Title: DEVICE FOR MEASUREMENT OF LENGTH OF WOOD

Abstract: The invention relates to a measuring device for the measurement of a length of wood and particularly for the measurement of a length of a vertically felled tree. According to the invention, the measuring device includes a measuring element (4) filled at least partially with fluid, a pipe, hose or equivalent, extending to the vicinity of a wood felling head (3) fastened to a boom (2) of a work machine (1), which element is connected to a sensor unit (5) which is arranged to measure the hydrostatic pressure of fluid in the measuring element.
DEVICE FOR MEASUREMENT OF LENGTH OF WOOD

The invention relates to a device for the measurement of a length of wood.

Measuring the length of wood before felling the tree is important particularly when mechanically harvesting fuel wood. When using a work machine with a collecting felling head, it is often necessary in the harvesting of whole trees and bole trees to first cut a standing tree from about the middle and then cut the base part, first take the tree crown into the grip of the felling head and then the base part in order for the load to fit better in a forwarder. If harvesting bole trees and transporting felled poles also on the road with a timber carrier, the importance of the wood being cut to size is more and more emphasised. The capacity of truck transport will be best and most cost-effectively utilised when the wood bundles are accurately of agreed size, e.g. there are two bundles of 3 m on the platform and three bundles of 3 m in the trailer. This requires that also vertically felled tree trunks can be cut to size.

With existing measuring devices integrated in the grips of the felling head, the length of wood is measured after felling in connection with deliming. In harvesting fuel wood, a conventional large multi-process machine intended for harvesting sawn and pulp wood and its felling head and felling technique are rarely used due to its slowness. Felling heads used in harvesting fuel wood are simpler, and they usually have no reliable measuring device for the accurate measurement of the length of wood.

The object of the invention is to eliminate the above disadvantage and to introduce a device for measuring the length of wood. A further object of the invention is to introduce a reliable length measuring device particularly intended for vertically felled wood, applicable to mechanic harvesting.

The object of the invention is achieved with a measuring device which is characterised by what is presented in the claims.

The measuring device according to the invention includes a measuring element filled at least partially with fluid, a pipe, hose or equivalent, extending to the vicinity of a wood felling head fastened to a boom of a work machine, which element is connected to a sensor unit fastened to the work machine which is arranged to measure the hydrostatic pressure of fluid in the measuring element. The measuring device is based on measuring height on the basis of the hydrostatic pressure of the fluid of the measuring element. Trees grow vertically on the average,
whereby the hydrostatic pressure difference between different cutting points provides data accurate enough on the length of the felled tree.

The invention will now be described in more detail with reference to the accompanying drawing which schematically shows an embodiment of the measuring device fastened to the work machine.

The measuring device shown in the figure includes a sensor unit 5, a pipe or a hose or an equivalent measuring element 4 which contains fluid suitable for the purpose, and a measuring element, e.g. a coupler of the hose end, which allows the flow of fluid in the pipe or the hose. The sensor unit 5 is fastened to a work machine 1 at a suitable point, such as e.g. to the chassis. In the sensor unit, there are also electronics required and display and calibration functions. The measuring element 4, such as the pipe or the hose, is fastened to a boom 2 of the work machine and extends in the vicinity of or until the fastening of a felling head 3 fastened to the boom, whereby it registers the position of the felling head in the height direction. From its other end, the pipe or the hose is fastened to the sensor unit 5.

The work machine is operated and the measuring device is used in the following way: When being at the point of a tree to be felled, the felling head of the work machine is set at the base of the tree at the cutting point and the hydrostatic pressure at the point of the base is registered. Next, the felling head is lifted upper to the next cutting point, the hydrostatic pressure is measured and registered, after the measurement the felling head is moved to the accurate cutting point and the tree is cut, whereby wood of accurately specific length is obtained. Like this, it is proceeded to the cutting point of the tree top. Another measuring order of the base and the cutting point can also be used depending on the flexibility of working. It is possible to move from top downwards, whereby the hydrostatic pressure of the cutting point of the top is first measured, the tree is cut, the felling head is moved lower and the hydrostatic pressure of the next cutting point is measured, the felling head is moved to a desired point and the tree is cut at the desired point. It is also possible to cut the tree at a desired point chosen visually, whereby the accurate length of wood is obtained from the differences in the hydrostatic pressures of different points. Of the pressure differences, a measure is calculated which can be expressed directly as units of length considering calibration.

In the prototype device, the accuracy has been about 1 cm. The vibration of the machine and the inert oscillation of fluid can be minimised by modifying the properties of the fluid and the hose or by electronically processing the pressure.
signal. The oscillation of the boom is usually no impediment in the felling situation, because the felling head is fastened in the cutting phase to the tree trunk stopping the oscillation.

The measuring device is quick to install and easy to use. Commonly, zero calibration is done once a day, after which the device operates independently and reliably.

In another embodiment of the invention, the measuring, calibration and display functions are combined in the sensor unit, whereby they can be parts or units separate from the sensor unit but they logistically operate together. Combining means that they are joined together by wires or equivalents or wirelessly. The measuring sensor operating as the sensor unit can be located within the end of the pipe or the hose in some embodiments.

The measuring sensor is usually located in the frame of the work machine or in its vicinity. In an embodiment, the hose or pipe can extend only some distance from the point of the felling head towards the other end of the boom e.g. midway or some other point, whereby the measuring sensor is at a distance from the frame.

There can be more than one of fluid spaces required for measuring hydrostatic pressure in the different embodiments of the invention i.e. the pipe or hose can be divided into two or more parts.

The invention is not limited to the described advantageous embodiment, but it can vary within the scope of the inventive idea presented in the claims.
CLAIMS

1. A measuring device for the measurement of a length of wood and particularly for the measurement of a length of a vertically felled tree, *characterised* in that the measuring device includes a measuring element (4) at least partially filled with fluid, a pipe, hose or equivalent, extending in the vicinity of a wood felling head (3) fastened to a boom (2) of a work machine (1) which element is connected to a sensor unit (5) which is arranged to measure the hydrostatic pressure of fluid in the measuring element.

2. A measuring device according to claim 1, *characterised* in that in the sensor unit (5) are combined measuring, calibration and display functions.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G01B, G01C, A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Fi, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
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Further documents are listed in the continuation of Box C. See patent family annex.

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