

DEVELOPMENT OF DEVICES USED FOR LOADING THE HEAVY MACHINES ON TO THE FREIGHT TRAILERS

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Abstract: *The paper gives an analysis of carried out solutions for devices used for loading the heavy mobile machines on to the freight trailers. The flaws of these devices have been spotted, researches have been done and in the paper there is presented the kinematic scheme of a new device that provides a safe loading and unloading of mobile machines with a single command. The use of this device completely avoids the incidental damages of freight trailers and vehicles that are loaded for transport. Proposed solution of a device for loading the heavy mobile machines on to the freight trailers has been practically realized, for the needs of a roads construction company, in transport of heavy construction machines.*

Key words: *loading device, freight trailer, single command.*

1. INTRODUCTION

Certain number of machines with pneumatic or caterpillar drives are designed so that they function without movements or with very short distance movements (up to a few tenths of meters). Considering that their weights vary from a few hundreds of kilos to several tenths of tons, and that their speeds are up to several kilometers per hour, their moving from one construction site to another has to be carried out by freight trailers. These machines are, in most of cases, equipped by caterpillar running gear mechanism, which could damage the driveway, especially knowing that their weight can be more than 50 tons. In order to transport these machines by freight trailers, it is necessary to load them. For this purpose, the indirect supports are installed as steep planes in order to set these machines on to the carrying platform of a freight trailer. As the freight trailers over pneumatics lean on the road surface, due to elasticity of pneumatics it used to happen that machines slip during loading and very often endure damages. Also, due to excessive and unequable load of some pneumatics, the rear as a rule, they used to burst which additionally influenced the unsafe loading.

2. PLANS OF DESIGNED DEVICES

With construction mechanization machines and army machines of lower weights (up to 2 tons), the loading on to the freight trailer is not a big problem as a rule. By using the devices in a form of articulated steep planes, it is possible with great certainty to carry out the loading (Fig. 1). By its self-drive, the machine 3 (Fig. 1) slips on to the carrying platform of freight trailer. Considering that the machines are of lower weights, the lifting and lowering of steep plane can be carried out manually because its weight is also small (up to 100 kg). In such cases, the load on rear pneumatics is not big, so there is no possibility of them bursting, in other words, the loading of vehicle is reliable.

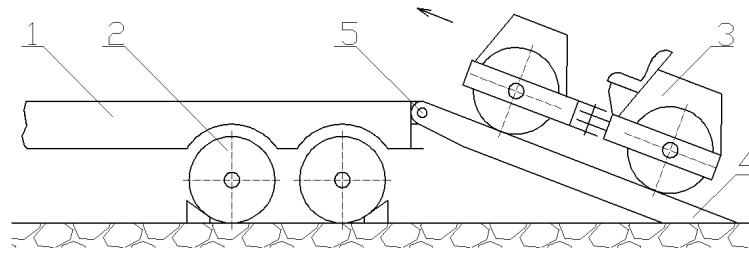


Fig.1 Plan of the device with articulated steep plane

1- Carrying platform of freight trailer; 2- Pneumatics; 3- Machine being loaded; 4-Steep plane (slipway device); 5-Articulated bond of steep plane with carrying platform of freight trailer.

When machines of bigger weight are loaded, the device with articulated steep plane will also have bigger weight. In such cases, it is almost impossible to lift and lower the slipway device (steep plane) manually. By installing the swathe springs in the articulated bond of steep plane and carrying platform, the potential energy of slipway device at its lowering can be used in the way that it accumulates in the swathe spring. In this way, accumulated energy in the swathe spring enables lifting of slipway device into the transportation position manually (Fig. 2).

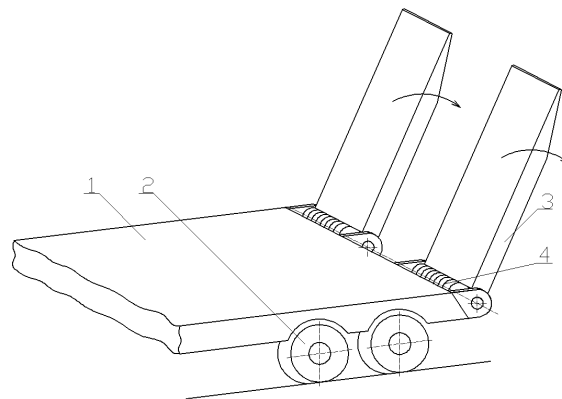


Fig.2 Plan of the device with swathe springs

1-Carrying platform of freight trailer; 2-Pneumatics; 3-Slipway device; 4-Swathe spring.

