The invention relates to a ground surface cutting device comprising: a cutting motor for rotationally driving a cutting tool; an advancing device for displacing the cutting tool with an advancing speed relative to the ground surface, and; a rotationally speed measuring device for measuring an actual value for the rotational speed of the cutting tool or of the cutting motor. The actual value is evaluated by a control device and is compared with a predetermined set value. The control device controls the advancing device and changes the advancing speed based on a variation of the actual value from the set value.
GROUND SURFACE CUTTING DEVICE

[0001] The invention pertains to a floor cutter according to the preamble of patent claim 1.

[0002] Floor cutters of this type have been known for a long time in the form of floor sawing machines, slit or joint cutter, and are used to cut asphalt or concrete floors.

[0003] The figure shows a known floor cutter of this type, which will be explained in more detail below.

[0004] Smaller floor cutters are pushed by hand by the operator, whereas larger devices are equipped with an automatic self-driven advancing unit. To this end, usually one or more wheels are driven mechanically, hydraulically or electrically. The advancement rate is adjusted by the operator by hand using actuators, either continuously or in discrete speed steps. In order to get the best possible results, an optimum advancement rate is required that depends on four factors. The main factors include the material composition of the floor to be cut, the capacity and the service life of cutting tool (the cutting disc), the cutting depth, the rpm and the torque of the cutting shaft that drives the cutting disc, as well as the stability and the track precision of the cutter.

[0005] Thus, because there are many factors, it is not easy to adjust to a favorable advancement rate and to manually maintain it, even for experienced operators. In particular, a few of the above parameters can either be detected by the operator at all or they can only be detected through secondary effects. For example, the operator can usually only estimate the rpm of the cutting shaft by way of the noise coming from the cutting motor that drives the shaft. This is usually difficult if the operator is wearing a prescribed hearing protector or if there are other sources of noise present in the direct vicinity of the workplace. Moreover, in automatic advancement, the operator has no way to estimate the advancement force, which is an important parameter that he can feel directly from the force applied to the handle in floor cutters with manual advancement.

[0006] If the advancement rate is not optimally adjusted, various disadvantages can arise: shorter service life of the cutting disc, increased chance of broken cutting discs, uneconomical or environmentally unfriendly operating range of the cutting motor, overloading of the cutter or cutting motor, more time needed to do the work and poor quality of the work (e.g. uneven cutting depth).

[0007] Therefore, the objective of the invention is to provide a floor cutter with which an optimum advancement rate can be guaranteed at all times.

[0008] According to the invention, the objective is met by a floor cutter with the features of patent claim 1. Advantageous developments of the invention are defined in the dependent claims.

[0009] A floor cutter according to the invention has a power detector and a controller that is coupled to the power detector. The power detector detects an actual value for the power applied at the cutting tool or of the power output at the cutting motor, which is proportional to the power applied to the cutting tool. Alternatively, the power detector can also monitor a parameter that depends on one of the above power values or corresponds to it some other way. This then provides another reliable indicator.

[0010] The actual value is sent to the controller, which compares it to a prescribed setpoint value, e.g. one that had been stored at the factory at assembly. The controller changes the advancement rate in relation to a deviation of the actual and setpoint value.

[0011] This makes it possible to adjust the advancement rate automatically and not manually—either by means of the operator pushing the floor cutter or manually adjusting the advancement rate—through the controller. In the control circuit according to the invention, the power applied to the cutting shaft, i.e. the power applied to the cutting tool (cutting disc) or the output of the main drive motor (cutting motor) represents the control parameter.

[0012] In an advantageous development of the invention, the power detector has an rpm detector to detect an actual value for the rpm of the cutting tool or for the rpm of the cutting motor, which is proportional to the rpm of the cutting tool. Alternatively, the rpm detector can also monitor a parameter that depends on one of the above rpm’s or that corresponds to one of the rpm’s and is thus also a reliable indicator. The actual value of the rpm is used in this embodiment instead of the actual value for the power, and is used as a control parameter for the controller. A known torque characteristic of the cutting motor is that the rpm is a criterion that corresponds to the physical power output.

