AUTONOMOUS WIND-HYDROGEN STATION

Description

In connection with a threat of the global energy and ecology crisis the developed countries around the world are elaborating alternative technologies and devices utilizing the renewable energy of the Sun and its derivatives (wind, water waves etc). Among them the wind power is used most effectively and fully, so numerous wind plants of small and high capacity have been created. In many cases these plants are integrated into industrial electric networks (farms), and the regions distanced from these centralized networks have no possibility to enjoy this natural gift. We propose elaboration of an autonomous wind-hydrogen station (AWHS), task of which is generation of hydrogen to be utilized later on in various machines and mechanisms (power installations on the basis of fuel cells, motor transport etc).

Creation of such station is based on utilization of a primary electric power with non-standard parameters (in terms of frequency, current's parameters) in order to get final products (oxygen and hydrogen) in the end of the technological line. This solution will allow simplification of electric stations and, as a sequence, cost reduction of their building and service. Such concept will find its niche in the AWHS markets and create conditions for settling and development of the world's remote regions.

Innovative Aspects and Main Advantages

The source of a primary energy in AWHS composition is an autonomous wind power plant (WPP) of ~ 200 kW, which converts the wind energy into electric one.

The generated by WPP electric power of non-standard parameters is delivered through a system of electric transformation and control directly to an electrolyzer, in which hydrogen and oxygen are produced by electrolytic method from water prepared in a desalting unit and provided by pumps under commands of respective control system. The obtained hydrogen and oxygen are accumulated and stored in standard high-pressure bottles. Later on they can be pumped from them into more compact storage vessels, for instance, into tanks of cars.

The following novel principal solutions have been chosen for the WPP:

- wind wheel of adaptive type;
- orientation system of passive type with a tail-vane mechanism;
- support of modular design;
- earthquake-proof foundation;
- synchronous generators with permanent magnets;
- control system of simplified type.

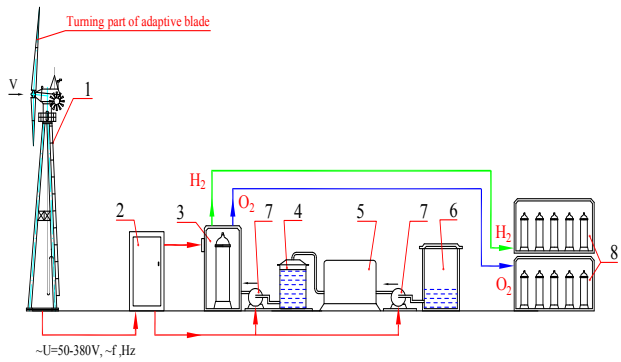

Figure 1 – Principal scheme of AWHS
1 – wind power plant; 2 - cabinet of control and electric equipment; 3 – high-pressure electrolyzer of module type; 4 – tank of desalted water; 5 – desalting unit (distilling/reverse osmosis type); 6 – tank of initial water; 7 – pump; 8 – system of produced hydrogen and oxygen storage.

One such station at continuous operation in the specified mode is able to produce hydrogen in amount of ~100 kg. It corresponds to ~250 l of petrol in energy equivalent and reduces CO_2 emission into atmosphere by 500 kg.

Area of Application

The AWHS is intended for provision of decentralized regions (distanced from industrial electric grids) having sufficient wind potential with gaseous hydrogen and oxygen. The obtained gases can be utilized later on in various machines and mechanisms (power installations on the basis of fuel cells, motor transport etc).

Stage of development

On the basis of the own experience in designing, manufacture and experimental operation of WPP of ~200 kW power in composition of active electric stations, high-pressure electrolyzers and system of hydrogen compact storage both in high-pressure bottles and in hydrides of metals, a project of AWHS has been developed, a stand specimen of AWHS has been mounted for experimental investigations of electric station's characteristics, such as power and mass-flowrate ones at non-standard parameters of electricity.

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