

DEVICE FOR CUTTING SHEETS OF MATERIAL

The present invention concerns a device for cutting sheets of material. It includes a counter for the material to rest on, a blade holder that slides up and down in a frame and accommodates a blade along the bottom, and a mechanism for raising and lowering the blade holder. The mechanism comprises a motor, a transmission, a crank, and a connecting rod. The transmission transmits force from the motor to the crank, the crank to the connecting rod, and the connecting rod to the blade holder.

A device for cutting sheets of material with a counter for the material to rest on, a blade holder that slides up and down in a frame and accommodates a blade along the bottom, and a mechanism for controlling the blade is known from European 0 056 874 A1 for example. This device has been improved along the lines of the aforesaid generic device and has operated very well in practice.

A method of and device for optimizing the cutting done by a cutting machine is known for German 4 228 651 A1. The material is secured by a holdfast while being cut. The edge of the holdfast that faces the blade has a sensor for sensing its position in relation to the blade. The stroke traveled by the holdfast and blade can be optimized subsequent to a cut. The optimization concerns the concrete position of the

holdfast, specifically where it rests against the top of the material being cut.

Detecting the force to be exerted in making a cut with a cutting machine along with the flection of the blade and its holder is known from German 4 013 906 C2. The results are employed as a criterion for how sharp the blade is and are processed separately or together to determine the quality of the cut. The force to be exerted is preferably obtained in the form of expansion or impact of an actuating rod. The type of material being cut is taken into consideration in determining the quality of the cut. It is not positions of the blade in relation to a stationary component on the machine that is detected but parameters that accompany the cutting.

The object of the present invention is to improve the generic device to the extent that it can detect essential parameters that relate to the blade.

This object is attained in accordance with the present invention in the generic device by an angle-of-rotation detector that operates in conjunction with the transmission takeoff and controls a data processor.

It is essential to the present invention for the angle-of-

rotation detector to detect any motion in the power train with a cycle that corresponds to that of the blade. A total blade cycle is generated by a 360 ° rotation of the transmission takeoff for example. "Transmission takeoff" herein means not only the takeoff shaft that the crank is connected to, but also any cogwheel in the vicinity that rotates at the same speed as the takeoff shaft.

The present invention accordingly makes it possible to unambiguously assign to every position of the blade in a particular direction one angle of the transmission takeoff. The angle-of-rotation detector, operating in conjunction with the transmission takeoff, converts the angle information into data that can be handled by the downstream processor. This information can not only represent the position of the transmission takeoff or blade. If there is a clock in the system, the angular difference per unit of time can be exploited to represent the speed of the blade. That speed, finally, can be varied to decelerate the blade.

Detecting the position, speed, and acceleration of the blade makes it possible to directly or indirectly determine important blade-operating parameters as will now be described.

A device for cutting sheets of material in accordance with the present invention can have a combination clutch and brake

in the power train between the motor and the transmission. Such a combination can eventually wear out, and it is desirable to replace it when the level of wear becomes unacceptable. Attempts have also been carried out to develop a system of detecting damage to the combination in due time. One simple way and means of doing so is to detect, first, the position of the transmission takeoff and hence indirectly that of the blade as the clutch disengages and accordingly as braking commences and, second, the position of the inactive transmission takeoff along with its braking time, meaning how long it takes for the transmission takeoff or blade to stop once the brake has been engaged. When braking time exceeds a prescribed threshold, it is time to repair or replace the combination clutch and brake. It would also be possible basically to measure how long it takes to attain a specified blade speed once the clutch has been engaged. This parameter would also be indicative of the clutch's function.

The device in accordance with the present invention also provides information as to how sharp the blade is. The angle-of-rotation detector can for example detect any deceleration in the motion of the blade as it cuts. Such deceleration can be employed as a parameter of sharpness.

The device in accordance with the present invention also makes it possible to vary the blade's lower dead points. This

feature is particularly useful in order to compensate for effects on the flexible cutting system due to differences in the hardness of the material being cut. The blade is secured in a holder that can hold it at different distances from itself within the cutting plane. The blade can accordingly be positioned to enter the cutting strip to a defined depth in spite of the system's flexibility. When the material is soft for example, the angle-of-rotation detector can rotate the crank to an angle slightly less than 180° and the blade can be secured while just touching the cutting strip to the blade holder with the crank at that position. When the material is hard on the other hand, the crank can be rotated farther from the lower dead point. For soft material the angle can be 178° and for hard material 174° .

