

CLAIMS

1. Pumping unit (1) having:
- a rough-vacuum pump (2),
 - a Roots vacuum pump (3) comprising a pumping stage (7) having a stator (9; 24; 25) inside which two Roots rotors (5) are configured to rotate synchronously in opposite directions to drive a gas to be pumped between an inlet orifice (10) and an outlet orifice (11),
 - a pipeline (13; 21; 26; 27) connecting the outlet orifice (11) to an intake (12) of the rough-vacuum pump (2),
- characterized in that the shortest distance (d) between an edge of the outlet orifice (11) and each of the rotors (5) in the pumping stage (7) is at least less than three centimetres.
2. Pumping unit (1) according to Claim 1, characterized in that the shortest distance (d) is less than two centimetres, for instance less than one centimetre, for instance less than 0.5 centimetre, for instance greater than 0.1 cm.
3. Pumping unit (1) according to either of the preceding claims, characterized in that the outlet orifice (11) has a circular shape, the diameter (D) of which is less than five centimetres, for instance between two and five centimetres.
4. Pumping unit (1) according to one of the preceding claims, characterized in that the outlet orifice (11) is situated at the end of an upstream tube (14) of the pipeline (13) that passes into the pumping stage (7).
5. Pumping unit (1) having:
- a rough-vacuum pump (2),
 - a Roots vacuum pump (3) comprising a pumping stage (7) having a stator (9) inside which two Roots rotors (5) are configured to rotate synchronously in opposite directions to drive a gas to be pumped between an inlet orifice (10) and an outlet orifice (11),

- a pipeline (13; 21; 26) connecting the outlet orifice (11) to an intake (12) of the rough-vacuum pump (2),
characterized in that the outlet orifice (11) is situated at the end of an upstream tube (14) of the pipeline (13; 21; 26) that passes into the pumping stage (7).

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6. Pumping unit (1) according to either of Claims 4 and 5, characterized in that the upstream tube (14) projects from an outlet receptacle (15) of the pumping stage (7).

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7. Pumping unit (1) according to one of Claims 4 to 6, characterized in that it has a cooling circuit (30) configured to at least partially cool the upstream tube (14) of the pipeline (13).

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8. Pumping unit (1) according to the preceding claim, characterized in that the cooling circuit (30) has a jacket (31) surrounding a base of the upstream tube (14) of the pipeline (13), an inlet (32) and an outlet (33) of the jacket (31) allowing a coolant to flow through a volume of the double wall formed by the jacket (31) and the upstream tube (14).

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9. Pumping unit (1) according to the preceding claim, characterized in that the inlet (32) is situated at the end of an inlet pipe (34) of the cooling circuit (30) and the outlet (33) is situated at the end of an outlet pipe (33) of the cooling circuit (30), the inlet pipe (34) and outlet pipe (33) projecting into the volume of the double wall.

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10. Pumping unit (1) according to the preceding claim, characterized in that the length of the outlet pipe (33) is greater than the length of the inlet pipe (34).

11. Pumping unit (1) according to one of Claims 6 or 7 to 10 in combination with Claim 6, characterized in that a bottom (16) at least of the outlet receptacle (15) is removable.

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12. Pumping unit (1) according to one of Claims 6 or 7 to 11 in combination with Claim 6, characterized in that the outlet receptacle (15) has, for the one part, a circumferential portion (17) formed in the

stator (9) of the pumping stage (7) and, for the other part, a bottom (16) fastened to the upstream tube (14) of the pipeline (13; 21; 26).

13. Pumping unit (1) according to one of Claims 4 to 12, having a frame (6) configured to support the Roots vacuum pump (3), characterized in that the pipeline (21) has a downstream portion (20) that is detachable from the upstream tube (14).

14. Pumping unit (1) according to the preceding claim, characterized in that the downstream portion (20) has a bellows (23).

15. Pumping unit (1) according to one of Claims 1 to 3, characterized in that the outlet orifice (11) of the pumping stage (7) is provided in the stator (24; 25) of the pumping stage (7).

16. Pumping unit (1) according to the preceding claim, characterized in that the outlet orifice (11) is formed in a flat portion of the stator (24) of elongate cross section.

