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Substantiation of Hydraulic System for Weighing Freights Transported with Dump Trucks

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Abstract

The paper considers the solution of a problem of number of the moving connected with weighing of freights, reduction, consisting in development of the device for determination of the freight mass mounted directly on the dump truck. The operation of the suggested device is based on the principle of hydraulic sensors use. It consists of hydraulic sensors of the left and right longerons, hydraulic sensors system of high pressure oil pipelines, hydraulic ram's high pressure oil pipeline, the oil pressure gauge thoriated in weight units, the three-running distributive tap, the hydraulic ram of the dump truck, the oil pump with the operation tap, an oil tank, low pressure oil pipeline, a return piping and the bilateral action valve. The hydraulic sensors of the left and right longerons are connected to a hydraulic ram high pressure oil pipeline in parallel via a three-running distributive tap and a bilateral action valve. The operation principle of hydraulic sensors of the device for weighing of freights is similar to the hydraulic ram operation.

The dependences allowing determining the key parameters of the specified device such as the internal diameter of oil pipelines for a liquid supply to sensors of the left and right longerons according to the passed amount of working fluid, Reynolds number and pressure losses in all elements of the hydraulic system are presented.

The suggested device in combination with the device for fixing of the transported freight mass can find broad practical application. Its use will allow reducing the transportations route and, therefore, increasing the efficiency and safety of transport and technological processes.

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1. Introduction

Transport works are one of the most important components of any production. Trucks transport a large amount of various materials [1,2]. Thus there is a need of weighing of the freights transported by vehicles [3]. For this purpose drivers should make moving on stationary points of weighing which often settle down at considerable distance from a location of execution of works. This circumstance has adverse impact, leading to work decline, increase in fuel consumption, increase of wear of systems and parts of cars, etc. Besides, need of additional transportations has an adverse effect on the drivers safety at work general level as the increase in number of operations causes fatigue of mobile machines operators [4-7]. The fatigue (exhaustion) can be an immediate cause of a road accident or the adverse condition complicating actions of the driver in emergencies [8,9].

In our opinion, the optimum solution of a problem of number of the moving connected with weighing of freights reduction consists in development of the device for determination of the freight mass mounted directly on the dump truck [10].

2. Structure and operation of the device

Authors offer the device for weighing of the freight transported by the dump truck [11]. Operation of the offered device is based on the principle of hydraulic sensors use.

The device (fig. 1) consists of hydraulic sensors 1, 13 of the left and right longerons, hydraulic sensors' system of high pressure oil pipelines 2, hydraulic ram's high pressure oil pipeline 9, the oil pressure gauge 12 thoriated in weight units, the three-running distributive tap 10, the hydraulic ram 8 of the dump truck, the oil pump 3 with the operation tap 4, an oil tank 7, low pressure oil pipeline 5, a return piping 6 and the bilateral action valve 11. Hydraulic sensors 1. 13 of the left and right longerons are connected to a hydraulic ram's 8 high pressure oil pipeline 9 in parallel via the three-running distributive tap 10 and the bilateral action valve 11.

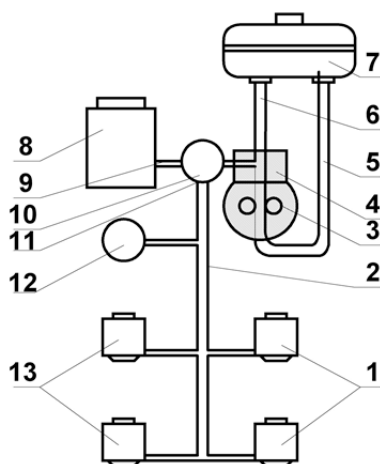


Fig. 1. Schematic diagram of the device for weighing of freights:

1 – hydraulic sensors of the right longeron, 2 - hydraulic sensors' system of high pressure oil pipelines; 3 - oil pump; 4 – operation tap; 5 - low pressure oil pipeline; 6 - return piping; 7 - oil tank; 8 – hydraulic ram of the dump truck; 9 - high pressure oil pipeline; 10 - three-running distributive tap; 11 - bilateral action valve; 12 - oil pressure gauge; 13 - hydraulic sensors of the left longeron.

The principle of operation of hydraulic sensors of the device for weighing of freights is similar to the hydraulic ram operation.

Before weighing of freight the body of the dump truck has to be raised by the hydraulic ram for the purpose of a free exit of hydraulic sensors rods to their maximum height. For this purpose the distributive tap is put in position I (fig. 2). Then the power takeoff is switched on and the oil from a tank comes to the pump through a low pressure pipeline. From here through the high pressure pipeline it is pumped into the hydraulic ram and hydraulic sensors. At

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