National predictive model for assessing wind damage risk to forest stands

The program itself is a model that, based on the created algorithms and created databases, allows calculation of critical wind speeds leading to damage to spruce stands and was created by implementing data from field measurements, statistical methods, and other knowledge.

The actual model of critical wind speed prediction works on the following principle:

- based on user-defined stand parameters, the critical force required to cause damage is predicted by neuron network analysis
- based on user-defined crown parameters (by selecting predefined categories), the wind speed is then searched in the database to exert the desired pressure on the tree.

Each forest owner can detect the current threats to its stands. The model is also useful for other entities that deal with the consequences of the effects of destructive winds, such as the Fire Rescue Service of the Czech Republic. The model has already been positively accepted by the integrated emergency services, road and rail management, forest owners, as well as towns and cities, given the possibility of predicting all risks associated with wind throw damage in cities (urban greenery, parks, etc.). It is therefore very beneficial for society because it not only protects people's property but also their safety.
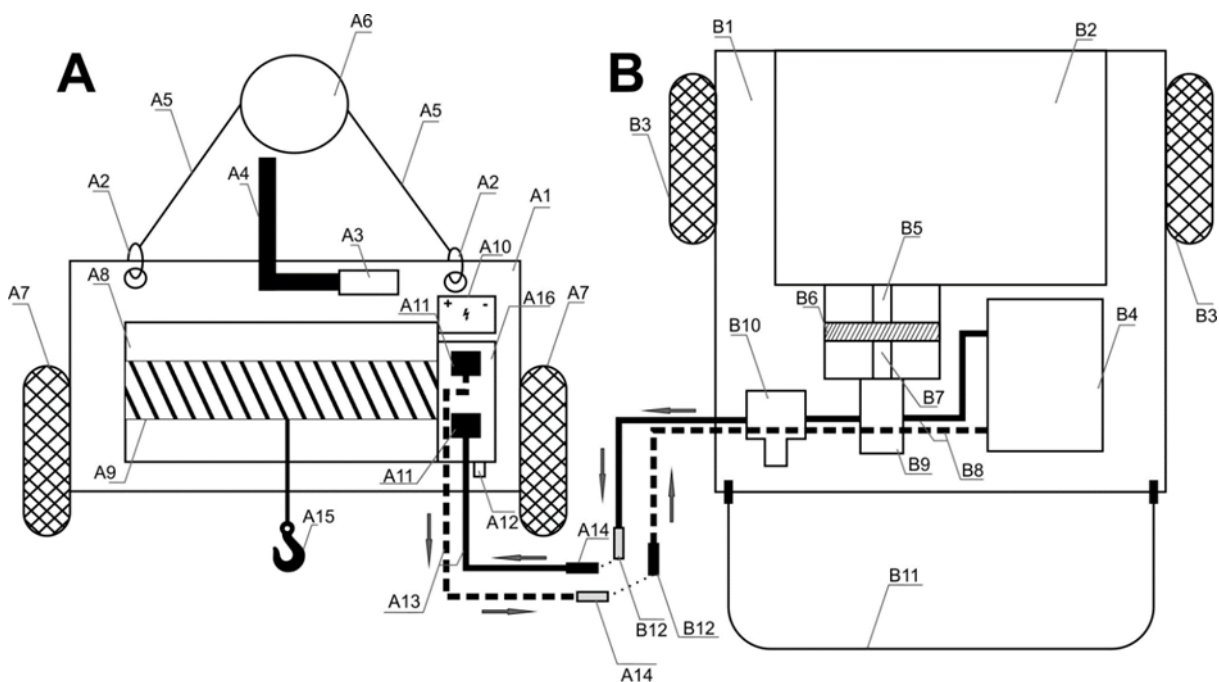

Fig. 1 The hydraulic winch (A) and the power unit as seen from above (B). A1 = carriage of the winch; A2s = anchor points; A3 = carriage bar housing; A4 = removable carriage bar; A5s = lashing loops; A6 = anchoring point; A7 and B3 = pneumatic; A8 = winch case; A9 = winch drum; A10 = battery; A11s = electric valves; A12 = controlling unit connector; A13 and B8 = high-pressure hydraulic hose; A14 and B12 = non-drip connectors; A15 = rope with a hook; A16 = rotary hydromotor; B1 = power unit chassis; B2 engine; B4 = oil tank; B5 = engine shaft; B6 = flexible clutch; B7 = pump shaft ; B9 = oil pump; B10 = pressure reduction subsystem; and B11 = handlebar (Macků et al. 2016).

Procedure of mechanical stressing of trees https://www.youtube.com/watch?v=MDdfkhMOslo

The mechanical winch can also be used to clear wood in extremely unfavourable conditions (Fig. 2).

Fig. 2. Photographs of different ways of moving logs with the experimental winch. A) The hydraulic winch; B) generator; C) The winch is held in place by attachment to wooden pegs; the orange generator is in the rear; D) The winch is held in place by lashing it to a tree trunk; E) A bundle of timber being extracted from the forest with the winch; F) A bundle of timber being extracted by the directional pulley attached to a tetrapod; G) Extraction of three 4-m-long logs using the directional pulley attached to a tree trunk.