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**Abstract.** Today, in the conditions of a market economy, the use of various electrical devices in various sectors of the national economy poses great challenges to specialists in the field of their development. Taking into account world experience, instead of traditional motors, which perform most of the work in industry and require a lot of electricity, linear motors are used in some sectors of the economy, which, in turn, are distinguished by their simple design and high efficiency. In particular, the prospects for using linear asynchronous motors in various sectors in Uzbekistan have been established and scientific and practical research is being conducted.

**Keywords:** Linear induction motor, conventional induction motor, LIMTV, RTV31, JFK, Alstom Citadis, Eurotram, linear synchronous motors, EMALS induction motor, platform, livestock farm.

Linear induction motors are generally less efficient than conventional asynchronous motors, but over time, the frequent occurrence of air gap effects in conventional asynchronous motors led to a decrease in power output for a given power rating. The absence of these effects in linear induction motors led to their development.

However, the advantage of linear asynchronous motors is that they minimize the impact of air gaps. However, energy consumption is not always the determining factor. For example, in many cases, linear asynchronous motors have very few moving parts and may require minimal maintenance. Furthermore, using linear asynchronous motors in motion control systems instead of rotary motors with rotary-linear gearboxes (reducers) provides higher throughput and control system accuracy, as rotary-linear gearboxes introduce backlash, static friction, and/or mechanical compliance into the control system (fig 1).





**Figure 1. The testing process of the LIMTV linear induction motor in 1973.**

Thanks to these properties, linear motors have found widespread use, for example, on the Linimo magnetic levitation train line near Nagoya, Japan (Fig. 2).

The world's first commercial automated magnetic levitation system was a low-speed magnetic levitation train that ran from Birmingham Airport to the nearby Birmingham International Station and operated from 1984 to 1995. The track was 600 meters long, the trains were levitated by electromagnets to a height of 15 millimeters, and were driven by linear induction motors. It operated for nearly eleven years, but was decommissioned due to problems with its electronic systems. One of the original carriages is now on display at the Railworld museum in Peterborough, alongside the floating carriage RTV31.



**Figure 2. Maglev trains at Birmingham Airport.**

However, linear motors have been used independently of the magnetic field, such as Tokyo's Toei Ōedo Line. The longest rapid transit system using this technology is the Guangzhou Metro, which runs for about 130 km (81 mi) on Lines 4, 5, and 6, with CHAM-powered metro trains.

Most of the linear motors used are CHAM (linear asynchronous motors) or CHSM (linear synchronous motors) (Figure 4).



**Figure 4. View of the EMALS asynchronous motor.**

Linear induction motors have also been used to launch aircraft. The first example is the Westinghouse Electropult system, introduced in 1945, as well as the Electromagnetic Aircraft



Launch System (EMALS), scheduled for delivery in 2010. Linear induction motors are also used in weaving machines, where magnetic levitation allows bobbins to move between fibers without direct contact.

Given the above, today in our republic, versatile, simple-design, and automated electric machines are used in various industries, such as agriculture, livestock farming, water management, and manufacturing. The most common of these are linear asynchronous motors, which can be used for feed distribution in livestock farming, one of the most important sectors of the national economy. The main technological processes in livestock farming include the preparation, storage, and transportation of feed to the farm; its preparation; the transportation of all types of feed within the livestock farm; the distribution of all types of feed and feed mixtures; the removal, loading, and transportation of manure; and feed technology. One of the technological processes for the maintenance and feeding of young cattle on small farms is shown in Figure 5. Figure 5 shows that, in addition to animal care, this process includes the preparation, storage, and distribution of feed, and the removal and storage of manure.



**Figure 5. Localized feed distribution technology on a livestock farm. Photo taken on a livestock farm in the Kui-Chirchik district of Tashkent region.**

Feed distribution to animals is one of the most labor-intensive processes. The degree of its electrical mechanization on farms ranges from 50% to 60%, accounting for 20% to 70% of the total labor costs for animal care. Feed distribution completes the feeding process and is a crucial part of this complex, as the effectiveness of all animal feeding activities depends on the timely distribution of feed.

Based on feed delivery and distribution methods, production is divided into three groups: stationary feed delivery systems; mobile feed delivery systems; and portable feed delivery systems; and stationary feed distribution systems. Consequently, high labor productivity and versatile, convenient equipment are essential for producing high-quality products. Given this, the



use of platform feed dispensers on livestock farms is considered one of the most effective methods (Figure 6).

