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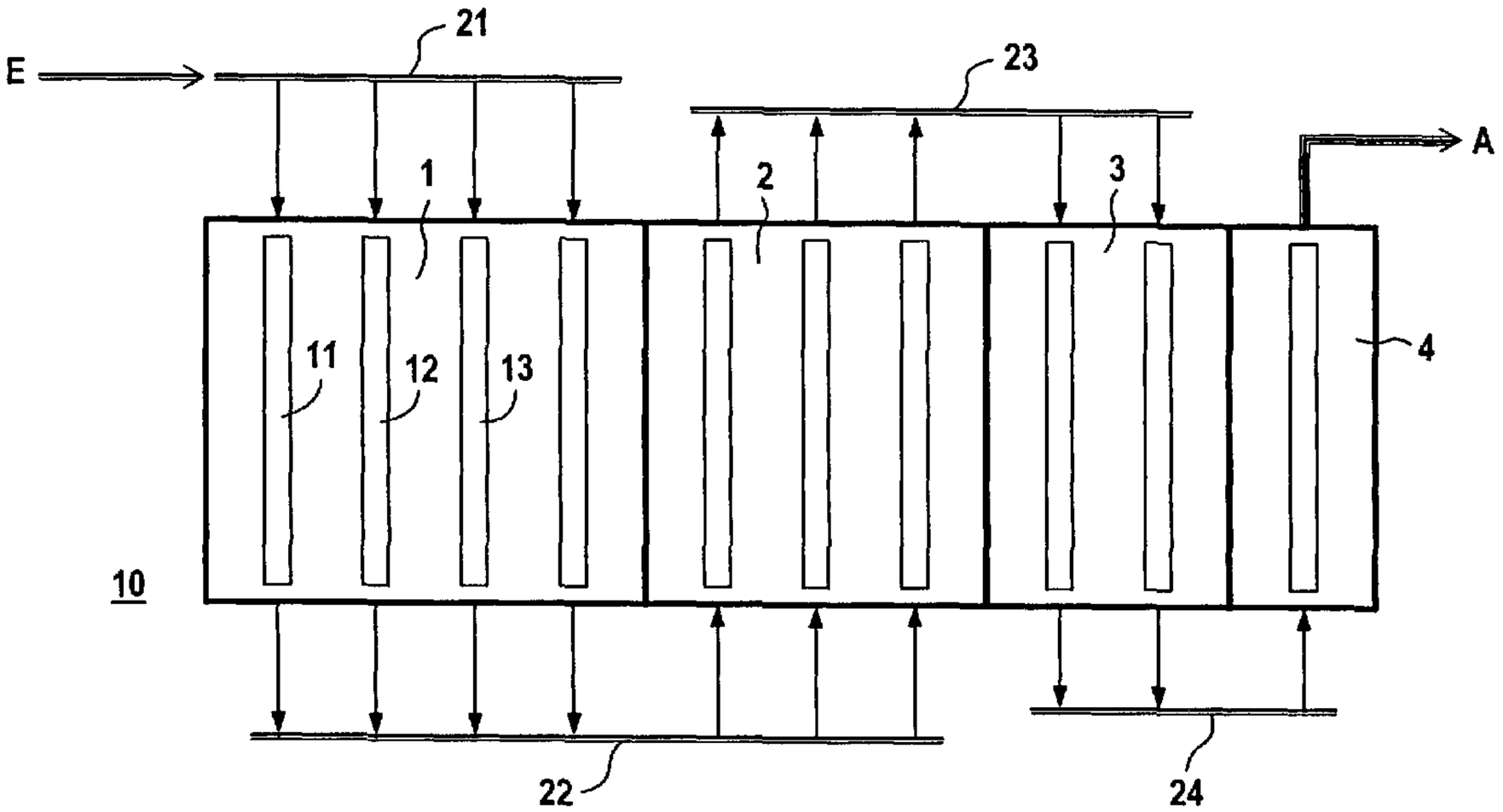
(54) Titre : PROCEDE D'UTILISATION D'UN SYSTEME DE PILES A COMBUSTIBLE HT-PEM ET SYSTEME DE PILES A COMBUSTIBLE CORRESPONDANT

(54) Title: METHOD FOR OPERATING AN HT-PEM FUEL CELL SYSTEM AND ASSOCIATED FUEL CELL SYSTEM



(57) Abrégé/Abstract:
The operation of a fuel cell device in a cascade arrangement is already known according to the prior art. The invention provides a cascade construction especially for a HT-PEM fuel cell device for which cascade operation is possible. This enables the outlet emissions to be influenced advantageously.