[0013] If the advancement rate is too fast or too slow as a result of external parameters (interference), the rpm of the cutting shaft normally decreases or increases accordingly. The corresponding rpm change is monitored by the rpm detector and is evaluated in the controller. The controller can then increase or decrease the advancement rate until the cutting shaft returns to the prescribed setpoint rpm.

[0014] In another embodiment of the invention, the cutting motor has an rpm controller and/or limiter to maintain a prescribed rpm, the control activity of which can be evaluated by the power detector that determines the actual value for the power output of the cutting motor. This then can also provide a reliable indicator of the motor load when the motor rpm does not change.

[0015] In a preferred embodiment of the invention, the cutting motor is an internal combustion engine whose ignition stroke, i.e. the time difference between ignitions, is used as the criterion for the motor rpm and thus for the rpm of the cutting shaft and of the cutting tool. The rpm detector monitors the actual value for the rpm based on the ignition stroke, which is then forwarded to the controller.

[0016] In another advantageous embodiment of the invention, the cutting motor is an electric motor. In this case, it can be advantageous if the instantaneous current draw of the cutting motor is evaluated as the criterion for its rpm.

[0017] The setpoint provided in the controller can be permanently adjusted at the factory. In another embodiment of the invention, however, it is possible for the operator to change the setpoint based on changing operating parameters, namely the material of the floor to be cut, the capacity of the cutting tool, the cutting depth or the nominal rpm of the cutting motor.

[0018] The controller operates an advancing motor provided in addition to the cutting motor and that is part of the advancing unit. This advancing motor moves the frame relative to the floor.
The controller can be switched on or off so that the operator still has the option as before of manually pushing the floor cutter or of fixing the advancement rate by hand to a value of his choice.

The automatic adjustment of the advancement rate reduces the danger of incorrect operation, in particular by inexperienced operators. Furthermore, manual control parts that used to be a necessity can be eliminated. The automatic control system guarantees better economical and ecological operation of the floor cutter.

This and other advantages and features of the invention are explained in more detail below with the help of an example and with the aid of the figure.

The single FIGURE shows a joint cutter used as a floor cutter.

A main drive motor is fastened to a frame and serves as the cutting motor. The cutting motor is an Otto motor that receives fuel from a tank. The cutting motor drives a cutting disc as the cutting tool by way of a cutting shaft, which is not shown. This cutting disc saws the floor to be worked on in a known manner. The cutting disc can, for example, be a diamond slitting disc. Behind the tank is a water feed system that feeds water to cool the cutting disc.

At the rear of the frame is a rear axle with two rear wheels, only one of which can be seen in the FIGURE. Similarly, there is a front axle at the front of the frame, also with two wheels.

The rear wheels can be driven by an advancing unit that is not shown, which has among other things an advancing motor, for example an electric motor, in addition to the cutting motor. The electric motor that serves as the advancing motor for the rear wheels can for example be powered by a generator that is driven by the cutting motor.

There are basically two options for running the joint cutter when cutting the floor:

One option is for the operator to push the joint cutter over the floor using a handle. In the process, the operator can change the advancement rate as desired, taking into account the effective advancing force in particular (as an indication of the resistance that opposes the cutting disc during cutting) and the motor rpm, which he can hear.

Alternatively, there is the known option from the prior art of automatic advancement that the operator can switch on using control element. The electric motor on the advancing unit then drives the rear wheels, wherein the advancement rate available to the operator is essentially held constant in known joint cutters from the prior art.

According to the invention, however, an rpm detector and a controller are provided that enable the advancement rate to be automatically adjusted and changed. As criterion for the adjustment of the advancement rate, the controller evaluates the rpm of the cutting shaft or evaluates a parameter that depends on this rpm, for example a parameter that is proportional to it. Thus, other suitable parameters include the rpm of the cutting disc or the motor rpm.

The motor rpm can be established by monitoring the ignition stroke, for example in an internal combustion engine. The generation of the ignition sparks produces an electrical signal that can be evaluated by the rpm detector in a simple manner. This signal is a reliable criterion for the motor rpm.

If in other embodiments of the invention the joint cutter has an electric motor as the cutting motor, the evaluation of the current draw can be applied as the criterion for determining the motor rpm, for example.