Considering that the accumulated energy in swathe springs has limited values, the plan in Fig. 2 is not applicable for bigger weights of machines loaded because the slipway devices weight is also considerably bigger. By modifying the swathe springs devices, applying the hydraulic cylinder with thrust lever, it is possible to lift and lower the slipway devices of considerably bigger weights (Fig. 3).

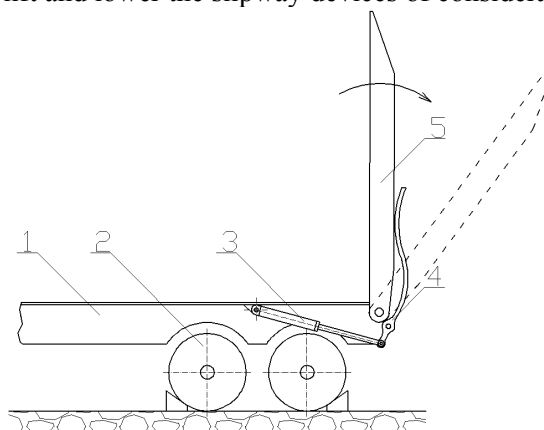


Fig.3 Plan of device with hydro-cylinder and thrust lever

1-Carrying platform of freight trailer; 2-Pneumatics; 3-Hydraulic cylinder; 4-Thrust lever; 5-Slipway device.

As it has been said, with weight increase of machines that are being loaded, the weight of slipway devices increases. In such cases, lifting and lowering of slipway device (5) is successfully realized by hydro-cylinder (3) over the thrust lever (4). All the named plans of devices for lowering and lifting the

slipway devices for loading the machines for transportation do not exclude the possibility of rear pneumatics overload (2). When loading the machines, the carrying platform lowers towards the road surface for 10 or more centimeters, causing additional loads that can cause burst of pneumatics, by which the carrying platform unlevels. Due to unleveling of platform, the transported machines used to slip off very often and, naturally, damage. In order to eliminate this occurrence, there have appeared the slipway devices with stiff support in proximity of articulated bond with platform (Fig. 4). In accordance with the plan of device with articulated bond (Fig. 1), the slipway device has an additional stiff support that prevents the lowering of carrying platform towards the road surface, and also the additional load of rear pneumatics.

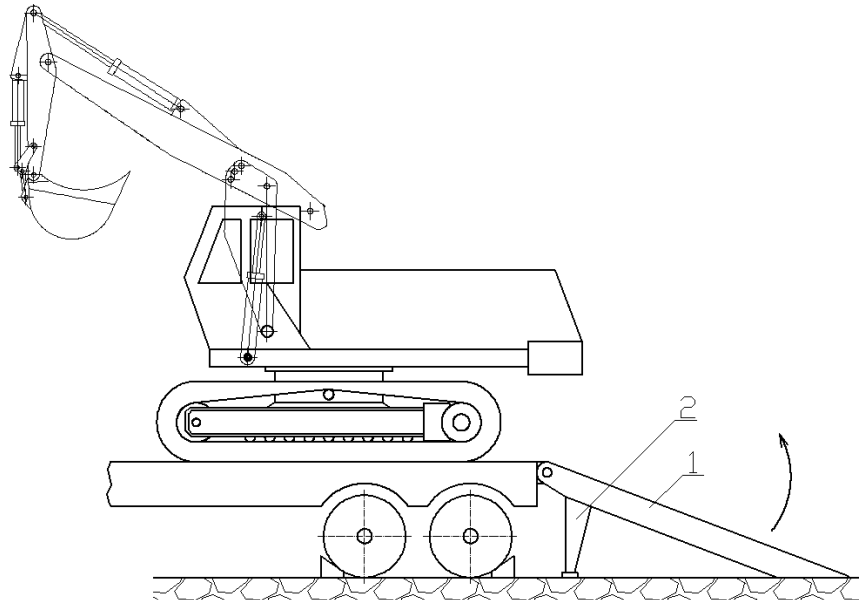


Fig.4 Plan of device with stiff support
1-Slipway device; 2-Stiff support.

