Autonomous complex module for peat development on watered deposits

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Abstract. Nowadays the issues of Russia outlying regions development are connected with energy security and very acute. Existing producing methods have a negative anthropogenic impact on the environment. Existing devices for peat primary processing and formation in the conditions of natural water contents are not suitable for application of the autonomous complex. The following modules were suggested: the module of primary processing, the module of formation and dehydration, which can produce a finished product with qualitative physic-mechanical properties.

1. Introduction

Russia has huge fossil fuels stores; herewith natural gas, oil, and coal are mostly used in energy supply and industry. The main trend of the country energy saving politics is gradual reduction of the fossil fuel utilization and use of alternative sources of energy. One of them is peat. As it is noted in [1], peat is one of the most promising sources of energy. In Russia the peat stratum annually builds up by 1 mm per year. If the swamp area is 1.1 million km^2 it makes more than 1 billion m2 annually [2].

Table 1. Peat resources distribution over Russia area [3]

Russia region	Total area of peat deposits within the boundaries of the productive pool
North-West	8.9
Central	1.4
Central Black Earth Region	0.04
Volga-Vyatka Region	0.5
Povolzhskiy Region	0.1
Ural Region	2.7
West-Siberian Region	34.1
East-Siberian Region	3.1
Far East Region	5.7
Kaliningrad Region	0.1

2. Materials and methods

All countries actively develop peat deposits and use them in energy supply, agriculture and industry. Russian peat deposits are still undeveloped. Many foreign countries do not develop peat; some of them process it till the finished product and export it [4]. Peat has many different applications: peat grains, pellets, metallurgical coke, adsorbent carbon, filter elements and sorbents, organic fertilizers, cosmetics production, in landscaping of the urban areas and near-house areas. Nowadays, peat has insignificant share in the country energy supply (0,1 %), while in Ireland it takes 15 % of energy supply, in Finland – 11 %, in Belorussia – more than 4 % [5].

According to the 2017 year results, only 67 % of the country is gasified, whereas 33 % of population has to use alternative sources of energy. Distant regions cannot be fully gasified as gas pipelining costs a lot; delivery of existing traditional energy resources is also expensive.

Existing production practices have a negative anthropogenic impact on the environment - drying of big areas worsen the ecological situation. Tilled pit development and storage is rather dusty and fire risky. Peat development requires big territories as extraction is done in layers and not downwards the whole stratum [8].

Basing on the above mentioned, it is necessary to implement modern peat developing complexes for extracting, processing and producing a finished product. Application of these complexes in the country distant regions is vital. Russia peat deposits provide wide opportunities for energy supply in regions.

An autonomous complex for peat extraction and processing at watered deposits meets these requirements [6]. Its ability to extract peat on the watered areas is its advantage. The complex is able to operate autonomously and power feed the nearest regions.

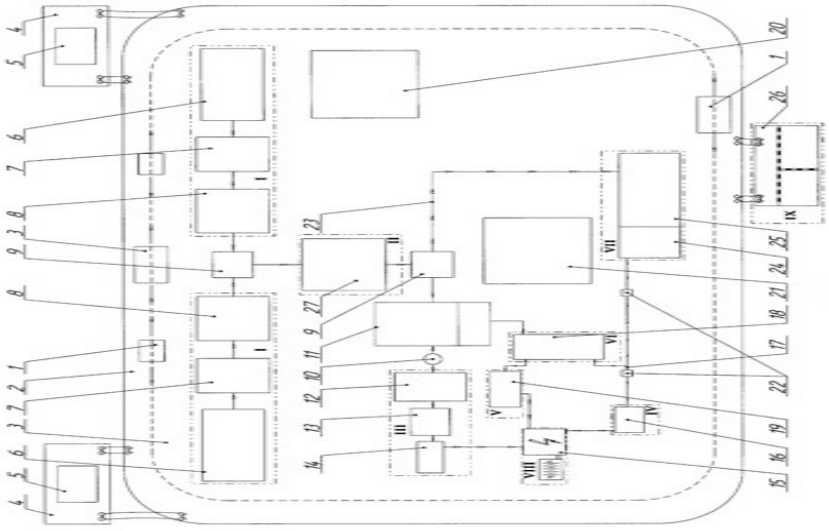

Figure 1. Peat extraction and processing method for plant-peat floating bogs and a device for its implementation.