ABSTRACT

The operation of a fuel cell device in a cascade arrangement is already known according to the prior art. The invention provides a cascade construction especially for a HT-PEM fuel cell device for which cascade operation is possible. This enables the outlet emissions to be influenced advantageously.

Description

Method for operating an HT-PEM fuel cell system, and associated fuel cell system

The invention relates to a method for operating an HT-PEM fuel cell system which comprises at least one fuel cell module, which is designed as a stack of fuel cells, for hydrogen operation. In addition, the invention also relates to an associated HT-PEM fuel cell system having at least one fuel cell module for hydrogen operation.

PEM fuel cells are known from the prior art. The term HT-PEM fuel cell system is to be understood as meaning a system in which the fuel cells are polymer electrolyte membrane fuel cells which work at elevated operating temperatures. In the present context, elevated operating temperatures are to be understood as meaning higher temperatures than the working temperature of the PEM fuel cell of 60°C, specifically temperatures of between 60°C and 300°C, in particular in the range between 120° and 200°C.

Furthermore, it is known from the prior art, in the case of fuel cell systems which are specifically designed for submarine operation, for the fuel cells which have been combined to form a stack to be operated in cascaded form. This is intended to achieve optimum utilization of the fuel. In detail EP 0 596 366 B1 describes a method and an associated device in which the fuel cell is concentrated by a suitable fluid system after it has flowed in parallel through a first group of fuel cells and is then successively fed to further fuel cell groups.

It is not possible to transfer this arrangement to an HT-PEM fuel cell system. Nevertheless, in practice the same demands are proposed.

Therefore, it is an object of the invention to propose an HT-PEM fuel cell system with improved operation.

According to the invention, the object is achieved by the measures described in patent claim 1. An associated fuel cell system is given in patent claim 3.

The invention proposed measures and associated means for constructing a fuel cell module which enables an HT-PEM fuel cell system to operate in cascaded mode. The HT-PEM fuel cell system is operated in the temperature range between 60°C and 300°C, preferably between 120°C and 180°C.

The invention advantageously enables the so-called λ value to be set at a targeted level during fuel operation. This specifically results in particular advantages for the HT-PEM fuel cell.

Further details and advantages of the invention will emerge from the following description of figures of an exemplary embodiment. The only figure shows a fuel module of an HT-PEM fuel cell system with means for cascaded operation.

In the figure, 10 denotes a fuel cell module comprising a multiplicity of fuel cell units which is part of an HT-PEM fuel cell system. As with the standard PEM fuel cell, the stacking of the fuel cell units with in each case one membrane electrode assembly results in what is known in the specialist terminology as a stack. An HT-PEM fuel cell stack of this type is operated at higher temperatures than the conventional PEM fuel cell, which operates, for example, at 60°C; by way of example, an HT-PEM fuel cell stack of this type is operated at temperatures of between 60 and

300°C. Advantageous operating temperatures for the HT-PEM fuel cell are between 120°C and 200°C.

The fuel cell module 10 is divided into individual units 1, 2, 3, 4, ..., the figure illustrating, by way of example, a cascade having four units 1 to 4. All four units 1 to 4, which have a successively decreasing number of fuel cell units and MEAs, are operated in cascaded from with hydrogen as fuel gas from a common fuel gas system, allowing suitable adjustment of the fuel gas. The cascaded operation results in an improvement to the process management such that in each case the appropriate quantity and concentration of hydrogen is present at the sensitive MEAs of the HT-PEM fuel cells.

The fuel cell module 10 is supplied with the fuel gas via the inlet E. The fluid lines in the individual cascade stages are denoted by 21 to 24. Residual gas is discharged at the outlet A.

The cascaded arrangement described makes it possible even for HT-PEM fuel cells to optimize what is known as the λ value, which is characterized by the use of the fuel gas. This results in considerable improvement specifically for HT-PEM fuel cells. In detail, the exhaust emissions can be influenced and therefore in particular polluting emissions to the environment can be reduced.

Patent claims

1. A method for operating an HT-PEM fuel cell system which comprises at least one fuel cell module having a stack of HT-PEM fuel cells for hydrogen (H_2) operation, characterized in that the fuel cell module is operated with the HT-PEM fuel cell in cascaded format.

