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[54] **FREE-CUTTING DEVICE**
27 Claims, 2 Drawing Figs.

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[51] **Int. Cl.** **E21c 1/00,** B23d 49/00, B27b 9/00
[50] **Field of Search** 173/162, 30; 143/43; 30/167, 296

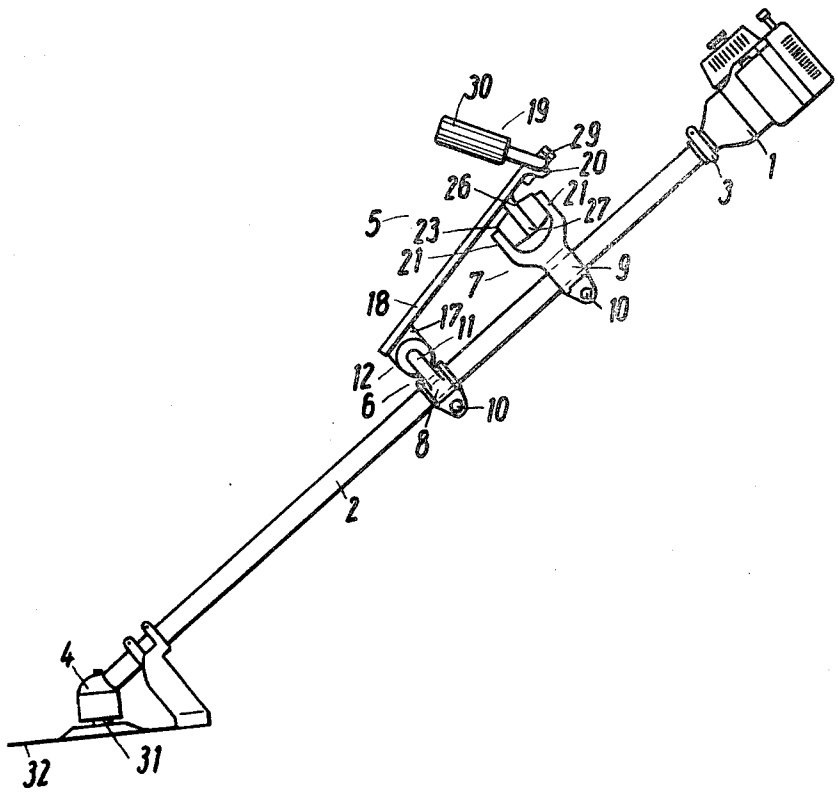
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ABSTRACT: A free-cutting device with an internal combustion engine drivingly connected through a pipe surrounded shaft with a free-cutting tool adapted to be moved over the ground, said pipe being provided with handle means for guiding the device while said handle means is connected to the device through at least one vibration-damping bearing.



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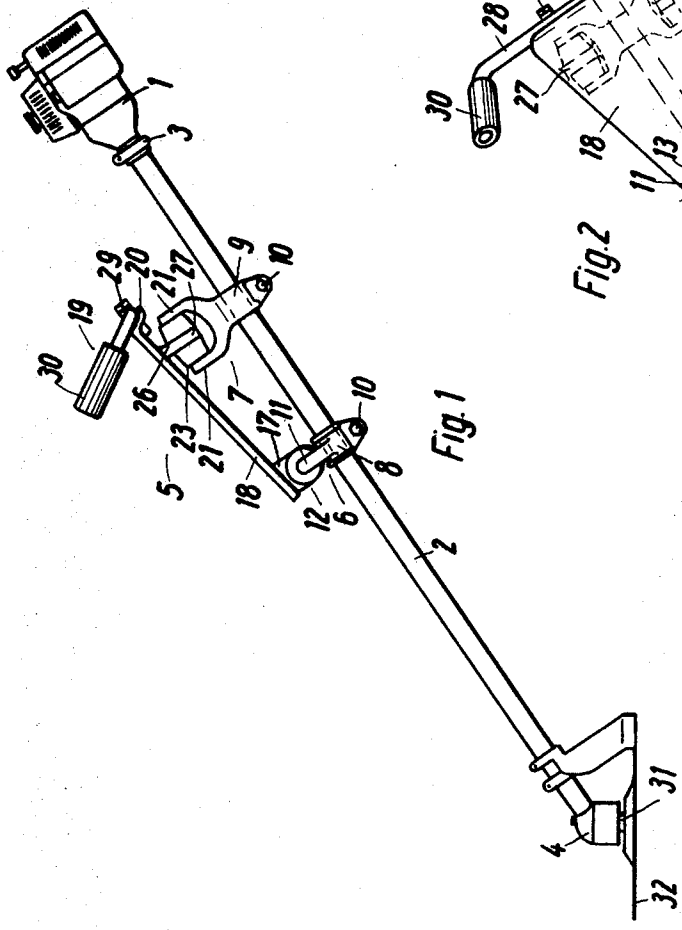


