IJDIAS International Journal of Discoveries and Innovations in Applied Sciences

| e-ISSN: 2792-3983 | www.openaccessjournals.eu | Volume: 3 Issue: 2

Feasibility Study of the Designed Working Equipment of the MM-1 Machine

Kamoliddin Juraboevich Rustamov

Acting Head of the Department of Engineering of Technological Machines, Tashkent State Transport University (Tashkent, Uzbekistan)

Abstract:

This article discusses the issues of machine performance indicators of a machine with multi-purpose working bodies. Also, area of rational use of the machine are analyzed.

Keywords: machine performance indicators, multi-purpose working bodies, area of rational use, MM-1, preliminary assessment.

Introduction

Machine Performance Indicators

A preliminary assessment of the efficiency of the machine is performed based on the analysis of the generalized indicator Π_{Nmn} by comparing it with the indicators for a set of single-purpose machines that perform the same work as multi-purpose machines [1, 2, 3, 4, 5, 6, 7, 8 ,9]. For a machine with multi-purpose working bodies, the indicator Π_{Nmn} is reduced to the form:

$$\Pi_{Nmnмmn} = \frac{\sum_{i=1}^{n} N_i \left(\sum_{j=1}^{k} m_j + m_м \right) n_p p_{np}}{\sum_{j=1,g=1}^{k,Q} \left(\Pi_{jg} p_j p_g \right)^3}$$

where: n is the number of engines installed on the machine; N_i is the power of the engine of the corresponding working body; k is the number of working bodies that ensure the performance of the relevant types of work; m_j is the mass of working bodies and elements that ensure the performance of the corresponding types of work; m_m is the mass of the base machine; n_p is the number of workers servicing the machine; p_{pr} is the probability of the appearance of the total number of workers servicing the machine at the same time; Q is the number of types of operating conditions (types of soil, building materials, etc.); P_{jg} - performance for each type of work and under appropriate operating conditions; p_j is the probability of occurrence of types of work; p_g is the probability of occurrence of operating conditions.

We determine the performance of drilling equipment on different categories of soil:

$$\Pi = \frac{3600}{T_ц} q_я \frac{k_н k_в}{k_р}$$

where: $T_ц$ – cycle time;

$q_я$ – geometric volume of the drilled hole;

$k_н$ – auger filling ratio;

$k_в$ – soil loosening factor;

| e-ISSN: 2792-3983 | www.openaccessjournals.eu | Volume: 3 Issue: 2

k_p – working time utilization rate.

$$П_I = \frac{3600}{136{,}1} \cdot 0{,}4 \cdot \frac{1 \cdot 0{,}85}{1{,}1} = 8{,}04 м^3 / ч$$

$$П_{II} = \frac{3600}{138{,}8} \cdot 0{,}4 \cdot \frac{0{,}97 \cdot 0{,}85}{1{,}2} = 7{,}15 м^3 / ч$$

$$П_{III} = \frac{3600}{143{,}2} \cdot 0{,}4 \cdot \frac{0{,}95 \cdot 0{,}85}{1{,}25} = 6{,}72 м^3 / ч$$

We determine the performance of excavation equipment

$$П = \frac{3600}{T_ц} q_к \frac{k_н k_в}{k_p}$$

where: $q_к$ – excavator bucket geometric capacity;

$k_н$ – bucket fill factor;

$$П_I = \frac{3600}{15{,}8} \cdot 0{,}25 \cdot \frac{1 \cdot 0{,}85}{1{,}1} = 43{,}5 м^3 / ч$$

$$П_{II} = \frac{3600}{16{,}0} \cdot 0{,}25 \cdot \frac{0{,}97 \cdot 0{,}85}{1{,}2} = 38{,}7 м^3 / ч$$

$$П_{III} = \frac{3600}{16{,}3} \cdot 0{,}25 \cdot \frac{0{,}95 \cdot 0{,}85}{1{,}25} = 36{,}3 м^3 / ч$$

We determine the performance of crane equipment

$$П = \frac{3600}{T_ц} Q k_г k_в$$

where: Q – crane lifting capacity;

$k_г$ – crane utilization factor by lifting capacity.

$$П = \frac{3600}{15{,}0} 0{,}5 \cdot 0{,}8 \cdot 0{,}85 = 81{,}6 т / ч$$

Probability of occurrence of types of work p_j:

- for drilling equipment - 0.15;
- for crane equipment - 0.30;
- for excavation equipment - 0.55.

Probability of occurrence of operating conditions p_g:

- I category - 0.2;
- II category - 0.48;
- III category - 0.2.

The mass of working bodies and elements m_j, ensuring the performance of the relevant types of work;

- drilling equipment - 730 kg;
- crane equipment - 170 kg;
- excavation equipment - 800kg.

The mass of the base machine mm=5600kg.

