Claims

1. Apparatus (0) for production of at least one product gas from at least one reactant gas, especially for the production of nitriles, comprising the following features:
   a) a chamber (1) having a gas-permeable and heat-insulating wall (2), having an inlet (3) for reactant gas, having an outlet (4) for product gas, and having a main flow direction (V) that extends from the inlet (3) to the outlet (4);
   b) a gas-tight shell (9) that surrounds the chamber (1), with the inlet (3) and the outlet (4) conducted through the shell (9);
   c) an interspace (12) which is disposed between chamber (1) and shell (9) and which surrounds the chamber (1) and is itself surrounded by the shell (9);
   d) at least one electrical heating element (5) that extends through the chamber (1) and penetrates the wall (2) thereof at least once, and which has at least two electrical terminals (+,-) disposed within the interspace (12) and outside the chamber (1);
   e) an electrical voltage source (8) which is disposed outside the shell (9) and is connected at least via a first electrical lead (71) to the first electrical terminal (+) of the heating element (5) and via a second electrical lead (72) to the second electrical terminal (-) of the heating element (5), where the first and second electrical leads (71, 72) are conducted through the shell (9);
   f) at least one terminal element for a filling gas source (11) which is disposed outside the shell (9) and which is connectable via a filling gas conduit to the interspace (12) in a fluid-conducting manner in such a way that the interspace (12) is chargeable with a filling gas drawn from the filling gas source (11);
   g) a catalyst disposed in the chamber (1).

2. Apparatus (0) according to Claim 1, characterized by at least one heat exchanger (10) which is disposed outside the gas-tight shell (9) and is connected to the shell (9) in a thermally conductive manner.

3. Apparatus (0) according to Claim 2, characterized in that the heat exchanger (10) comprises a cooling fluid, and in that the heat exchanger (10) is connected in a fluid-conducting manner via a feed to a cooling fluid source (13) and via a return to a cooling fluid sink (14).

4. Apparatus (0) according to Claim 3, characterized in that the gas-tight shell (9) has a jacketed design as a double jacket (9), and in that the cooling fluid is conductable at least partly within the double jacket (9).

Apparatus (0) according to Claim 3, characterized in that the heat exchanger (10) comprises a cooling coil which connects the feed to the return in a cooling fluid-conducting manner and is wound around the shell (9), in particular

- the cooling coil is designed as a tube connected to the outside of the gas-tight shell (9) via heat bridges or
- an open profile is welded onto the outside of the gas-tight shell (9), and wherein a cooling fluid is conductable at least partly between the profile and the outside of the gas-tight shell (9).

5. Apparatus (0) according to any of the preceding claims, characterized in that the electrical heating element (5)
- has exactly two electrical terminals (+, -) and extends through the chamber (1) in a linear manner,
- has exactly two electrical terminals (+, -) and extends through the chamber (1) in a U shape or M shape,
- has exactly three electrical terminals and extends through the chamber (1) in a W shape, or
- combinations of the electrical terminals extending in a U, M or W shape.

6. Apparatus (0) according to Claim 5, wherein the electrical heating element (5) extends through the chamber (1) along a main resistance axis (H), where the main resistance axis (H) and the main flow direction (V) form an angle (φ) of at least 0° and at most 90°, in particular in that the angle (φ) is 90°.

7. Apparatus (0) according to Claim 6, characterized in that
- the main flow direction (V) runs vertically or
- the main flow direction (V) runs vertically and counter to the acceleration due to gravity (*g*).

8. Apparatus (0) according to any of the preceding claims, characterized by a multitude of electrical heating elements (5) that are electrically interconnected in series and/or parallel connection.

9. Apparatus (0) according to any of the preceding claims, characterized in that the catalyst has been applied to the surface of at least one electrical heating element (5) in the form of a catalytically active coating.

10. Apparatus (0) according to Claim 9, characterized by at least one heating element (5) which is free of any catalytically active coating.