Fig. 1

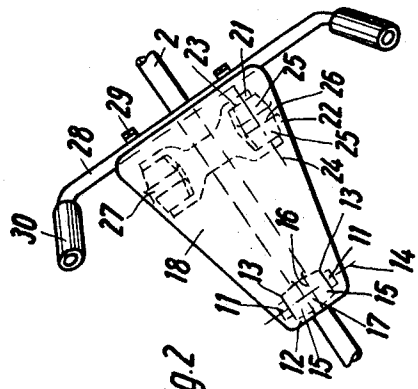


Fig. 2

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FREE-CUTTING DEVICE

The present invention relates to a free-cutting device with a combustion engine which engine is drivingly connected to a free-cutting tool through the intervention of a shaft surrounded by a pipe, said device, especially said pipe, being provided with at least one handle means for guiding the device. Such devices, especially portable free-cutting devices, are as a rule provided with a supporting and guiding device so that the engine can be carried directly on the body of a person by means of a shoulder strap while a sufficiently long shaft extends to the free-cutting tool from the engine or motor located approximately at the hip of said person, the arrangement being such that the shaft can be held at an angle of 30° with regard to the ground so that the axis of the free-cutting tool will be approximately perpendicular to the ground and that the tool will be located in the immediate vicinity of the ground. When working with the free-cutting device, the free-cutting tool is by means of the handle guided in the desired manner, for instance, above the ground.

It is an object of the present invention so to design a free-cutting device of the above-mentioned type that vibrations are avoided at the handle as far as possible.

This object and other advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which;

FIG. 1 diagrammatically illustrates a side view of a free-cutting device according to the invention.

FIG. 2 is a top view of a portion of the device according to FIG. 1.

The above-outlined object has been realized by connecting the handle to the device through at least one vibration-damping bearing. In this connection it is particularly advantageous to connect the handle to the device exclusively through the intervention of at least one vibration-damping bearing.

Referring now to the drawing in detail, FIGS. 1 and 2 thereof illustrate a free-cutting device according to the invention which is provided, for instance, with a one-cylinder-two-cycle engine or motor 1 which is flanged to one end of a pipe 2 having a length of, for instance, 1 meter. The motor 1 is by means of a clamp 3 detachably connected to pipe 2 in such a way that the main bearing axis of the crankshaft of motor 1 is located in the axis of the pipe 2. The other or lower end of pipe 2 has connected thereto a transmission housing 4 for a bevel gear transmission. The drive shaft 31 of said bevel gear transmission defines with the axis of the pipe 2 an angle of approximately 125° and protrudes downwardly beyond the transmission housing 4 while carrying a free-cutting tool 32, for instance in the form of a grass-cutting knife or a circular sawing blade. The bevel gear transmission is through a nonillustrated shaft journaled in pipe 2 drivingly connected to the crankshaft of the motor 1. A handle 5 is in a simple manner connected to the pipe 2 somewhat closer to the motor 1 than to the transmission housing 4. The said handle 5 serves for guiding the free-cutting device when working therewith. In addition to the handle 5, a nonillustrated shoulder strap may be connected to the motor 1 which strap preferably has such a length that the motor 1 can be carried laterally of the body of a person or directly on the body of a person in approximately the height of the hip of said person so that the tool 32 will then be directly above the ground and approximately perpendicular thereto.