Thus, a preliminary assessment of the efficiency indicator for the use of P_{Nmn} machines with multi-purpose replaceable working bodies.

$$\Pi_{Nmnмmn} = \frac{65{,}4\cdot(730+170+800+5600)\cdot 1\cdot 0{,}9}{(8{,}04\cdot 0{,}2\cdot 0{,}15)^3+(7{,}15\cdot 0{,}48\cdot 0{,}15)^3+(6{,}7\cdot 0{,}2\cdot 0{,}15)^3}$$

$$\frac{1}{(43{,}5\cdot 0{,}2\cdot 0{,}55)^3+(38{,}7\cdot 0{,}48\cdot 0{,}55)^3+(36{,}3\cdot 0{,}2\cdot 0{,}55)^3+(81{,}6\cdot 1\cdot 0{,}3)^3} = 27\,м^3/ч$$

Comparing the generalized indicator of the efficiency of the use of P_{Nm} machines with the indicators for a set of single-purpose machines, the values of which lie in the range 36÷45, we establish that this machine corresponds to the best samples

Area of Rational Use of the Machine

It is advisable to determine the areas of rational use of road machines of various designs, considering the background of operation, by analyzing the expressions of equal efficiency, which are formed on the basis of analytical dependencies of the corresponding indicators [10, 11, 12, 13, 14, 15]:

$$\left(\sum_i^n \Pi_i p_i\right)_{i1} = \left(\sum_i^n \Pi_i p_i\right)_{i2} \qquad (4.3.1)$$

where Π_i process performance indicator;

p_i likelihood of operating conditions.

The competitiveness of road machines is an important and specific performance indicator. The level of competitiveness is assessed for imported machines and machines supplied for export in order to justify their acquisition or develop measures to increase their competitiveness in the foreign market, identify promising machines for export and stimulate the sale of export products. Competitiveness is determined by a set of consumer properties necessary and sufficient for the sale of a machine at comparable prices in a particular market. The quality of export products can be determined by a system of indicators. Depending on the specific features, certain groups of indicators may be absent. If necessary, enter additional indicators. Indicators of the terms of sale, service and prestige advertising are determined in points by experts. The competitiveness of machines is evaluated by the complex indicator of competitiveness k_k [16, 17, 18, 19, 20]. This indicator is defined as the sum of relative private indicators, considering the relative weight of each:

$$k_k = \sum_{i=1}^{n} k_i \alpha_i$$

IJDIAS International Journal of Discoveries and Innovations in Applied Sciences

| e-ISSN: 2792-3983 | www.openaccessjournals.eu | Volume: 3 Issue: 2

where k_k - relative *i*-th quality indicators of the considered machine; α_i - weight coefficient of the *i*-th relative quality indicator.

Relative quality indicators

$$k_i = П_i / П_{i0} \qquad (4.3.2)$$

$$k_i = П_{i0} / П_i \qquad (4.3.3)$$

where $П_i$ - the value of the *i*-th indicator of the evaluated machine: $П_{i0}$ - value of the *i*-th indicator of the reference machine.

When using an indicator, an increase in the value of which indicates an improvement in quality, take the dependence (4.3.2), if vice versa, then take the dependence (4.3.3).

According to the complex indicator kk, the machine can be classified as competitive if $k_k>1$ or non-competitive if $k_k<0.9$. Intermediate values characterize a low level of competitiveness. A complex indicator is a necessary criterion for assessing competitiveness, subject to the obligatory observance of a high level of each particular indicator [21, 22, 23, 24, 25, 26, 27].

Conclusion

1. The efficiency indicator of the designed MM-1 machine has been established and determined, on the basis of which the efficiency estimate is within 36-45%.

2. The calculated technical and economic effect from the introduction of the developed machine design is determined:

- productivity;
- cost of capital investment;
- annual fund of working hours;
- cost.

REFERENCES:

1. Баловнев В.И., Хмара Л.А. Интенсификация земляных работ в дорожном строительстве. М.: Транспорт, -1983. 3-9 с.
2. Крутиков И.П. Экскаваторы. М.: Машиностроение, -1984. -392 с.
3. Экскаватор одноковшовый с ковшом 0,25 м^3 на тракторе «Беларусь» ЮМЗ-6АЛ/6АМ гидравлический ЭО-2621А. Техническое описание и инструкция по эксплуатации ТО. Саранский экскаваторный завод. Саранск. -1978. -94 с.
4. Аскарходжаев Т.И. и др. Разработка технологической машины ММ-1 на базе трактора ТТЗ. // Сборник докладов республиканских научно-техни-ческих конференций с участием зарубежных ученых. Ташкент. -2004. -58 с.
5. Тракторы ТТЗ-80.10, ТТЗ-80.11. Техническое описание. Инструкция по эксплуатации и техническому обслуживанию. Ташкент. ГАО «ТТЗ». -с. 7.
6. Панкратов С.А. Конструкция и основы расчета главных узлов экскаваторов и кранов. М.: «Машгиз», -1972. -540 с.
7. Алексеева Т.В. и др. Дорожные машины. Часть 1. Машины для земляных работ. М.: Машиностроение. -1972. 393-434 с.