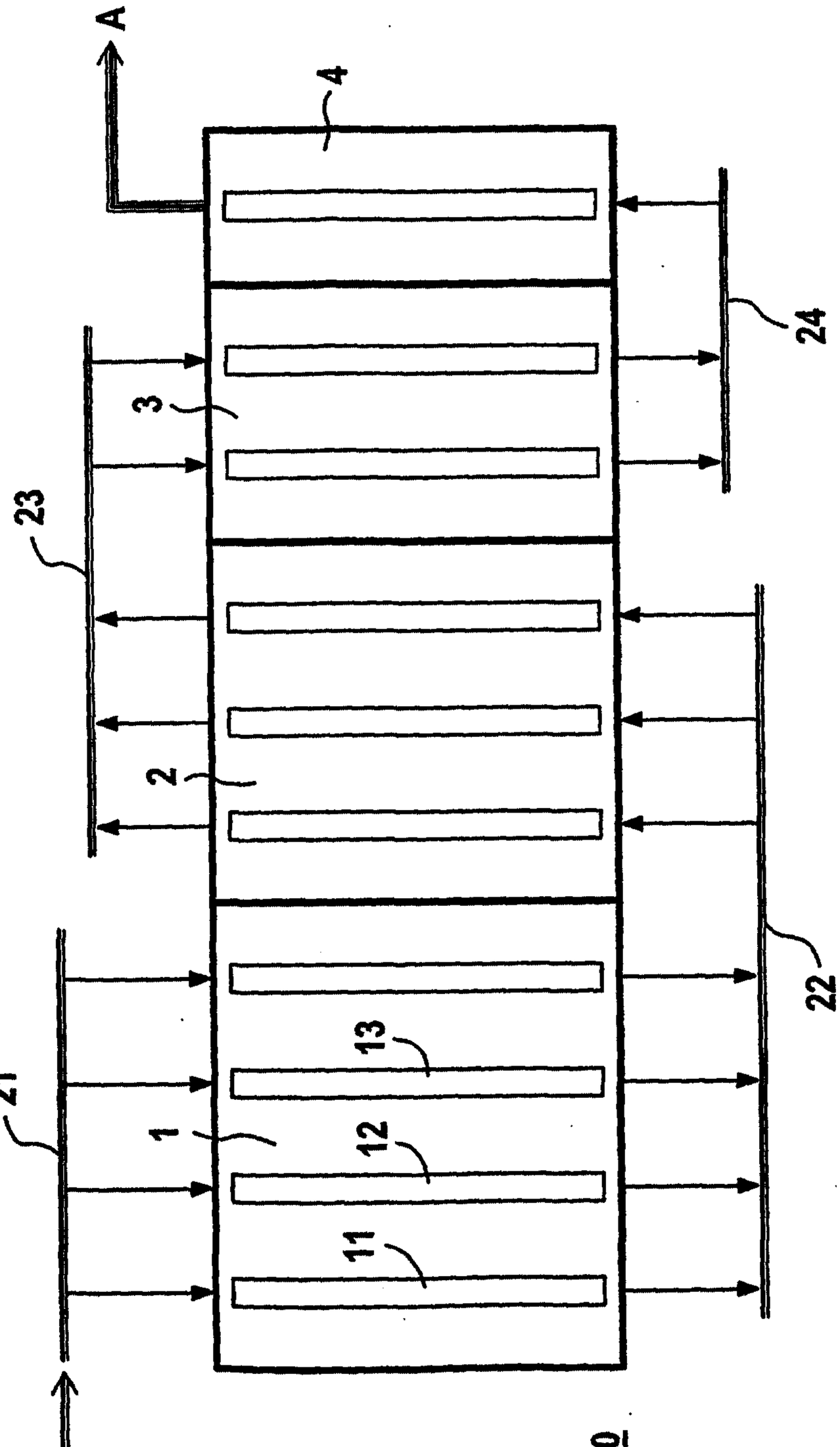
2. The method as claimed in claim 1, characterized in that the fuel cell module of the HT-PEM fuel cell system is operated in the temperature range between 60°C and 300°C, preferably between 120°C and 200°C.

3. The method as claimed in claim 1 or claim 2, characterized in that the cascaded arrangement influences, in particular reduces, the exhaust emissions from the fuel cell module.

