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PARAMETRES JUSTIFICATION OF PORTABLE CABLE SKIDDING MACHINE

The article dwells on the theoretical results and general specification analysis of domestic and imported cable skidding machines. On the basis of the calculations made the principal rational parametres of skidding machines and puffers have been recommended. The required parametres of basic chassis and process equipment of cable skidding machine are analyzed and selected.

Introduction. Every year a problem of effective development of hard-to-reach cutting areas or areas with low soil bearing capacity (these areas about 30% of all cutting areas of Belarus) becomes more and more urgent. Use of wheeled skidding tractors when developing such cutting areas either difficult (because of failure of tractor driving conditions) or absolutely impossible. Owing to these factors there is a necessity of building and implementation of such machinery which would allow to develop hard-to-reach cutting areas. Cable installations are referred to such kind of machinery.

Main part. For skidding logs in hard-to-reach conditions when it is impossible to apply skidding tractors cable installations are used [1]. They consist of a winch, thrust and suspension cables, spar trees, booms, ropes, hitches and special carridges. They help to skid trees, tree-length material and logs in semi-suspended or suspended state. Selection of skidding type depends on a topography, physical and mechanical properties of soil, type and characteristics of processing equipment. According to the purpose and character of work cable installations are classified into skidding (ISC), transporting (IST), skidding-loading (STI) and loading (IL). Cable skidders are used for skidding trees from a stump to a forest road or a run when loading forest on the train). Skidding-transporting installations skidd lumber from a stump to a suspension cable (not less than 30 m) and its following transporting in suspended state. For skidding forest in suspended state and its loading on a rolling stock of forest road, transporting installations are used.

We can also distinguish suspended skidders with bearing, pulling and return lines, running continuous line.

For lifting and thrust operations winches use in cable installations. They consist of the motor, drum heads, the reduction gearboxes, a shift sleeve of drum heads, the brakes, the devices for winch control and frames where all knots are fixed. The basic operating mechanisms of a winch are drum heads on which chain cables are reeled. Winches are classified according to a number of drum heads, their rope capacity, tractive force on basic load rope, travelling speed of chain cables.A number of winch barrels depends on the number of executed operations. Normally each operation requires two drums: the working drum transfers load, and another one is for feeding towing implements to a place of load catching (return drum). Single-, two-winches and yarders with internal combustion engine are used when skidding forest.

For a driving a cable installations modern winches have high towing-speed characteristics this results in their having boxes of vicissitude of drives. To ease the control of drums, winches are equipped with pneumatic friction couplings of clutch and brakes.

Analysis of cable installations structures and a state of logging in Belarus showed that for efficient development of a hard-to-reach cutting areas it is expedient to use portable cable installations on the basis of a wheel tractor equipped with skidder and an artificial spar tree acting as process equipment.

The overall view of a portable cable installation is introduced at the drawing below.

To support high parameters of operating ability of the machine being designed the required parameters of basic chassis and process equipment have been determined.

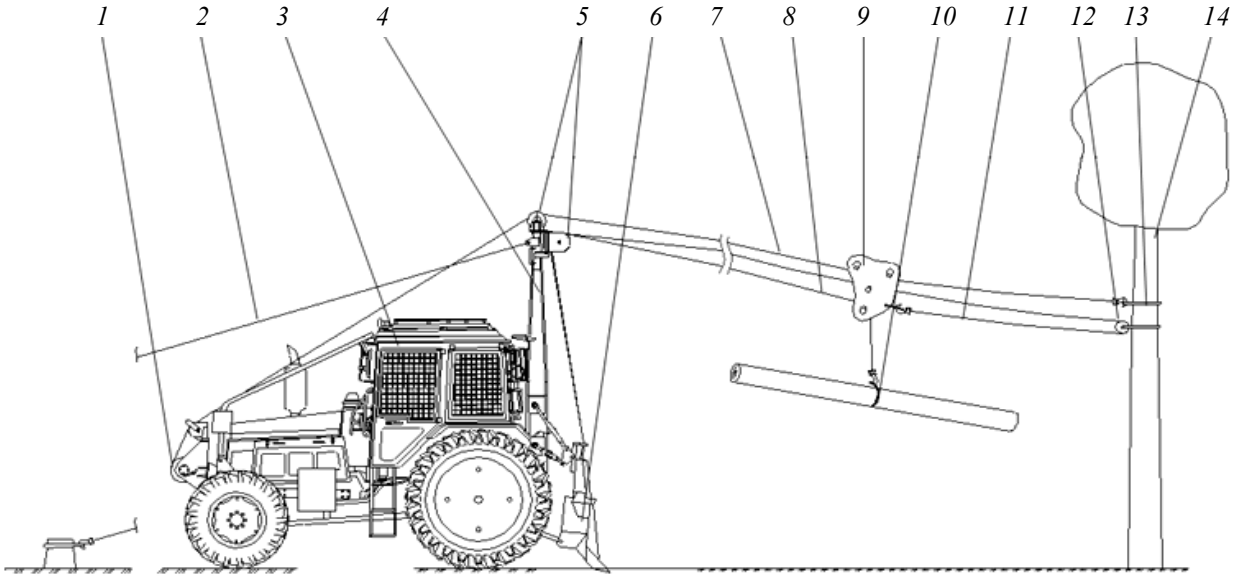
The tractive force of a winch and diameter of a load rope depend on a volume of wood bunch being skidded, type of cable installation and skidding conditions. The designed transportable cable installation is referred to single bearing rope type and is intended for skidding lumber in completely suspended state, with average volume of a bunch of 1.15–1.20 м^3.

The following formula was used to obtain a tractive force of winch $F_т$ [2]:

$$F_t = F_{fr} + G_b \cdot \cos \alpha + F,$$

where F_{fr} – friction force of carrige on a chain cable; G_b – weight of the bunch being skidded; α – a bending angle of running line; F – force of a pretension.

As a result of calculations numerical values of a tractive force of a winch should be within the limits of 50–55 kN. Considering a numerical value of travelling speed of a chain cable, which is equal to 1.2 m\s, the indispensable drive power of a winc is determined and it comprises 55–60 kW.



The scheme of a portable cable installation:
1 – a winch for a bearing wire; *2* – a tie rod; *3* – a tractor carrier; *4* – a tower; *5* – units;
6 – a skidder butt plate; *7* – a bearng wire; *8* – a trailing rope; *9* – the caridge; *10* – the choker;
11 – return line; *12* – portable unit; *13* – a tree belt; *14* – a rare tower

Analyzing the justification of parametres of a transportable cable installation, according to reference books, diameters of chain cables are determined (specific).The calculations made for a running line allowed to fix its diameter and it should be not less than 13 mm.

Diameter of a return line should be not less than 6 mm.

It is necessary to apply tie rods to increase the stability of the machine being designed. As a result of calculations there have been assumed two tie rods fixed at 120° respect to longitudinal axis of a basic tractor. Diameter of tie rods should be not less than 6 mm.

Conclusion. The review of design features of existing cable installations has been carried out. This resulted in recommendations concerning layout drawing of cable skidder with running line.

In order to operate efficiently tower height of the machine should be within the range of 4–6 m, a winch tractive force – not less than 50 kN, diameter of a running line – 14–16 mm, a return line – 6 mm.

Tie rods calculations of a tower allowed to fix their diameter and it should comprise not less than 6 mm (two tie rods installed at 120° respect to longitudinal axis of a basic tractor.

References

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