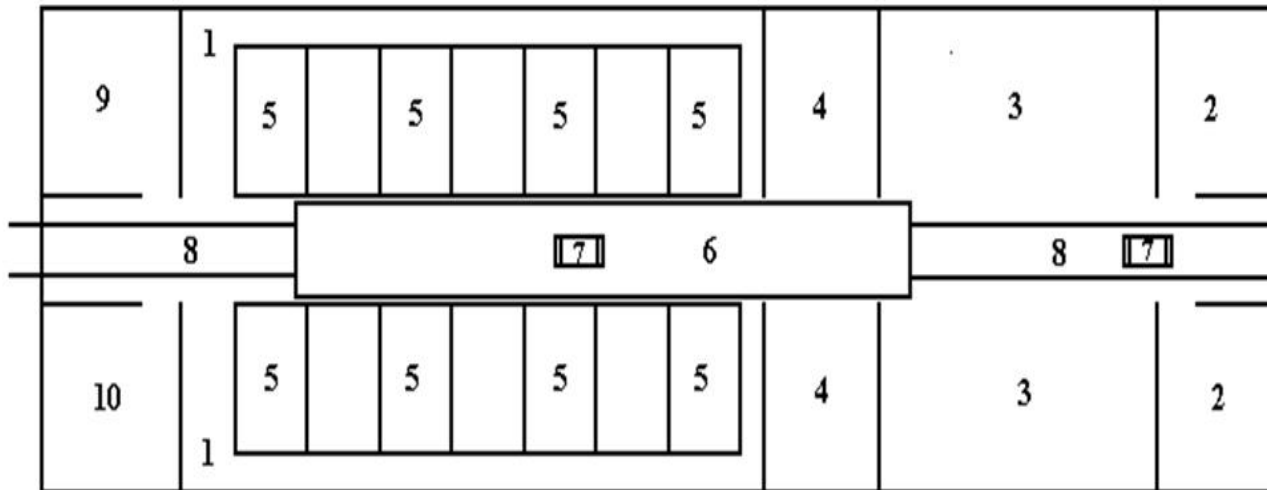
Proper rearing of young cattle (calves) on farms, organization of their adequate feeding, application of environmental technologies, compliance with veterinary and sanitary measures, and the use of recommendations for growing nutritious crops are important factors in the further development of animal husbandry.



**Figure 6. Local feed dispenser (nursery). Photo taken at the farm of the Research Institute of Animal Husbandry and Beekeeping.**

One of the technological schemes for the maintenance and feeding of young cattle for small farms is presented in Figure 7. As can be seen from the diagram, here, in addition to animal care, the preparation, storage, and distribution of feed, as well as the removal and storage of manure, are carried out.

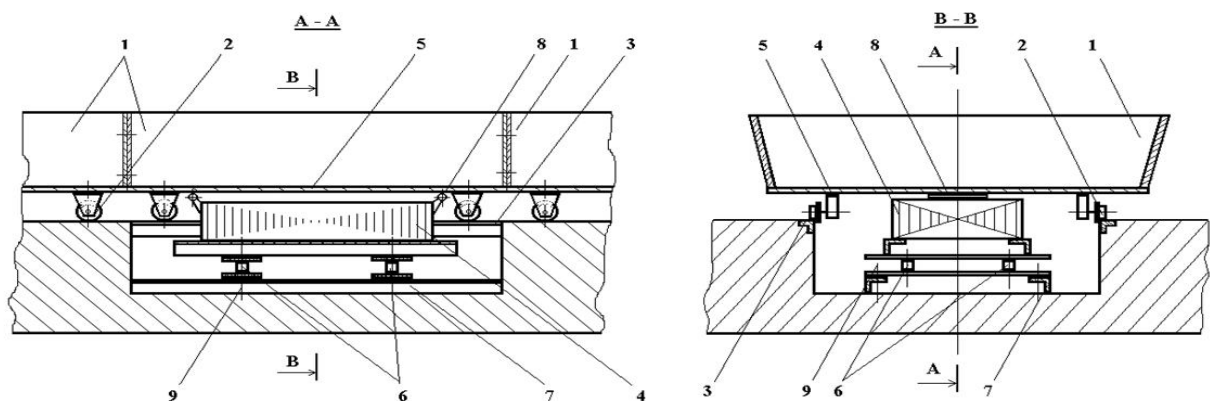




**Figure 7. Technology of feeding young cattle for farms:**

- 1 – Livestock buildings; 2 – Feed storage; 3 – Feed processing plant; 4 – Finished feed storage; 5 – Cattle stalls; 6 – Feeding platform;
- 7 – Electric drive; 8 – Feeding platform movement path;
- 9 – Weighing equipment; 10 – Feed storage.