For purposes of mounting the handle 5, the pipe is provided with two serially arranged holding members 6, 7 which extend around the pipe 2 with clamplike extensions 8, 9 and by means of screws 10 are detachably connected to the pipe 2 so that it will also be possible to equip prior-art free-cutting devices with an arrangement according to the present invention. The front holding member 6 or the holding member which is closer to the tool 32 than the other holding member has two arms 11 which extend upwardly and in a direction perpendicular to the axis of the pipe 2. These arms 11 are located symmetrically with regard to the axis of the pipe 2 and form a fork. Between the said arms 11 there is provided a rubber elastic vibration-damping bearing 12 which is safely supported in a space-saving manner. The outer connecting surfaces 13 located at the end face and pertaining to the vibration-damping bearing 12 are arranged parallel to those inner surfaces of the arms 11 which face each other and engage said arms while being parallel to the longitudinal direction of the pipe 2. Inasmuch as the vibration-damping bearing 12 forms a body of revolution with end faces 13 which are perpendicular to its axis, the axis of said vibration-damping bearing 12 is located perpendicular to the axis of pipe 2. The arrangement of the vibration-damping bearing 12 is such that its central axis 14 will in the position of use of said free-cutting device and in conformity with FIG. 1 be located horizontally or vertically to the axis of rotation of the tool 32 and will be subjected to thrust or pressure by vibrations acting perpendicularly with regard to the motor axis. When working with the free-cutting device, the latter is as a rule moved back and forth in the manner of a scythe so that it is advantageous to have the axis of the bearing 12 located approximately horizontally whereby this bearing will in view of the cutting pressure be subjected to a thrust or pressure. The vibration-damping bearing 12 comprises two bearing portions 15 which are arranged axially adjacent to each other and are preferably of the same design. Between the end faces 16 which face each other and pertain to the bearing portions 15 there is provided a fishplate 17 which forms a connecting member which is connected to the bottom side of a holding plate 18 for holding handles 19 so that a simple assembly will be assured. The fishplate 17 has its plane parallel outer surfaces in engagement with those end faces 16 of the bearing portions 15 which face each other and are perpendicular to the axis 14.

The other holding member 7 located toward the motor 1 in spaced relationship to the holding member 6 has two symmetrically located forks arranged at both sides of the longitudinal axis of pipe 2, said forks being formed by two parallel arms 21. Between said arms of each fork there is arranged a vibration-damping bearing 22 for increasing the damping effect. The arms 21 are so located that the central axes 24 of the vibration-damping bearing 22 are parallel to the central axis of the pipe 2, in other words the connecting surfaces 23, 26 at the end faces are located perpendicularly with regard to the central axis of pipe 2, and a stabilization of the handle relative to the device will be obtained. The vibration-damping bearings 22 which are particularly subjected to shearing stresses and have a high vibration-damping effect are precisely of the same design as the vibration-damping bearing 12. The holding plate 18 has within the range of each vibration-damping bearing 22 its bottom side provided with a connecting fishplate 27 which is held between the two bearing portions 25 of the respective rubber elastic bearing 22. The holding plate 18 is thus at three points located at the tips of an imaginary triangle connected to the pipe 2 by means of vibration-damping bearings. Two of these bearing have their axes parallel to each other while the third bearing has its axis perpendicular thereto, while all of the vibration-damping bearings are located symmetrically with regard to a plane which is parallel to the axis of rotation of the tool 32 and passing through the central axis of pipe 2.

Inasmuch as the internal combustion engine is connected to the pipe in an axis-parallel manner or along the axis of the shaft, vibrations may occur in all directions perpendicular to the longitudinal direction of the shaft. These vibrations can in a simple manner be damped by the design referred to above inasmuch as the connecting surfaces of two or more bearings or the central axes thereof are located at an angle with regard to each other. This also brings about the advantage that the handle is on one hand journaled in a highly vibration-damping manner and on the other hand is relatively rigid with regard to the device which means that the maximum possible deviations of the handle in view of its elastic connection with the device are only very small so that the free-cutting tool can be guided in a safe manner.