11. Apparatus (0) according to any of the preceding claims, characterized in that the thermally insulating wall (2) of the chamber (1) has a multilayer design, or wherein the

thermally insulating wall (2) of the chamber (1) has a multilayer design and comprises at least two layers that differ with regard to their specific thermal conductivity.

12. Apparatus (0) according to Claim 11, characterized by an additional inner layer on the wall of the chamber with a continuous surface.

13. Apparatus (0) according to any of Claims 9 to 12, characterized in that the inner layer on the wall (2) of the chamber (1) has been provided with a catalytically active or activatable coating containing the catalyst.

14. Apparatus (0) according to any of the preceding claims, characterized in that the heating elements (5), viewed in main flow direction (V), are arranged in succession or arranged offset from one another.

15. Apparatus (0) according to Claim 14, characterized by at least one heating element (5) that runs parallel to the wall (2) directly adjacent to the wall (2) and is not connected to at least one of the two electrical leads (71, 72).

16. Apparatus (0) according to any of the preceding claims, characterized in that the catalyst contains platinum (Pt).

17. Apparatus (0) according to any of the preceding claims, characterized in that the heating element (5) comprises a core of silicon carbide or molybdenum silicide, with a protective coating applied to the core and a catalytically active coating applied to the protective coating.

18. Process for producing nitriles, especially hydrogen cyanide (HCN), comprising the following steps:

a) providing an apparatus (0) according to any of Claims 1 to 17;
b) supplying the inlet (3) with a reactant gas mixture comprising at least ammonia (NH_3) and gaseous hydrocarbon, preferably methane (CH_4);
c) supplying the heating element (5) with electrical current drawn from the electrical voltage source (8);
d) drawing a product gas mixture comprising at least one nitrile formed, preferably hydrogen cyanide (HCN), from the outlet (4) and
e) charging the interspace (12) with a filling gas such that a gas pressure (p_c) in the interspace is equal to or greater than the reaction pressure (p_R) in the chamber (1).

19. Process according to Claim 18, characterized in that the reactant gas mixture comprises methane (CH_4), such that hydrogen cyanide (HCN) is produced.

20. Process according to Claim 18 or 19, wherein the reactant gas mixture additionally comprises oxygen (O_2), such that the reactant gas mixture can be assigned a limiting oxygen concentration (SGK) above which the reactant gas mixture is ignitable, characterized in that the oxygen concentration (KO_2) within the reactant gas mixture is below the limiting oxygen concentration (SGK).

21. Process according to any of Claims 18 to 20, performed at a reaction pressure (p_R) within the chamber (1) of at least $1*10^5$ Pa absolute and at most $5*10^5$ Pa absolute.

22. Process according to any of Claims 18 to 21, performed continuously in such a way as to result in a flow through the chamber (1) in a main flow direction (V) that extends from the inlet (3) to the outlet (4), where the heating element (5) extends through the chamber (1) along a main resistance axis (H), characterized in that the main flow direction (V) extends at right angles to the main resistance axis (H) of the heating element (5).

23. Process according to any of Claims 18 to 22, performed at at least a reaction temperature (T_R) within the chamber (1) of greater than 800°C and less than 1500°C, where the intermediate temperature (T_c) in the interspace (12) is less than 400°C.

24. Process according to any of Claims 18 to 23, characterized in that the filling gas is selected from the group consisting of the following filling gases: gaseous nitrogen, gaseous hydrogen, gaseous hydrocarbon, gaseous ammonia or mixtures thereof.

25. Process according to any of Claims 18 to 24, wherein an apparatus (0) according to any of Claims 3 to 17 is provided, characterized in that the cooling fluid is drawn continuously from the cooling fluid source (13), the heat exchanger (10) is supplied continuously with the cooling fluid, and cooling fluid is drawn off continuously from the heat exchanger (10), where the temperature of the cooling fluid in the feed is lower than in the return, and where the cooling fluid is reactant gas mixture, and in that the cooling fluid sink is the chamber (1), such that the reactant gas mixture is preheated in the heat exchanger (10).

26. Use of an apparatus (0) according to any of Claims 1 to 17 for provision of negative control power for the purpose of stabilizing power grids.