8. Аскарходжаев Т.И., Рустамов К.Ж. Обоснование и выбор основных параметров гидропривода многоцелевой машины ММ-1. XII Московская международная межвузовская научно-техническая конференция студентов, аспирантов и молодых ученых. Москва, 3 апреля 2008.

9. Аскарходжаев Т.И., Рустамов К.Ж. Особенности гидропривода многоцелевой машины ММ-1. XII Московская международная межвузовская научно-техническая конференция студентов, аспирантов и молодых ученых. Москва, 3 апреля 2008.

10. Аскарходжаев Т.И., Ульмасова Л.А. Расчет экскавационного оборудования многоцелевой машины ММ-1. ТИИЖТ, Материалы научно – технической конференции по проблемам наземных транспортных систем. Ташкент, 29-31 мая 2008.

11. Аскарходжаев Т.И., Рустамов К.Ж. Определение основных параметров гидропривода многоцелевой машины ММ-1. Журнал «Вестник», Ташкент, февраль 2008.

12. Isyanov, R., Rustamov, K., Rustamova, N., & Sharifhodjaeva, H. (2020). Formation of ICT competence of future teachers in the classes of general physics. *Journal of Critical Reviews*, *7*(5), 235-239.

13. Alimukhamedov, S. P., Abdukarimov, A., Sharifhodjaeva, H. A., & Rustamov, K. J. (2020). Structural and kinematic analysis of gear and lever differential mechanisms by symmetric movement of rotation centers for driving and slave gear wheels. *International Journal of Psychosocial Rehabilitation*, *24*(01).

14. Rustamov, K., Komilov, S., Kudaybergenov, M., Shermatov, S., & Xudoyqulov, S. (2021). Experimental study of hydraulic equipment operation process. In *E3S Web of Conferences* (Vol. 264, p. 02026). EDP Sciences.

15. Rustamov, K. J. (2021). Innovative Approaches and Methods in Teaching Technical Subjects. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, *12*(5), 1861-1866.

16. Askarhodjaev, T., Rustamov, K., Aymatova, F., & Husenova, G. (2020). Justification of the hydraulic system parameters of the excavation body of a multi-purpose road construction vehicle based on the TTZ tractor. *Journal of Critical Reviews. Innovare Academics Sciences Pvt. Ltd. https://doi. org/10.31838/jcr*, *7*, 40.

17. Rustamov, K. (2022). The Mathematical model of a positioning hydraulic drive: Mathematical model of a positioning hydraulic drive. *Acta of Turin Polytechnic University in Tashkent*, *12*(2), 76-81.

18. Juraboevich, R. K. (2020). Technical solutions and experiment to create a multipurpose machine. *International Journal of Scientific and Technology Research*, *9*(3), 2007-2013.

19. Rustamov, K. J. (2019). Experimental Work of the Hydraulic Equipment of the Multi-Purpose Machine MM-1. *International Journal of Recent Technology and Engineering (IJRTE) ISSN*, 2277-3878.

20. Dj, R. K. (2019). Experimental Work of the Hydraulic Equipment of the Multi-Purpose Machine MM-1. *IJRTE, November*.

21. Rustamov, K. J., Komilov, S. I., Kudaybergenov, M. S., Shermatov, S. X., & Sh, S. Xudoyqulov. Experimental Study of Hydraulic Equipment Operation Process. Construction Mechanics, Hydraulics and Water Resources Engineering. -pages 5, 2021-year.

22. Rustamov, K. J., & Tojiev, L. O. (2022). Types of Steering and Their Design Aspects. *Indonesian Journal of Innovation Studies*, *20*, 10-21070.
23. Rustamov, K. J., & Husenova, G. Y. (2021). Mathematical modeling of hydraulic equipment of a multi-purpose machine and the sequence of transfer of the dynamic model to the generalized coordinate system. *Asian Journal of Multidimensional Research*, *10*(12), 736-745.
24. Rustamov, K. J., & Bazarbaev, B. M. U. (2021). Theoretical study of the power balance of the equipment of a single bucket hydraulic excavator under the conditions of determining the productivity. In *International Conference on Agriculture Sciences, Environment, Urban and Rural Development.* (pp. 32-37).
25. Rustamov, K. J. Development of a Dynamic Model and Equations of Motion for Hydraulics of Multipurpose Machine MM-1, Tashkent State Transport University, Tashkent City, 100167, Temiryulchilar 1, Uzbekistan. http://khorezmscience.uz
26. Рустамов, К. (2021). Обоснование оптимальных углов позиционирования рабочего оборудования при копании грунта. *Транспорт шелкового пути*, (2), 54-59.
27. Рустамов, К. Ж. (2009). Анализ гидропривода современных строительно-дорожных машин. *Строительные материалы, оборудование, технологии XXI века*, (1), 44-44.