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The Innovative Wind Turbine

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***Abstract*—Scientific research is devoted to a wind turbine, which is a mechanism for generating electricity from mechanical wind energy.**

It should be noted that modern wind turbines with a horizontal axis of rotation are characterized by such problems as low efficiency, minimum wind speed to start them in operation of 3-5 m / s and complete stop at a wind speed of 25 m / s.

In this scientific study, based on the above problems, the following problem was posed below, and was solved.

The purpose of the work is to increase the wind speed mechanically inside the system, increase the efficiency of the turbine, ensure the operability of the equipment at low wind speeds, ultimately, achieving more kilowatts of energy in this sector.

The goal was solved by the following methods.

From our side, the design of wind turbines was improved, based on the Bernoulli law. The number of turbines in an improved wind turbine is not 1, but 5. These turbines are placed inside specially designed stages. As a result, on the basis of a multistage regime, the kinetic energy of the wind will be used without loss and more efficiently, and wind turbines will be able to function by increasing the wind speed at relatively low speeds while generating more energy.

Keywords: wind turbine, improved, Bernoulli law, windy weather, efficiency.

I. INTRODUCTION

The world directly depends on the development of the economy and sources of inorganic energy. Exhaustion of underground energy resources, their direct production of human and machine reactions requires energy-efficient and beneficial use of energy in alternative sources, one and the most effective of which is a wind power plant (WPP).

Wind power plant (WPP) is a device serving to convert the kinetic energy of the wind flow into mechanical energy of the rotor rotation of the generator, thereby converting it into electrical energy.

A. TYPES OF WIND POWER PLANTS.

The wind turbine is classified by the number of blades, according to the materials from which they are made, along the axis of rotation and the pitch of the screw[8, 9, 10, 11, 12, 13, 14].

There are two main types of wind turbines:

• with a vertical axis of rotation.

• with a horizontal axis of rotation. They are high-speed with a small number of blades and slow-moving multi blade, with an efficiency of up to 40%.

B. ADVANTAGES AND DISADVANTAGES OF DIFFERENT TYPES OF WIND TURBINES.

The main advantages are:

1. Absence of environmental pollution
2. Use inexhaustible energy source, which does not require costs.
3. Minimum losses in the transmission of energy - the wind turbine can be built both at the consumer and in remote locations that can be connected to the backbone network.

The main disadvantages are:

1. Variability of power in time - the productivity of wind turbines depends, on a straight line, on the strength of the wind.
2. Noise - according to the latest studies it was proved that this disadvantage is insignificant since the noise emanating from the windmill at a distance of 30-40 m reaches the level of ambient noise.
3. The threat to birds is not significant and unlikely [1, 2] .

It should be noted that modern wind turbines with a horizontal axis of rotation are characterized by such problems as low efficiency, minimum wind speed to start them in operation of 3-5 m / s and complete stop at a wind speed of 25 m / s.

In this scientific study, based on the above problems, the following problem was posed below, and was solved [4, 5, 6, 7].

II. PURPOSE OF THE WORK.

The purpose of the work is to increase the wind speed mechanically inside the system, increase the efficiency of the turbine, ensure the operability of the equipment at low wind speeds, ultimately, achieving more kilowatts of energy in this sector.

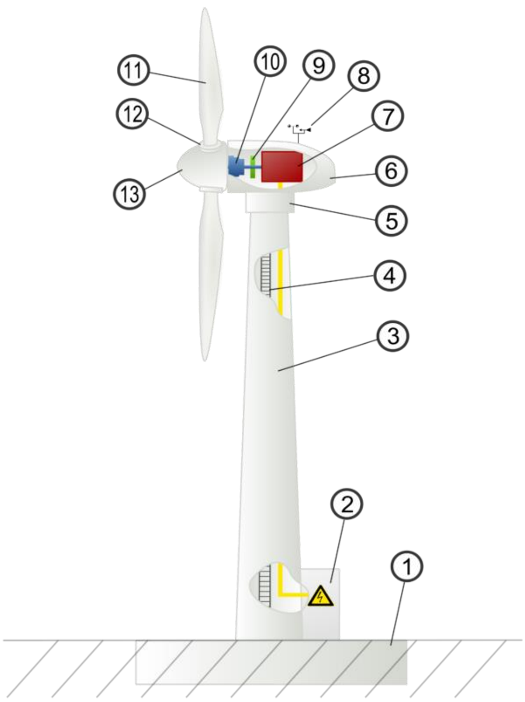
The goal was solved by the following methods [15].

From our side, the design of wind turbines was improved, based on the Bernoulli law. The number of turbines in an improved wind turbine is not 1, but 5. These turbines are placed inside specially designed stages. As a result, on the basis of a multistage regime, the kinetic energy of the wind will be used without loss and more efficiently, and wind turbines will be able to function by increasing the wind speed at relatively low speeds while generating more energy.