The vibration-damping bearings are, for instance, by means of screws connected to the arms 11, 21. These screws are located in the axis of the respective vibration-damping bearing while said vibration-damping bearings are so designed that the

connection of the handle **19** with the pipe **2** is effected exclusively through rubber elastic material.

The holding plate **18** which is located above the vibration-damping bearing and is substantially plane is inclined toward the tool **32** and at an acute angle toward the axis of the pipe **2**. The plate **18** is located in a plane which is parallel to the axis **14** of the front vibration-damping bearing **12** so that the vertical distance of the third vibration-damping bearing **12** from the shaft is less than the distance between the two other vibration-damping bearings **22** so that this bearing **12** is by a force acting axis-parallel to the shaft subjected to shearing stresses in the direction perpendicular to the longitudinal direction of the shaft. The rear end of the holding plate **18** extends rearwardly beyond the rear vibration-damping bearing **22** and has a bent-off portion **20** which in cross section forms a portion of a circle and extends perpendicularly to the axis of the pipe **2** while a handle bar **28** is provided for receiving the central portion. The handle bar **28** is by means of screws **29** detachably connected to the holding plate **18** so that a handle suitable for the respective purpose of employment may be provided. The two ends of the tubular handle bar **28** which protrude laterally beyond the somewhat trapezoidal holding plate **18** are approximately at a right angle to its central part bent off upwardly and extend at an acute angle with regard to the holding plate **18**. The said ends of the handle bar **28** are provided with handle members **30** which are located symmetrically on both sides of the central axis of the pipe **2** and bring about an improvement in the guiding of the free-cutting device.

The rubber elastic bearings **12, 22** are of a double conical design and preferably consist of rubber or another material with similar elastic properties.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawing but also comprises any modifications within the scope of the appended claims.

What we claim is:

1. A free-cutting device which includes: an internal combustion engine, pipe means having one end connected to said engine, transmission housing means connected to the other end of said pipe means, transmission means within said housing means, a free-cutting tool movable over the ground and drivingly connected to said transmission means, shaft means rotatably journaled in said pipe means and drivingly connecting said engine to said transmission means, handle means adjacent said pipe means, and vibration-damping bearing means interposed between and interconnecting said handle means and said pipe means intermediate said engine and said housing means, said vibration-damping bearing means comprising two vibration-damping bearings arranged on opposite sides of said pipe means and having their axes substantially parallel to the axis of said shaft means.

2. A free-cutting device which includes: an internal combustion engine, pipe means having one end connected to said engine, transmission housing means connected to the other end of said pipe means, transmission means within said housing means, a free-cutting tool movable over the ground and drivingly connected to said transmission means, shaft means rotatably journaled in said pipe means and drivingly connecting said engine to said transmission means, handle means adjacent said pipe means, and vibration-damping bearing means interposed between and interconnecting said handle means and said pipe means intermediate said engine and said housing means, said vibration-damping bearing means comprising two vibration-damping bearings arranged on opposite sides of said shaft means and symmetrically with regard to each other while having their axes substantially parallel to the axis of said shaft means, said vibration-damping bearing means also comprising a third vibration-damping bearing having its plane of symmetry extending through said pipe means and having its axis arranged substantially at a right angle with regard to the axes of said first-mentioned two bearings, said third bearing having its axis substantially perpendicular to the axis of rotation of said shaft means.

3. A device according to claim **2**, in which the three vibration-damping bearings are located symmetrically through a central plane passing through the axis of said shaft means.

4. A device according to claim **2**, in which the vertical distance of the third bearing from said shaft means is less than the vertical distance of the other two bearings from said shaft means.

5. A device according to claim **2**, which includes a holding element common to and supporting said first-mentioned two vibration-damping bearings, said holding element being detachably connected to said pipe means.

6. A device according to claim **5**, in which said holding element includes a fork-shaped portion for engaging opposite end faces of the respective adjacent vibration-damping bearing.

