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Preliminary laboratory testing of prototype tractor with a universal chassis in completing with swap bodies

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ABSTRACT: The results of preliminary laboratory tests of a prototype tractor with a universal chassis in completing with swap bodies and an assessment of installation suitability of applying the jack support device when replacing the swap bodies are specified in the article.

KEYWORDS: FARM, UNIVERSAL CHASSIS, BODY, PLATFORM, SUPPORT JACK, TESTS, STAND, PARKING BRAKE, INSTALLATION SUITABILITY.

I.INTRODUCTION

The farming movement in the country is becoming the main producer of agricultural products and a powerful socio - political force capable for taking responsibility for the further development of the agricultural sector. In development of farms, main emphasis is focused on their diversity.

Considering trend towards the development of diversified farms, it is desirable to rid farmers of a large set of different purpose machines, in particular designed for the cultivation of agricultural products and transportation of various agricultural goods [1].

It involves works aimed on creating a modular tractor trailer with universal chassis, allowing it to use the body of different size and volume, depending on the type of cargo.

Thus, the farmer instead of several different complete trailers will be able to purchase one universal chassis complete with different body, which will undoubtedly reduce the total cost of the acquisition.

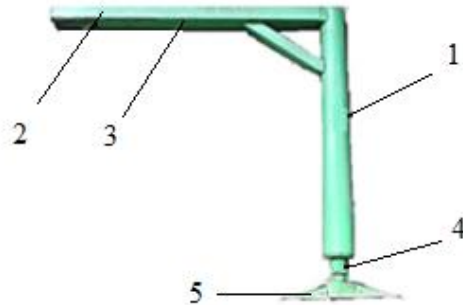
One of the solutions to this problem is the development of a tractor trailer with universal chassis.

Given this, the UE SKB "Tractor" and together with TIPMEAD conducted research work on the design and creation of a tractor modular trailer with a universal chassis, allowing the use of the body of different volume and capacity, depending on the type of cargo [2].

Therefore, the design of the newly created chassis and bodies replaceable to it should be maximally adapted to the technological capabilities of TZST JSC, taking into account its specific production.

Based on this, the terms of reference for a prototype tractor tractor were developed.

When developing the overall layout [3], the mutual arrangement of the nodes and individual assembly elements of the tractor, their preliminary design and geometrical parameters confirming and specifying the value of the indicators specified in the technical project were determined (Fig.1).



1-support post; 2-transverse frame for installation the changeable body; 3-special bolt; 4-screw mechanism; 5- support foot (shoe).

Figure 1. General view of the jacking device

According to the results of the calculations and the layout, working drawings were developed for the manufacture of a prototype of a universal chassis and supporting-jacking devices used to perform the work of the TTZ 8526 trailer body [4].

The developed documentation was transferred to the pilot production workshop of the UE SKB "Tractor", where a prototype tractor trailer was manufactured.

The TTZ 8526 trailer differs from the serial trailer by the presence of a braking system on both axles, an increased base, the size and volume of the body platform [5]. A general view of the manufactured and assembled universal tractor trailer with a chassis assembled with a changeable body and a separately replaceable body is presented in Figure 2.3.

TRAILER COMPLETING

TTZ 8526 trailer is equipped with an additional supporting and jacking device to provide a body change from the universal trailer chassis for storing the demountable body in safe and secure conditions in the process of disconnecting and connecting the trailer chassis (Fig. 3)

TEST RESULTS

After manufacturing, assembly control and intrashop testing, preliminary laboratory and bench tests of the universal tractor chassis with interchangeable bodies and bodies were carried out [6].

In the process of studying the technical characteristics, the conformity of the product was established for the main parameters laid down in the technical specification (compliance of the product to its intended purpose, equipment, overall dimensions, the ability to perform the chassis and docking procedures, included in the technical specification, with the body, etc.) [7,8].