A. PRINCIPLE OF CONSTRUCTION.

Due to the wind-trap, the speed of the incoming wind in the wind turbine is increased by the calculated value. As a result, a wind force capable of driving two wind turbines simultaneously is achieved, at the first stage two turbines will rotate. The wind flowing inside the device at the first stage moves from a larger diameter to a smaller one, according to the Bernoulli law, the wind speed increases and rotates the turbine located on the second stage. In the next stage, the wind, which has used most of its kinetic energy leaving the second stage, passing to the third and in the same order to the fourth stage, as mentioned before according to Bernoulli's law increases its speed, therefore regenerating its kinetic energy and spinning turbines located on the third and the fourth stage after which it is released into the atmosphere through the fifth step. As a result of theoretical calculations, it was found out that the power of the wind turbines offered by us will increase by 3-4 times with respect to traditional structures.

B. DEVICE INDUSTRIAL WIND INSTALLATION



Consists of: 1-Foundation, 2- Power cabinet including power contactors and control circuits, 3- Tower, 4- Stairs, 5- Swivel mechanism, 6- Gondola, 7-Electric generator, 8- Tracking system for wind direction and speed , 9-Brake system, 10-transmission, 11- Blades, 12- blade angle change system, 13- fairing

C. IMPROVED WIND TURBINE.

The invention relates to a wind turbine, which is a mechanism for obtaining more electrical energy from mechanical wind energy than traditional wind turbines, using a new multi-stage static construction based on the Bernoulli law.

The power of the windmill depends on the coefficient of wind energy use (η = 0.6), wind speed (v) and swept area (S=π r^2){\displaystyle N=pSV^{3}/2}. There are two formulas for determining the power of the wind turbine, but more simplified, as well as common, is the following:

$$N = \eta \cdot \pi \cdot r^2 \cdot v$$

where: v - wind speed, η - coefficient of wind energy use, r - radius of blades [1].

To obtain a value close to true, the following losses must be taken into account:

1. The loss factor for the screw (0.6)
2. Drive loss factor (0.8)
3. Generator loss factor (0,8)

When using a new improved design:

4. The coefficient of loss of aerodynamic friction (0.8)

Using the above formula, for purposes of comparison, an initial calculation of traditional, horizontally axial wind turbines of circular rotation with a radius of (1,2,3 ... 15 m) and an average annual wind speed of 5 m / s was carried out (tab.1.),

Table.1.Calculation of traditional, horizontally axial wind turbines.

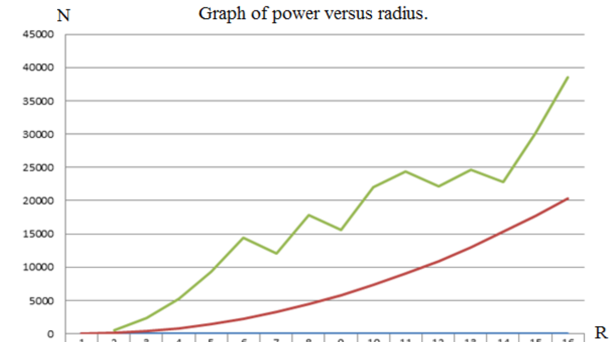
Radius. R. m.	Average speed wind. V m / s	Coefficient use of wind power. η.	π	Coefficient loss on the screw.	Coefficient losses drive.	Coefficient losses generator.	"Power. N1. W "
1	5	0,6	3,14	0,6	0,8	0,8	90,432
2	5	0,6	3,14	0,6	0,8	0,8	361,728
3	5	0,6	3,14	0,6	0,8	0,8	813,888
4	5	0,6	3,14	0,6	0,8	0,8	1446,912
5	5	0,6	3,14	0,6	0,8	0,8	2260,8
6	5	0,6	3,14	0,6	0,8	0,8	3255,552
7	5	0,6	3,14	0,6	0,8	0,8	4431,168
8	5	0,6	3,14	0,6	0,8	0,8	5787,648
9	5	0,6	3,14	0,6	0,8	0,8	7324,992
10	5	0,6	3,14	0,6	0,8	0,8	9043,2
11	5	0,6	3,14	0,6	0,8	0,8	10942,272
12	5	0,6	3,14	0,6	0,8	0,8	13022,208
13	5	0,6	3,14	0,6	0,8	0,8	15283,008
14	5	0,6	3,14	0,6	0,8	0,8	17724,672
15	5	0,6	3,14	0,6	0,8	0,8	20347,2

In an equivalent way, as well as with identical data, an improved wind turbine was calculated using the Bernoulli law (tab. 2.).

