially step-by-step or a part of such a component and/or stabilizes and supports a component which has been built up at least partially step-by-step during operation of the suction pump attached via the connection (4).

16. A method for layer-by-layer shaping of a component from a material comprising a powder provided as a powder bed (2), comprising:

- applying at least one layer of the material to a filter (3);
- forming a layer of a layer-by-layer shaped component in the at least one layer of material;
- setting up a pressure gradient between the at least one layer of material and the side of the filter (3) facing away from the material by producing a low pressure, wherein the at least one layer which is densified stabilizes and supports the layer of the layer-by-layer shaped component which is formed under the effect of the pressure gradient;
- optionally repeating the steps for application, forming and setting up of the pressure gradient until the component has been completely formed in a powder bed (2), having been built up by the repeated application of layers of material to the filter;
- unmoulding of the component.

17. The method as claimed in claim 16, further comprising:

- reinforcing the pressure gradient formed by producing an over-pressure on one side of the free surface of the powder bed (2) and/or on a side of the filter (3) facing the material, by supplying a gas.

18. The method as claimed in claim 17, wherein the gas which is supplied is selected from an inert gas and/or a reactive gas.

19. The method as claimed in claim 17 or claim 18, further comprising:

    - collecting and/or compressing the supplied gas on the side of the filter (3) facing away from the material, and
    - freshly supplying the collected and/or compressed gas to the side of the free surface of the powder bed (2) and/or to the side of the filter (3) facing the material.

20. The method as claimed in one of claims 17 to 19, wherein the pressure of the atmosphere on the side facing the material is more than 0 Pa.

21. The method as claimed in one of the preceding claims, wherein building up the pressure gradient is alternated with applying the material.

22. The method as claimed in one of the preceding claims, wherein the pressure gradient is maintained continuously during the application, the forming and the optional repeat steps.

23. A method for additive manufacturing of a component by layer-by-layer consolidation of a powdered material in a powder bed (2), comprising at least one temporary build-up of a pressure gradient in the powder bed and concomitant densification of the powder bed (2) and stabilization of the layer-by-layer consolidated material so that the layer-by-layer consolidated material is stabilized and fixed without the use of additional support structures during application of the non-consolidated powdered material.

24. Use of a device (10) as claimed in one of claims 1 to 15, for powder-based additive manufacturing.

CLAIMS

1. A device (10) for stabilizing a powder bed (2) employing low pressure for an additive manufacturing method, comprising:

   - a container (1) which is open on at least one side, comprising a bottom, a container opening, two side walls disposed in a parallel manner to each other and at least one filter (3) which is flush with each of the side walls and substantially at right angles to mutually opposing areas of the side walls and which can be moved freely between the side walls while retaining its orientation;
     wherein an area occupied by the filter (3) corresponds to the area of the bottom or the area of the side wall and wherein the filter (3) is substantially impermeable to the powder comprising the powder bed (2);
   - a suction pump connected to a connection (4) at the bottom and/or at the side wall of the container (1) or on a side of the filter (3) facing away from the container; and
   - a compression device which can be connected to or attached to the container opening, which can be used to exert pressure on the powder bed (2) via a pressurized gas,

   so that a powder bed (2) disposed in the container (1) is compressed against the filter (3) and stabilized by a low pressure produced by the suction pump and the pressurized gas.

2. The device (10) as claimed in claim 1, wherein the compression device is selected from a pump, a compressor and/or a compressed gas cylinder.

3. The device (10) as claimed in one of the preceding claims, wherein the filter (3) is constructed as a conveyor belt which is disposed to move transversely to the opposing side walls, which optionally is displaceable at right angles to a conveying direction, and/or can be moved step-by-step in a conveying direction.

4. The device (10) as claimed in claims 1 to 3, wherein the filter (3) can be moved in the container (1) relative to a container opening, in particular away from the container opening or towards the container opening and/or the container opening is an upper opening of the container (1) and the filter (3) can be lowered step-by-step in steps of a specific size.

5. The device (10) as claimed in claim 4, wherein the filter (3) can be lowered in such a manner that a distance from the filter (3) to a plane which is substantially defined by an opening cross-section of the container opening changes uniformly over the whole area occupied by the filter (3).

6. The device (10) as claimed in one of the preceding claims, wherein an arrangement of channels or recesses in the bottom of the container (1) ensures that, when the filter (3) has been lowered fully to the bottom of the container, evacuation of the powder bed (2) through the filter (3) occurs uniformly over the area occupied by the filter (3), or the uniform evacuation of the powder bed (2) through the filter (3) is ensured by means of a funnel shape for the filter (3) and/or the bottom.

7. The device (10) as claimed in one of the preceding claims, wherein the powder bed (2) surrounds at least a section of a component which has been built up at least partially step-by-step or a part of such a component and/or stabilizes and supports a component which has been built up at least partially step-by-step during operation of the suction pump attached via the connection (4).

8. A method for layer-by-layer shaping of a component from a material comprising a powder provided as a powder bed (2), comprising:

- applying at least one layer of the material to a filter (3);
- forming a layer of a layer-by-layer shaped component in the at least one layer of material;
- setting up a pressure gradient between the at least one layer of material and the side of the filter (3) facing away from the material by producing a low pressure, wherein the at least one layer which is densified stabilizes and supports the layer of the layer-by-layer shaped component which is formed under the effect of the pressure gradient and/or
- reinforcing the pressure gradient formed by producing an over-pressure on one side of the free surface of the powder bed (2) and/or on a side of the filter (3) facing the material, by supplying an inert gas and/or a reactive gas;
- optionally repeating the steps for application, forming and setting up and/or reinforcing of the pressure gradient until the component has been completely formed in a powder bed (2), having been built up by the repeated application of layers of material to the filter;
- unmoulding of the component.

9. The method as claimed in claim 8, further comprising:

   - collecting and/or compressing the supplied gas on the side of the filter (3) facing away from the material, and
   - freshly supplying the collected and/or compressed gas to the side of the free surface of the powder bed (2) and/or to the side of the filter (3) facing the material.

10. The method as claimed in one of claims 8 to 9, wherein the pressure of the atmosphere on the side facing the material is more than 0 Pa.

11. The method as claimed in one of the preceding claims, wherein building up the pressure gradient is alternated with applying the material or the pressure gradient is maintained continuously during the application, the forming and the optional repeat steps.

12. A method for additive manufacturing of a component by layer-by-layer consolidation of a powdered material in a powder bed (2), comprising at least one temporary build-up of a pressure gradient in the powder bed and concomitant densification of the powder bed (2) and stabilization of the layer-by-layer consolidated material so that the layer-by-layer consolidated material is stabilized and fixed without the use of additional support structures during application of the non-consolidated powdered material.

13. Use of a device (10) as claimed in one of claims 1 to 7, for powder-based additive manufacturing.