Peat extracting and processing complex consists of: a raw material preparation module; a pressing module; a module for energy production from solid fuel; a module for energy production from liquid fuel; a module for energy production from gas; a gas generator; a module for finish product reloading; an electrical power module; a finished product storage.

To achieve high rates it is necessary to develop and implement modern highly effective technologies for peat extracting and processing. To receive high quality finished product the following modules have been developed: the primary processing module, the module for peat formation and dehydration.

The primary processing module can divide the excavated raw material into two fractions (small and big), that allows better peat blending and averaging. The module excludes the necessity of warehouses for wastes storage, minimizing fire hazards.

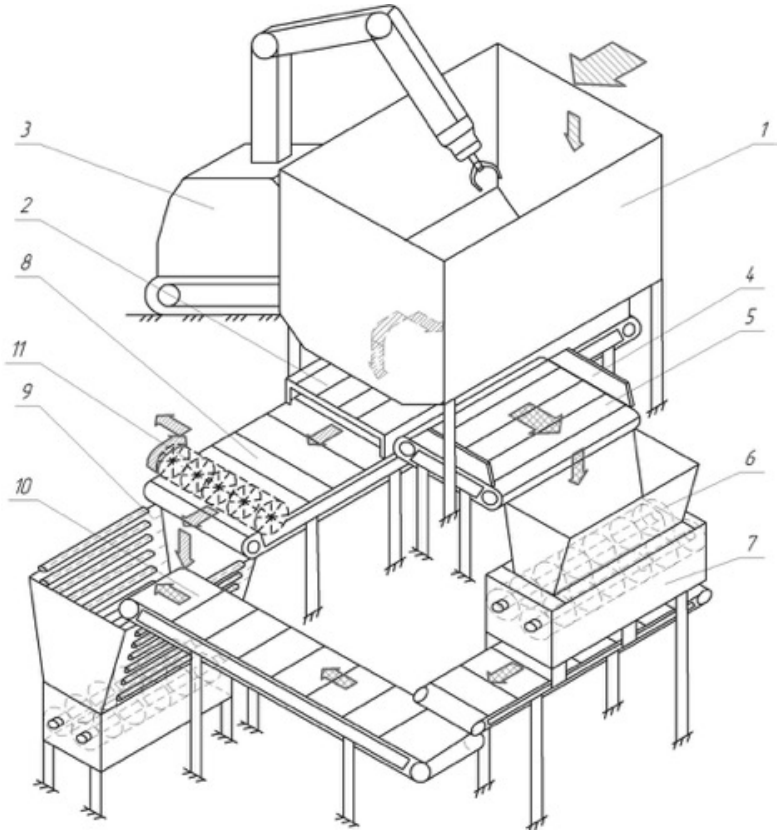

Figure 2. The primary processing module: 1 – receiving bin; 2 – keyed separator; 3 – ripper-manipulator; 4 – guide; 5 – feeder; 6 – feeding bin; 7 – wood chipper; 8 – belt conveyor; 9 – grinding mill bin; 10 – conveyor transporter; 11 – peat dust cleaner.

The formation and hydration bin differs from other peat formation devices by that the pressing plate compresses peat material till ohmic resistance sensors or pressure sensors give the signal of the set value.

The sensors are tuned for the proper values: the ohmic resistance sensors feel the raw material humidity; the pressure sensors feel maximal permissible formation pressure. The formation process finishes with the value limit signal from one of the sensors, it allows receiving forms of high quality and prescribed density, that diminishes cracks formation in the figures during drying and improves customers' suitability of the finished product.