17. Pumping unit (1) according to Claim 14, characterized in that the stator (25) has a turned-in wall (28) in which the outlet orifice (11) is provided.

18. Pumping unit (1) according to the preceding claim, characterized in that the turned-in wall (28) is formed by a raised flat wall, the raised portion following the shape of the path of the rotors (5).

19. Pumping unit (1) according to one of the preceding claims, characterized in that the pipeline (26) is straight.

CLAIMS

1. A pumping unit, comprising:
a rough-vacuum pump;
a Roots vacuum pump comprising a pumping stage having a stator inside which two
Roots rotors are configured to rotate synchronously in opposite directions to drive
a gas to be pumped between an inlet orifice and an outlet orifice; and
a pipeline connecting the outlet orifice to an intake of the rough-vacuum pump,
wherein a shortest distance between an edge of the outlet orifice and surfaces of each
of the Roots rotors in the pumping stage is less than 3 cm, the outlet orifice being
situated at the end of an upstream tube of the pipeline that passes into the
pumping stage.
2. The pumping unit according to claim 1, wherein the shortest distance is less than 2 cm.
3. The pumping unit according to claim 1, wherein the shortest distance is greater than 0.1
cm.
4. The pumping unit according to claim 1, wherein the outlet orifice has a circular shape, a
diameter of which is less than 5 cm.
5. The pumping unit according to claim 1, wherein the outlet orifice has a circular shape, a
diameter of which is between 2 cm and 5 cm.
6. The pumping unit according to claim 1, wherein the upstream tube projects from an
outlet receptacle of the pumping stage.
7. The pumping unit according to claim 6, wherein at least a bottom of the outlet
receptacle is removable.
8. The pumping unit according to claim 6, wherein the outlet receptacle has, for one part, a
circumferential portion formed in the stator of the pumping stage and, for another part, a bottom
fastened to the upstream tube of the pipeline.
9. The pumping unit according to claim 1, further comprising a cooling circuit configured
to at least partially cool the upstream tube of the pipeline.

10. The pumping unit according to claim 9, wherein the cooling circuit includes a jacket surrounding a base of the upstream tube of the pipeline, an inlet, and an outlet of the jacket allowing a coolant to flow through a volume of the double wall formed by the jacket and the upstream tube.

11. The pumping unit according to claim 10, wherein the inlet is situated at the end of an inlet pipe of the cooling circuit and the outlet is situated at the end of an outlet pipe of the cooling circuit, the inlet pipe and outlet pipe projecting into the volume of the double wall.

12. The pumping unit according to claim 11, wherein the length of the outlet pipe is greater than the length of the inlet pipe.

13. The pumping unit according to claim 1, further comprising a frame configured to support the Roots vacuum pump, wherein the pipeline has a downstream portion that is detachable from the upstream tube.

14. The pumping unit according to claim 13, wherein the downstream portion has a bellows.

15. The pumping unit according to claim 1, wherein the pipeline is straight.

16. A pumping unit, comprising:
a rough-vacuum pump;
a Roots vacuum pump comprising a pumping stage having a stator inside which two Roots rotors are configured to rotate synchronously in opposite directions to drive a gas to be pumped between an inlet orifice and an outlet orifice; and
a pipeline connecting the outlet orifice to an intake of the rough-vacuum pump, wherein the outlet orifice is situated at the end of an upstream tube of the pipeline that passes into the pumping stage.

17. The pumping unit according to claim 16, wherein the upstream tube projects from an outlet receptacle of the pumping stage.

18. The pumping unit according to claim 16, further comprising a cooling circuit configured to at least partially cool the upstream tube of the pipeline.

19. The pumping unit according to claim 18, wherein the cooling circuit includes a jacket surrounding a base of the upstream tube of the pipeline, an inlet, and an outlet of the jacket allowing a coolant to flow through a volume of the double wall formed by the jacket and the upstream tube.

20. The pumping unit according to claim 19, wherein the inlet is situated at the end of an inlet pipe of the cooling circuit and the outlet is situated at the end of an outlet pipe of the cooling circuit, the inlet pipe and outlet pipe projecting into the volume of the double wall.