

AP19675518 “Creation of a prototype of an innovative passenger pneumolift for buildings and structures” – p.m. Taranov A.V.

Relevance

The market of light passenger elevators needs to be modernized. In Kazakhstan, there are 5,000 elevators in operation that have reached their standard service life (according to the National Association of Elevator Engineers of Kazakhstan). A similar situation is observed in the other CIS markets.

Domestic development of passenger pneumatic elevators solves this problem, providing the safest equipment on the market.

Significant advantages of pneumatic lifts, compared to rope and the other types (hydraulic, rack, etc.), are as follows:

- simplicity of design;
- reliability and safety in operation;
- unlimited lifting height;
- reduced costs for manufacturing, installation and operation;
- low required excess pressure of compressed air in the subvascular cavity of the shaft creates favorable dynamic conditions for the pneumatic lift.

The project methodology is based on the theoretical foundations of mechanical engineering and electrical engineering, pneumatic devices and systems, mathematical statistics, methods of measuring and processing experimental results and methods of specialized software for design work.

As a result, a package of design documentation will be developed and a prototype of a passenger pneumatic lift will be manufactured. Potential consumers of the project are mid- and high-rise residential buildings, business centers and other administrative buildings. The basic operating principle and technical capabilities were successfully developed by the research group and tested on a serial cargo pneumatic lift.

The development of passenger pneumatic lifts allows us to offer the market a domestic export-oriented solution that surpasses foreign analogues in characteristics.

The project objective

The objective of this project is to develop a pilot industrial model of a passenger pneumatic elevator, as well as design and technological documentation/

Expected Results

1. Design and technological documentation for a passenger pneumatic lift for residential buildings.
2. Application for a Eurasian patent.
3. Pilot industrial model of a passenger pneumatic lift for residential buildings.
4. At least 3 (three) articles and/or reviews in peer-reviewed scientific publications indexed in the Science Citation Index Expanded of the Web of Science database and/or having a CiteScore percentile in the Scopus database of at least 35 (thirty-five).
5. At least 1 article or review in a peer-reviewed foreign or domestic publication recommended by CQASHE.
6. At least 3 (three) reports at international conferences.

Achieved results

1. 3D models of elements of a multi-story passenger pneumatic lift were developed to implement a functional scale model using additive technologies.
2. Boundary conditions and requirements for the characteristics of sealing elements and their design were determined.
3. Materials were selected for manufacturing a reliable seal.
4. Laboratory tests of the selected materials were carried out for final validation of their compliance with the established requirements.



Figure 1 – Fans manufactured by Taira



Figure 2 – Frequency converters VFD500

Research team

No.	Full name, education, degree, academic title	Main place of work, position	Hirsch index, ResearcherID, ORCID, Scopus Author ID (if any)	Role in the project, nature of the work performed	Brief justification of participation
1	Taranov Alexander Viktorovich, Candidate of Technical Sciences	Abylkas Saginov Karaganda Technical University NJSC, Associate Professor of the Power Systems	Hirsch index 3, ORCID - 0000-0002-1534-9737, Scopus Author ID - 56669560400	Project manager. General management, strategic planning. Managing the progress and analyzing the results of project decisions	24 years of research experience. Experience in creating three modifications of cargo pneumatic lifts