Structural diagram of the platform forage spreader electric drive. Figure 8 shows the structural diagram of a platform forage spreader with a linear asynchronous electric motor.



**Figure 8. Platform feed distributor and linear electric motor:**

- 1 – Conveyor platform; 2 – Roller; 3 – Moving track; 4 – CHAM inductor;
- 5 – Conveyor platform; 6 – Flexible element; 7 – Frame; 8 – Air gap roller; 9 – Adjusting bolt.

The performance characteristics of the asynchronous electric motor with a linear feed dispenser and platform, installed on a 100-head cattle farm, are shown in **Table 1**. Technological description of a cattle farm for 100 heads.

| T.p | Name of indicators                               | Dimension s |
|-----|--|-------------|
| 1   | Standard design 819                              | 22x84       |
| 2   | Number of young cattle on the farm               | 100         |
| 3   | Platform feed dispenser capacity, m <sup>3</sup> | 60          |
| 4   | Total length of platform feeder, m               | 60          |
| 5   | Length of the side of a cattle farm, m           | 30          |



|   |  |         |
|---|--|---------|
| 6 | Feeder platform width, m                   | 1,2     |
| 7 | Linear mass of feed, kg/m                  | 12-60   |
| 8 | Platform feed distributor speed, m/s       | 0,5-1,3 |
| 9 | Power of the platform feed distributor, kW | 5,0     |

**Relevance.** The above data demonstrates that using linear asynchronous motors as platform feeders increases farm productivity.

Firstly, this impacts the size of the cattle farm. For example, if we distribute feed locally, we would need to use equipment (tractors) to distribute the feed, which would, in turn, require the construction of a larger cattle farm. Using linear asynchronous motors on feed platforms will result in significant savings in farm space.

Secondly, the use of machinery on a farm affects the animals' peace of mind due to noise and gases emitted (Fig. 9). Using a platform feeder is environmentally friendly and quiet, preventing disturbance to farm animals.



**Figure 9. Feed grinder. Photo taken at the farm of the Research Institute of Animal Husbandry and Beekeeping, Kibray district, Tashkent region.**

Thirdly, the convenience of adjustable speed and automatic control of the platform feed dispenser will lead to increased productivity, reduced labor costs and the production of products that meet the requirements of a market economy.

**Conclusion:** In conclusion, it should be noted that in an era of technological advancement, the use of integrated, resource-saving electrical devices is one of our primary goals. Therefore, the use of linear asynchronous motors instead of traditional electric motors will help solve a number of problems arising in our industry. As already noted, the use of gearless motors is currently permeating all areas of society, including in Uzbekistan, where they are used as feed dispensers in virtually all industries, including livestock farms. Furthermore, scientific research is being conducted by professors and faculty at many research universities.



### References

1. Постановление Президента Республики Узбекистан от 29.01.2020 г. №ПП-4576. «О дополнительных мерах государственной поддержки животноводческой отрасли». – Народное слово, 30 января 2020 г.
2. Дегтерев Г.П. Справочник по машинам и оборудованию для животноводства. – М.: Агропромиздат, 2017. – 224 с.
3. Muhammadiev A., Yunusov R.F. and other. Liner motor drive of cattle farm feeders. 1st International Conference on Energetics, Civil and Agricultural Engineering 2020 (ICECAE 2020). IOP Conf. Series: Earth and Environmental Science 614 (2020) 012013.
4. Мухаммадиев А., Юнусов Р.Ф., Халиқназаров Ў.А., Рахмонов Ш.С. Тяговые характеристики линейного асинхронного двигателя для электропривода платформенного кормораздатчика. – В кн.: «Аграрные теоретические и практические проблемы аграрной науки и их решение». Сб. материалов Международной конф., 2020 г., 14-15 декабря, ТашГАУ. – Ташкент, 2020, С. 863-867.
5. Yunusov R.F., Rahmonov Sh.S. "Chiziqli motorlarni turlari va ularning ekspluatatsiyasining kamchilik va afzaliklari". – Development of science Ilmiy jurnal 2025/4 volume 1 ISSN 3030-3907, 345-352 b.