Table.2. Calculation of an improved wind turbine.

Radius. R. m.	Average speed wind. V m / s	Increased average wind speed V m/s	Coefficient use of wind power. η.	π	Coefficient loss on the screw.	Coefficient losses drive.	Coefficient losses generator.	The coefficient of loss of aerodynamic friction.	Power. N1. W
1	5	10	0,6	3,14	0,6	0,8	0,8	0,8	578,7648
2	5	10	0,6	3,14	0,6	0,8	0,8	0,8	2315,0592
3	5	10	0,6	3,14	0,6	0,8	0,8	0,8	5208,8832
4	5	10	0,6	3,14	0,6	0,8	0,8	0,8	9260,2368
5	5	10	0,6	3,14	0,6	0,8	0,8	0,8	14469,12
6	5	8,3	0,6	3,14	0,6	0,8	0,8	0,8	12057,6
7	5	8,57	0,6	3,14	0,6	0,8	0,8	0,8	17859,02811
8	5	7,5	0,6	3,14	0,6	0,8	0,8	0,8	15626,6496
9	5	7,7	0,6	3,14	0,6	0,8	0,8	0,8	22057,3696
10	5	7,5	0,6	3,14	0,6	0,8	0,8	0,8	24416,64
11	5	6,81	0,6	3,14	0,6	0,8	0,8	0,8	22196,94545
12	5	6,66	0,6	3,14	0,6	0,8	0,8	0,8	24693,9648
13	5	6,15	0,6	3,14	0,6	0,8	0,8	0,8	22794,42905
14	5	6,42	0,6	3,14	0,6	0,8	0,8	0,8	30137,10994
15	5	6,66	0,6	3,14	0,6	0,8	0,8	0,8	38584,32

According to the obtained data, having constructed a graph of the dependence of the power on the radius of the blades, it can be seen that the power of the improved wind turbine is much higher than the traditional one.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
R.(м)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N1 W	0	90,43	361,7	813,9	1447	2261	3256	4431	5788	7325	9043	10942	13022	15283	17725	20347
N2 W		578,8	2315	5209	9260	14469	12058	17859	15627	22057	24417	22197	24694	22794	30137	38584

III. CONCLUSION.

A new wind turbine was proposed from a number of existing designs, and its performance criteria were studied. 2. Calculations show that the proposed wind turbine of only one stage is

approximately 2 times more powerful than existing structures.

REFERENCES

[1] https://allalternativeenergy.com/content/raschyot-vetrogeneratora

[2] https://alternativenergy.ru/vetroenergetika/581-plyusy-minusy-vetroenergetiki.html

[3] Tony Burton, David Sharpe, Nick Jenkins, Ervin Bossanyi: Wind Energy Handbook, John Wiley & Sons, 2nd edition (2011), ISBN 978-0-470-69975-Darrell, Dodge, Early History Through 1875, TeloNet Web Development, Copyright 1996–2001

[4] Ersen Erdem, Wind Turbine Industrial Applications

[5]Robert Gasch, Jochen Twele (ed.), Wind power plants. Fundamentals, design, construction and operation, Springer 2012 ISBN 978-3-642-22937-4.

[6] Erich Hau, Wind turbines: fundamentals, technologies, application, economics Springer, 2013 ISBN 978-3-642-27150-2 (preview on Google Books)

[7] Siegfried Heier, Grid integration of wind energy conversion systems John Wiley & Sons, 3rd edition (2014), ISBN 978-1-119-96294-6

[8]Peter Jamieson, Innovation in Wind Turbine Design. Wiley & Sons 2011, ISBN 978-0-470-69981-2

[9] J. F. Manwell, J. G. McGowan, A. L. Roberts, Wind Energy Explained: Theory, Design and Application, John Wiley & Sons, 2nd edition (2012), ISBN 978-0-47001-500-1

[10] David Spera (ed,) Wind Turbine Technology: Fundamental Concepts in Wind Turbine Engineering, Second Edition (2009), ASME Press, ISBN 9780791802601

[11] Alois Schaffarczyk (ed.), Understanding wind power technology, John Wiley & Sons, (2014), ISBN 978-1-118-64751-6

[12] Hermann-Josef Wagner, Jyotirmay Mathur, Introduction to wind energy systems. Basics, technology and operation. Springer (2013), ISBN 978-3-642-32975-3

[13] GA Mansoori, N Enayati, LB Agyarko (2016), Energy: Sources, Utilization, Legislation, Sustainability, Illinois as Model State

[14] Wind Turbine / Invention/ Jafarov Kamran Cavad, Aslanov Jamaladdin Nuraddin. State Committee on Standardization, Metrology and Patents of Azerbaijan Republic, 2018.