		Department			
2	Suleimanov Seidakhmet Rishadovich, post graduate studies	KazakhAvtomatika LLP, project manager	Hirsch index 1, ORCID - 0000-0001-5753-3789, Scopus Author ID - 56669831600, ResearcherID - ADZ-1365-2022	Responsible researcher. Development of technology, its adaptation to market needs, participation in the preparation of patents and publications.	12 years of research experience. Experience in developing and commercializing innovative technologies. Understanding market needs. He was the head of a successfully implemented commercialization project
3	Bulatbayev Feliks Nazymovich, Candidate of Technical Sciences, Associated Professor	Abylkas Saginov Karaganda Technical University NJSC, Professor of the Power Systems Department	Hirsch index 7, ORCID - 0000-0002-3574-1189, Scopus Author ID - 56669831600	Researcher. Development of technology, preparation of publications and patents, performance of theoretical and practical research.	23 years of research experience. Experience in developing mining machines.
4	Brazhanova Dana Korabayevna, Master of Engineering	Abylkas Saginov Karaganda Technical University NJSC, lecturer	Hirsch index 1, ORCID - 0000-0002-1241-6279, Scopus Author ID - 57220805586	Researcher. Participation in all stages of the project. Preparation of reports, articles, patents, preparation of technical documentation.	Master of Instrumentation, 8 years of research experience. Experience in developing intelligent systems.
5	Baidyussenov Galym Nurzhanovich, Master	Abylkas Saginov Karaganda Technical University NJSC, senior lecturer	h-index 0, ORCID 0000-0001-6145-7117, Scopus Author ID 57541025100	Researcher. Participation in all stages of the project. Preparation of reports, articles, patents. Mathematical, computer modeling, preparation of technical documentation	He completed his doctoral studies at AUES and has 5 years of experience in studying thermal insulation and heating network operating modes. He is the author of 7 scientific articles.
6	Balandin Vitali Sergeevich, Master	Abylkas Saginov Karaganda Technical University NJSC, senior lecturer	ORCID - 0000-0002-6593-1864, Scopus Author ID - 57215332448	Researcher. Participation in all stages of the project. Preparation of reports, articles, patents. Mathematical, computer modeling, preparation of technical documentation.	Engineer specializing in "Electric Power Engineering". Scientific and pedagogical experience of 17 years. More than 50 scientific papers have been published.
7	Bilichenko Arkadi Petrovich	Abylkas Saginov Karaganda Technical	ORCID - 0000-0002-2132-7016	Researcher. Participation in all stages of the project. Preparation of reports,	Engineer specializing in "Electric Power Engineering".

		University NJSC, senior lecturer		articles, patents, theoretical and practical research. Mathematical, computer modeling.	Scientific and pedagogical experience of 17 years. More than 50 scientific papers have been published.
8	Vacancy	-		Engineer. Conducting tests of a pilot industrial sample, technical support.	Research experience, conducting factory tests.
9	Vacancy	-		Engineer. Conducting tests of a pilot industrial sample, preparation of technical documentation.	Preparation for certification of passenger pneumatic lift

List of publications

1) Taranov A.V. Methodology of factory testing of pneumatic lifts for buildings and structures // International scientific and practical conference "XV Toraiyrov's readings", Pavlodar, 2023, pp. 203-207.

2) Taranov A.V. Effect of compressed air leaks on the operation of a skip pneumatic lifting unit // International scientific and practical conference "Integration of science, education and production - the basis for the implementation of the Nation's Plan" (Saginov's readings No. 15), Karaganda, 2023, pp. 525-526

3) Taranov A.V. Experimental study of the skip pneumatic hoisting plant model // University Proceedings, No. 3 (92), 2023, pp. 513-518 (DOI 10.52209/1609-1825_2023_3_513)

4) Testing guide devices of passenger pneumatic lifts / Taranov A.V., Lukin D.A. International scientific and practical conference "Integration of science, education and production" (Saginov's readings No. 16), Karaganda, 2024, pp. 699-701.

5) A.V. Taranov, A.D. Mekhtiyev, F.N. Bulatbayev, Y.G. Neshina, V.S. Balandin. Pneumatic Load Hoists For Mineral Transportation From Mines // NEWS of the National Academy of Sciences of the Republic of Kazakhstan, No. 5(466), 2024, pp. 167-177.

6) Taranov A.V., Suleymanov S.R., Bulatbayev F.N., Brazhanova D.K., Issayev V.L., Kyzyrov K.B., Issayev I.V., Kalytka V.A. Piston pump // Application for Eurasian patent No. 298471 dated 07/01/2024.

7) Taranov A.V., Suleymanov S.R., Bulatbayev F.N., Brazhanova D.K., Issayev V.L., Kyzyrov K.B., Issayev I.V., Kalytka V.A. Gear hydraulic motor // Application for Eurasian patent, 2024.

Information for potential consumers

Technical and economic calculations have shown that simplification of the pneumatic lift design has led to reducing the costs of its manufacturing, mounting, maintenance, operating costs, and elimination of costs for construction, mounting, and adjustment work by 2-3 times (depending on the type of lift). This in turn makes the pneumatic lift competitive with the existing rope and the other types of freight elevators, and eliminates Kazakhstan dependence on foreign suppliers of such equipment.

Scope

Field of science: hoisting and transport machinery. Potential consumers of the project are residential buildings of medium and high storeys, business centers and other administrative buildings. Development of pneumatic lifts for passengers allows us to offer the market a domestic export-oriented solution that surpasses foreign analogues in characteristics.

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