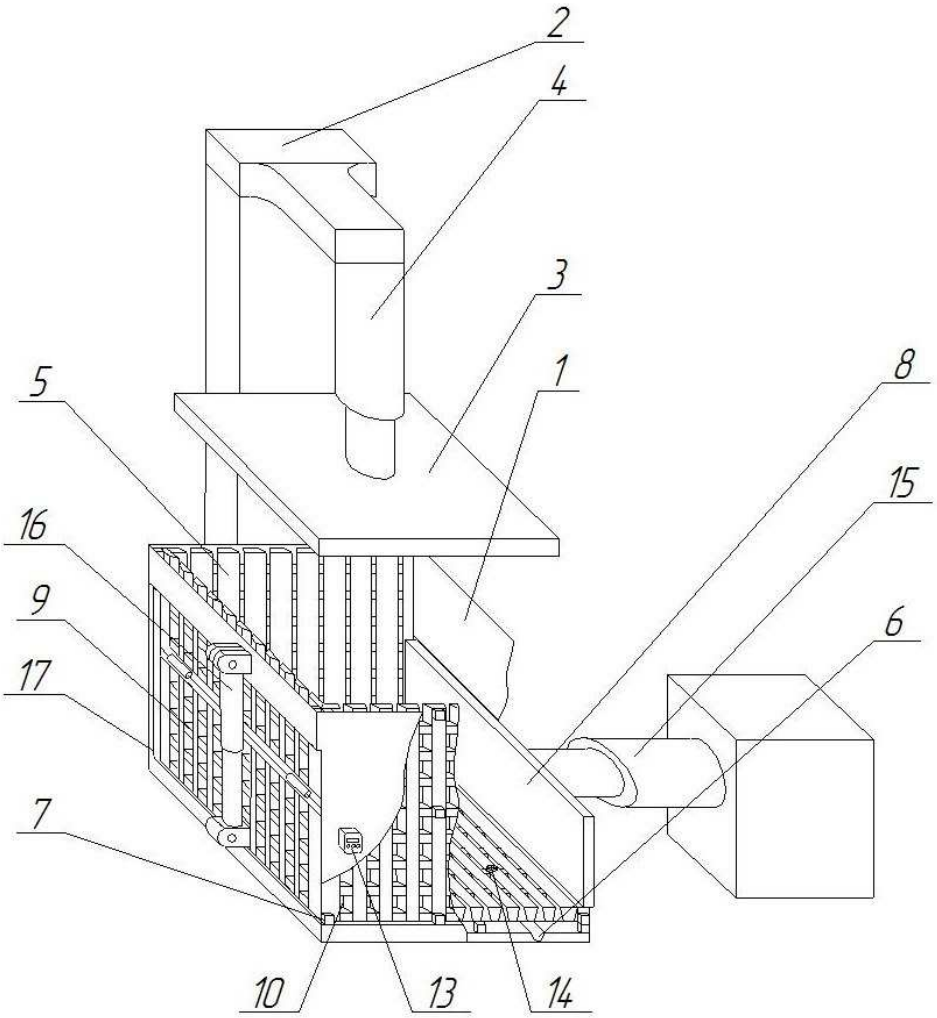

Figure 3. The peat formation and hydration module: 1 – container; 2– hydraulic press; 3 – press plate; 4 – piston rod; 5 – skeleton frame; 6 – discharge; 7 – sockolets; 8 – extrusion half-wall; 9 – hinged half-wall; 10 – perforation hole; 11 – entry end; 12 – exit end; 13 – ohmic resistance sensor; 14 – pressure sensor; 15 – extrusion half-wall hydro cylinder; 16 – hinged half-wall hydro cylinder; 17 – window.

3. Conclusion.

Nowadays, neat and power enterprises use fossil fuels; that has a bad anthropogenic influence on the environment and does not guarantee steady industry development in the long run. Country distant regions have to produce power from expensive resources. Many areas have vast peat deposits that allow producing constant and cheap power. Peat extraction and processing with the autonomous complex should consist of unified system of modules, processing peat material with further production of the good product for power supply. This complex eliminates environment contamination, and allows using a part of the product in industries and developing power supply of the country.

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