Of course, any other known option for rpm detection is suitable to provide the required actual value.

In the controller, a setpoint value is saved at the factory that should be maintained when operating the floor cutter. In order to obtain the best possible results, the motor should always be run at full load. It is of course possible to control the motor via rpm, but this is not absolutely necessary.

If the actual advancement rate is too fast, the forces acting on the cutting disc decelerate the rpm of the cutting disc and thus the cutting motor. If the actual value of the rpm falls below the prescribed setpoint value, this is recognized by the controller, which then reduces the advancing motor of the advancing unit, thus reducing the advancement rate produced by the rear wheels. This reduces the cutting forces acting on the cutting disc so that the rpm of the cutting disc can increase and so that it returns to range of the setpoint rpm again.

If, however, the forces acting on the cutting disc are too low, the cutting motor rotates faster so that the rpm reaches the nominal rpm, which in any case is above the setpoint rpm. Then, the controller increases the advancement rate, which causes the cutting forces to increase, thus causing the cutting disc to decelerate.

Using the controller, it is possible to continuously maintain the joint cutter in an optimum operating range in order to avoid an overloading of the cutting disc and of the cutting motor on the one hand and to facilitate expeditious completion of the work on the other.

The advancement mechanism can be switched on or off in a known manner in order to prevent the floor cutter from getting away from the operator.

Also, the controller can be switched off in order to let the operator either push the joint cutter by hand or—as in the prior art—to input a constant value for the advancement rate, which is then maintained independent of the actual loads.

The embodiment described above uses the rpm as a easy to monitor and evaluate criterion for the power output to be detected. However, other parameters can be used that are a criterion for the power output or load of the cutting motor or cutting disc.

1-10. (Cancel)

11. A ground cutting device, comprising:

- a travelling mechanism;

- a cutting motor supported by the travelling mechanism for rotationally driving a cutting tool; and having an advancing device for moving the cutting tool at an advancing speed relative to the ground;
wherein
a rotational speed measuring device for measuring an actual value of the rotational speed of the cutting tool or of the cutting motor, and by
a control device for comparing the actual value measured by the rotational speed measuring device with a predetermined desired value, and for changing the advancing speed in dependence upon a deviation from the actual value and desired value.

12. A ground cutting device as claimed in claim 11, wherein the control device is formed in such a manner that it reduces the advancing speed if the actual value of the rotational speed is less than the desired value and that it increases the advancing speed if the actual value is greater than the desired value.

13. A ground cutting device as claimed in claim 11, wherein the desired value can be changed manually in dependence upon operating parameters, wherein the operating parameters are parameters from the group including the material which has been cut, the efficiency of the cutting tool, the cutting depth, the nominal rotational speed of the cutting motor.

14. A ground cutting device as claimed in claim 11, wherein the travelling mechanism can be displaced relative to the ground by the advancing device.

15. A ground cutting device as claimed in claim 11, wherein the advancing device comprises an advancing motor which can be actuated by the control device.

16. A ground cutting device as claimed in claim 11, wherein the control device can be switched off and the advancing speed can be adjusted either by manually pushing the ground cutting device or manually specifying an advancing speed desired value for the advancing device.

17. A ground cutting device, comprising:
a travelling mechanism;
a cutting motor supported by the travelling mechanism for rotationally driving a cutting tool; and having
an advancing device for moving the cutting tool at an advancing speed relative to the ground;

18. A ground cutting device, comprising:
a development device for measuring an actual value of the rotational speed of the cutting tool or of the cutting motor or of a parameter which is dependent upon the power or corresponds to the power; and by
a control device for comparing the actual value measured by the power measuring device with a predetermined desired value, and for changing the advancing speed in dependence upon a deviation from the actual value and desired value;

wherein
the cutting motor comprises a rotational speed control device and/or a rotational speed limiting device, of which the control activity can be evaluated by the power measuring device for the purpose of determining the actual value of the power of the cutting motor.

the cutting motor is an internal combustion engine;
the parameter proportional to the rotational speed is an ignition stroke of an ignition device for the cutting motor, and wherein
the rotational speed measuring device is formed for the purpose of measuring the actual value with the aid of the ignition stroke.

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