The device in accordance with the present invention also makes it possible to exploit the detected position of the blade to initiate subsequent processing on the part of the device itself or of associated peripherals. A command to lift the holdfast can be released even while the blade is in a particular return position upstream of its upper dead point. This procedure decreases the overall cutting time, including the time needed to advance the material. It is even possible in certain situations to activate the grips that introduce the material etc. before the blade arrives at its upper dead point.

Additional characteristics of the present invention will be evident from the subsidiary claims, the description of the figures, and the figures themselves. All such characteristics and combinations thereof are essential to the invention.

One embodiment of the present invention will now be specified with reference to the accompanying drawing, wherein

Figure 1 illustrates the device with the components that move the blade in accordance with the present invention and

Figure 2 is a larger-scale illustration of the power train that leads to the blade or blade holder in accordance with the present invention.

The device includes a frame 1 that accommodates a counter 11 for the sheets of material 10 that is being cut to rest on. A blade holder 2 slides up and down inside frame 1 above counter 11. Blade holder 2 accommodates a blade 12 along its lower edge. Blade holder 2 travels in straight tracks 13 and 14. Tracks 13 and 14 pivot inside frame 1. An unillustrated holdfast parallels blade holder 2. The holdfast descends onto the material 10 and secures it while it is being cut.

Blade holder 2 and hence blade 12 are powered by a motor 9. The motor drives a transmission 6 by way of a V belt 8 and

flywheels. Between transmission 6 and V belt 8 is a combination clutch and brake 7. Transmission 6 is a worm gear. It has a threaded shaft 6a at the motor end and another threaded shaft 6b at the blade-holder end. Threaded shaft 6b is connected to the transmission's takeoff shaft 15. Also connected to takeoff shaft 15 is a crank 4. The free end of crank 4 is engaged by one end of a connecting rod 3. The other end of connecting rod 3 engages blade holder 2 in the vicinity of track 14. The resulting kinematic design ensures that a full cycle can be initiated by a 360° rotation of crank 4, takeoff shaft 15, or threaded shaft 6b. A full cycle occurs when the blade moves out of its uppermost position, into its lowermost position, and back into its uppermost position.

An angle-of-rotation detector 5 is mounted on takeoff shaft 15. The results of the measurements carried out by detector 5 are exploited in a further unspecified downstream processor 16. The speed and deceleration of the blade can be obtained from the extent of rotation per unit of time. Angle-of-rotation detector 5 can have for example a perforated disk fastened to takeoff shaft 15 with one perforation for each degree of angle for instance. The detector's housing can be fastened to transmission 6. A light barrier in the vicinity of the ring of perforations. The resulting transducer will provide information as to the extent of rotation to processor 16.

Claims

1. Device for cutting sheets of material (10), including a counter (11) for the material to rest on, a blade holder (2) that slides up and down in a frame (1) and accommodates a blade (12) along the bottom, and a mechanism for raising and lowering the blade holder, whereby the mechanism comprises a motor (9), a transmission (6), a crank (4), and a connecting rod (3) and whereby the transmission transmits force from the motor to the crank, the crank to the connecting rod, and the connecting rod to the blade holder, characterized by an angle-of-rotation detector (5) that operates in conjunction with the transmission takeoff (15 & 6b) and controls a data processor (16).

2. Device as in Claim 1, characterized by a combination clutch and brake (7) in the power train between the motor (9) and the transmission (6).

3. Device as in Claim 2, characterized by a V belt (8) and flywheel in the power train between the motor (9) and the transmission (6).

4. Device as in one of Claims 1 through 3, characterized in that the transmission (6) is a worm gear with a threaded input shaft (6a) and a threaded output shaft (6b).



5. Device as in one of Claims 1 through 4, characterized in that the angle-of-rotation detector (5) commands the processor (16) to output the position, and/or the speed, and/or the acceleration of the blade (12) and/or how long it takes to stop the blade.