Table 1
Technical parameters of trailer

| № | Name of indices | Value of indices | |
|---|---|----------------------|----------------------------|
| | | Technical parameters | TT38526 |
| 1 | Weight, kg - equipped - complete | 1090 - | 1843 - |
| 2 | Groundclearance, mm | 400 | 400 |
| 3 | Basis, mm | 2500 | 2500 |
| 4 | Track, mm | 1800 | 1800 |
| 5 | Loadingheight, mm | 1210 | 1205 |
| 6 | Internal dimensions of the body, mm - length - width | 4270 2350 | 4310 2330 |

| | | | |
|----|--|----------------------|----------------------|
| | | | - |
| 7 | Body area, m^2 | 10,000 | 10,042 |
| 8 | Body volume with main side walls, m^3 | 5,00 | 5,021 |
| 9 | Body volume with added side walls, m^3 | 15,00 | 15,123 |
| 10 | Overall dimensions, mm - length -width -height | 6390 2500 2930 | 6450 2500 2900 |
| 11 | Effort on the handle of the drive of the parking brake system, N | 60 | 60 |
| 12 | Effort on the handle of a thief of a brake of brakes, N. | 100 | 100 |
| 13 | The angle of transverse static stability, degrees | 30 | 31 |
| 14 | The torsional force of the screw claws supporting-jacking devices N. | - | 40 |

Also, assessments were made of the main parameters affecting the safety of the product:

- evaluation of the effectiveness of the parking brake system;
- assessment of the transverse static stability index (Fig. 4);
- efforts on torsion of the screw of the support-jack device for changing the body.



Figure 2



Figure 3

Figure 2,3. Swap body for a universal tractor chassis in storage position with supporting jacks and fixtures and removing (hauling) the chassis from the trailer body platform



Figure 4 Chassis assembly with a body on a slope when assessing effectiveness of parking brake system

Assessment of installation suitability

The installation suitability of the support-jacking device was also studied when installing under the body in the process of changing rolling and rolling up the universal chassis [9].

The nomenclature of indicators of fit ability includes the following names:

- labour consumption for installation;
- collection rate;
- coefficient of finished assembly.

Determination of indices

1. Labour consumption for installation (finished assembly) S_M , person-h, is determined by the following formula:

$$S_M = S_0 + S_e + S_{np,\delta} \tag{1}$$

where S_0 - labour consumption of the main work during installation (additional assembly), man-h;

S_a - labour consumption of the auxiliary work during installation (finished assembly), man-hours;

$S_{np,\delta}$ - labour consumption of the fitting-finishing works during installation (finished assembly), man-hr.

2. The coefficient of collection of the K_s is determined base on formula

$$K_c = \frac{S_0}{S_0 + S_{np,\delta}} \tag{2}$$

3. The coefficient of presassembly K_{fa} is determined base on formula:

$$K_{fa} = \frac{S_M}{S_{np} + S_M} \tag{3}$$

where S_{eff} - labour consumption of effective assembly of the fabric, man –h

Table 2
Values of indices valid for installation is shown in the below

| № | Name of indices | Values of indices | |
|---|--|-------------------|-----------------|
| | | Installation | Disinstallation |
| 1 | Labour consumption, man-h | 0,134 | 0,317 |
| 2 | Assembly coefficient | 1 | 1 |
| 3 | Coefficient of the finished assembly | 1 | 1 |
| 4 | Number of technologic design solutions during installation (finished assembly) | No | |
| 5 | Labor consumption of effective assembly of the fabric, man-h | No | |

II.CONCLUSION

1. Based on the monitoring materials in the laboratory and bench conditions presented by the two-axle tractor dumping trailer TTZ 8526 with an increased capacity of the body, manufactured by the Tractor Design Bureau, the following results were obtained:

- The use of the TTZ 8526 trailer with an increased capacity of the body increases the productivity of transportation of cotton, as it allows you to load up to three bins of raw cotton, which increases the efficiency of trailer operations.

2. A general analysis of the results of laboratory tests of the TTZ 8526 trailer showed that:

- ensures the effectiveness of the trailer parking brake system with interchangeable bodies on a slope of 12 ° (Fig. 4);

- indicators of transverse-static stability on the SU-40 test bench; the critical angle value was 31 °;

- torsion force of support screw of of the jacking device during the body change was 40 N.

The given indicators on the safety of the structure comply with the requirements of the “General technical regulation on the safety of the design of agricultural machinery” (paragraphs 16 and 54, 164). The use of support jacking devices when replacing the body provides for ease and simplicity of dismantling and assembling removable bodies, keeping them in a safe and secure, stable condition until the next use time. The above confirms the feasibility of the need to use and use in wide-profile farms of the trailer with the described additional equipment.



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