Talking about mechanisms for lifting and lowering of slipway devices, the ones in use are already mentioned (Fig 2, Fig 3). Due to additional load, pressure force of stiff support to the ground can make it difficult or even stop the lifting of slipway device. Also, during lowering the slipway device while unloading the machines, it is possible that the supporting part of the device does not make contact with the ground (Fig. 5).

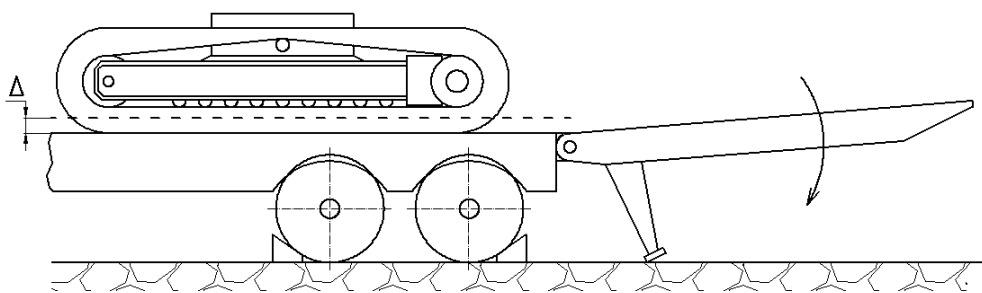


Fig.5 Display of negative effect of slipway device's stiff support at its lowering

This fault can be partly solved by installation of hydraulic cylinder for lowering and lifting the slipway device with stiff support, or completely removed by changing the length of stiff support (for example by installing the swathe spindle). It is clear that managing such mechanisms becomes more complex because it has to be realized by two independent managing actions:

- activating the hydraulic cylinder,
- adjusting the length of stiff support's swathe spindle.

Loading of big construction machines and military resources, whose weights are over 50 tons, is almost impossible or hardly feasible by devices whose plans are shown in previous figures.

Researches and development of new generations of devices for loading the heavy machines on to the freight trailers, carried out at the Faculty of Mechanical Engineering in Kraljevo within the project: Increase of security at big weights loads transportation, are based on the following demands:

- easy and fast lifting and lowering of loading device,
- lifting and lowering mechanism drive to be realized hydraulically,
- rear wheels while loading and unloading have to be released from additional loads, in order to avoid pneumatics burst,
- managing to be realized by single command.

3. KINEMATIC PLAN OF NEW SOLUTION OF MECHANISM FOR LIFTING AND LOWERING THE DEVICE

Defined demands which should be fulfilled by the mechanism for lifting and lowering can be realized by application of hydraulic drive, with hydro-cylinder as executive organ. Also, all previous disadvantages must be overcome, where the rear pneumatics must be protected from overload, whether it is loading or unloading of machines (for example excavator, steam roller, grinder, tank or other military resources). The aim is to, before loading or unloading, carry out partial relief of rear pneumatics by slipway device. In such way, the safe slipway of machines on to the freight trailer would be provided, the slipping off of the machines while loading or unloading would be avoided, and by itself the accidental damages of both freight trailers and machines for loading.

The given goals can be achieved if, at contact of support part of slipway device with the ground, the uplift (relief) of rear pneumatics can be achieved. Schematic display of such mechanism is given in Fig. 6.