4. An HT-PEM fuel cell system for carrying out the method as claimed in claim 1 or claim 2 or 3, having at least one fuel cell module with HT-PEM fuel cell for hydrogen (H_2) operation, characterized in that there are means (21, 22, 23) for producing a cascaded structure of the fuel cell module (1).

5. The HT-PEM fuel cell system as claimed in claim 4, characterized in that the cascaded structure comprises the fuel cell module (10) being divided into individual units.

6. The HT-PEM fuel cell system as claimed in claim 5, characterized in that the individual units of the fuel cell module (10) are supplied by a common fuel gas system.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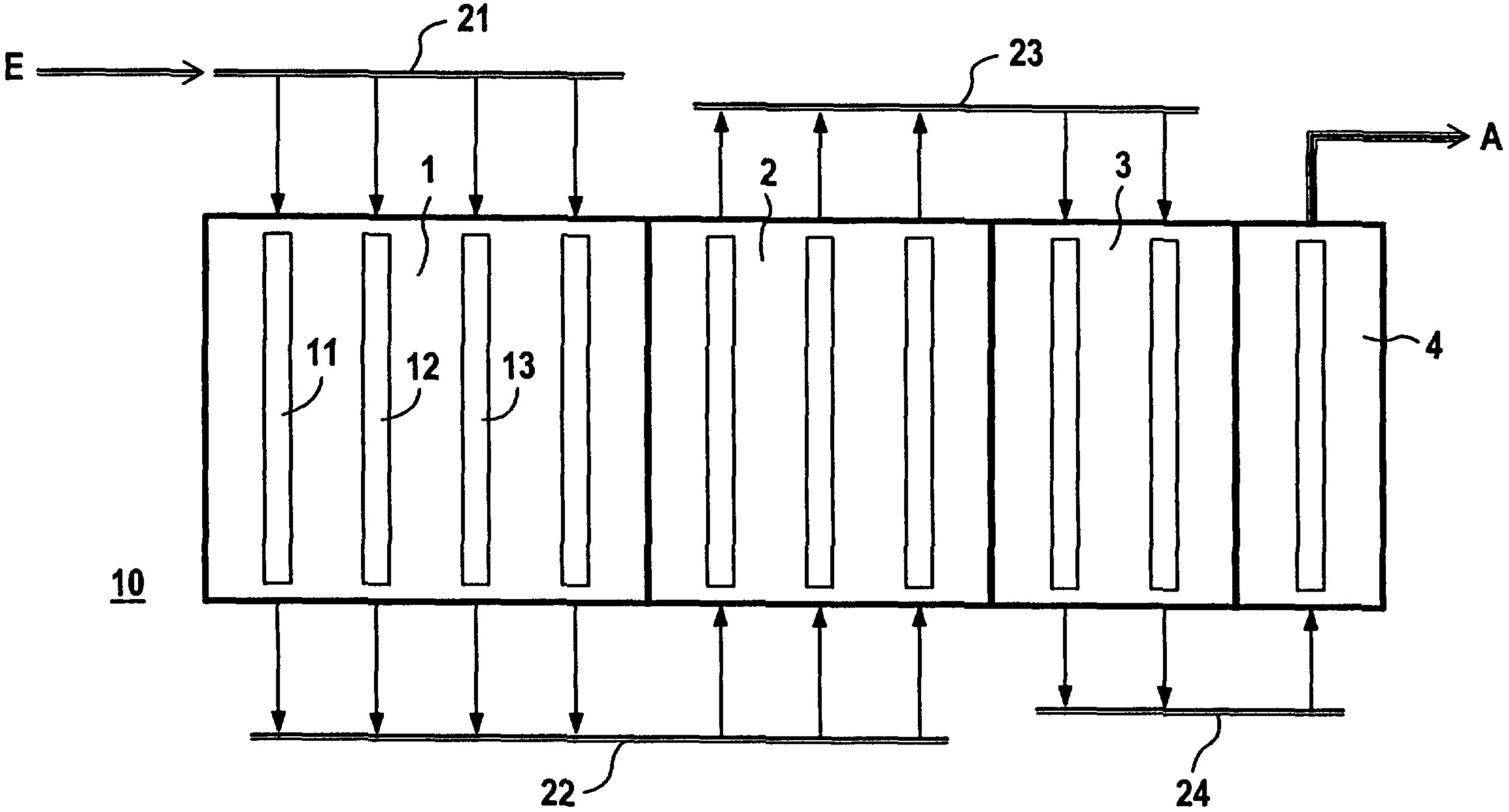
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