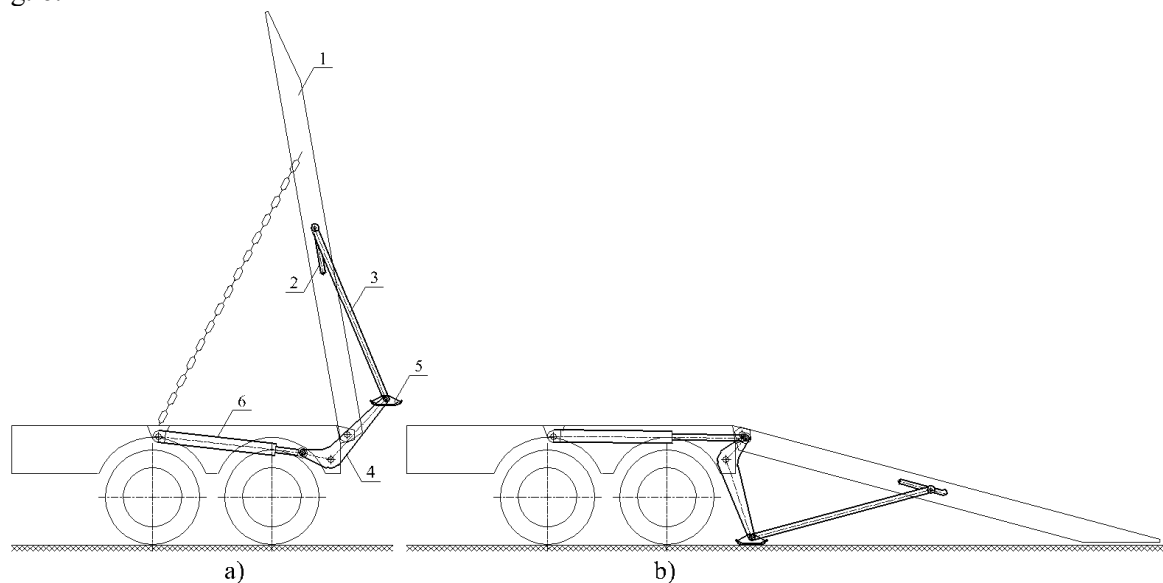


Fig.6 Kinematic plan of mechanism for relief of rear pneumatics
a) transport position; b) work position (load – unload).

In Figure 6 the following items are marked: 1-Slipway device, 2-Profiled gutter in the slipway device, 3- Junction lever, 4-Thrust rocker, 5- Support pedal, 6- Hydraulic cylinder. Functional plan of hydro-cylinder hydraulic drive is given in Fig. 7.

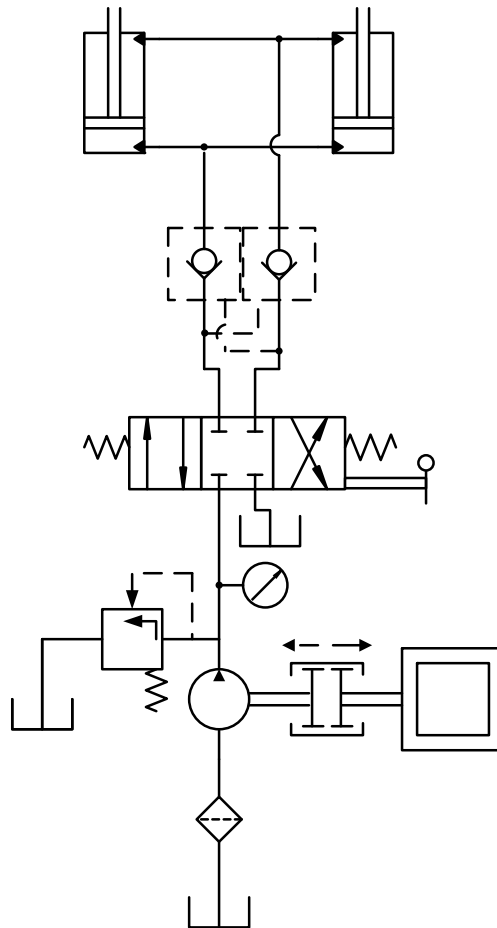


Fig.7 *Hydro-cylinder hydraulic drive functional plan*

4. CONCLUSION

Loading and unloading of machines is a constituent part a transportation route. The aim is to carry out the loading and unloading in a fast, easy and safe fashion. In this way, all the possibilities that could provoke the incidental damages would be removed. This paper points to drawbacks and disadvantages in carried out solutions of mechanisms for loading and unloading the heavy machines. There was researched and schematically presented a new solution which has been realized, specifically, on a freight trailer of a roads construction company. It has been in use a few years already and it has shown very reliable and easy to manage.

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РАЗРАБОТВАНЕ НА УСТРОЈСТВА, ИЗПОЛЗВАНИ ЗА ТОВАРЕНЕ НА ТЕЖКИ МАШИНИ НА ТОВАРНИ РЕМАРКЕТА

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Ключови думи: *устройство за товарене, товарно ремарке, една команда.*

Резюме: *Статията анализира направените решения за устройства, използвани за товарене на тежки мобилни машини върху товарни ремаркета. Отбелязани са недостатъците на тези устройства, направени са изследвания и в доклада е представена кинематична схема на ново устройство, което осигурява безопасно товарене и разтоварване на подвижни машини с една команда. С използването на това устройство се избягват напълно случайни щети на товарните ремаркета и превозните средства, които са натоварени за транспортиране. Предложеното решение на устройство за товарене на тежките мобилни машини на товарни ремаркета е практически реализирано за нуждите на пътно-строителната компания при транспортирането на тежки строителни машини.*