7. A free-cutting device which includes: an internal combustion engine, pipe means having one end connected to said engine, transmission housing means connected to the other end of said pipe means, transmission means within said housing means, a free-cutting tool movable over the ground and drivingly connected to said transmission means, shaft means rotatably journaled in said pipe means and drivingly connecting said engine to said transmission means, handle means adjacent said pipe means, and vibration-damping bearing means interposed between and interconnecting said handle means and said pipe means intermediate said engine and said housing means, and a holding member having a top side and a bottom side while having the latter provided with web means for connection of said holding member to said vibration-damping bearing means, said holding member being formed by a trapezoidal holding plate the plane of which defines an acute angle with said shaft means.

8. A device according to claim **7**, in which said vibration-damping bearing means comprise a plurality of vibration-damping bearings, each of said bearings being formed by two bearing sections separated from each other and connected to said holding member.

9. A device according to claim **7**, in which said vibration-damping bearing means comprise a plurality of vibration-damping bearings, each of said bearings forming a body of revolution and having its end faces designed as connecting surfaces for connection to said holding plate, said end faces being substantially perpendicular to the central axis of the respective pertaining bearing.

10. A device according to claim **7**, in which said vibration-damping bearing means comprise a plurality of vibration-damping bearings, each of said bearings being formed by two bearing sections separated from each other and connected to said holding member located therebetween for mounting said sections.

11. A device according to claim **7**, in which said handle means includes a handle bar protruding on both sides beyond said holding member and also comprises handles arranged at the ends of the handle bar, said handle bar being detachably connected to said holding member.

12. A device according to claim **11**, in which said handle means is connected to that end portion of said holding member which is adjacent said engine.

13. A free-cutting device which includes: an internal combustion engine, pipe means having one end connected to said engine, transmission housing means connected to the other end of said pipe means, transmission means within said housing means, a free-cutting tool movable over the ground and drivingly connected to said transmission means, shaft means rotatably journaled in said pipe means and drivingly connecting said engine to said transmission means, handle means adjacent said pipe means, and at least two vibration-damping bearing means provided approximately longitudinally of pipe means direction and spaced serially one after another as interposed between and interconnecting said handle means and said pipe means intermediate said engine and said housing means, at least one of said vibration-damping bearing means having an axis itself extending transverse to longitudinal direction of said pipe means.

14. A device according to claim 13, in which at least one vibration-damping bearing means extends on both sides of a plane that passes through said pipe means axially and vertically thereof.

15. A device according to claim 13, in which said vibration-damping bearing means are provided symmetrically with respect to a plane that passes through said pipe means axially and vertically thereof.

16. A device according to claim 13, in which at least one vibration-damping bearing means is provided directly above said pipe means.

17. A device according to claim 13, in which at least two vibration-damping bearing means have identical spacing from the axis of said pipe means.

18. A device according to claim 13, in which said bearing means comprise at least two vibration-damping bearings each having respective axes thereof arranged substantially at a right angle with regard to each other.

19. A device according to claim 13, in which said vibration-damping bearing means comprise two vibration-damping bearings which are located so that their common plane of symmetry extends at a right angle to the longitudinal axis of said pipe means.

20. A device according to claim 13, in which said vibration-damping bearing means comprise a plurality of vibration-damping bearings comprising connecting surfaces which are so arranged that at least the connecting surfaces of one of said bearings are perpendicular to the axis of said pipe means.

21. A device according to claim 13, in which vibration-damping bearing means are located directly above said shaft means and said pipe means surrounding the same.

22. A device according to claim 13, which comprises holding elements supporting said vibration-damping bearing means, said holding elements being detachably connected to said pipe means.

23. A device according to claim 13, which comprises one holding element arranged in common for at least two vibration-damping means.

24. A device according to claim 13, in which said vibration-damping bearing means include rubber bodies.

25. A device according to claim 13, in which said vibration-damping bearing means comprise a plurality of identical vibration-damping bearings.

26. A device according to claim 13, in which said vibration-damping bearing means comprise two vibration-damping bearings which are located one behind the other when viewed in the longitudinal direction of said pipe means.

27. A device according to claim 26, in which said bearings have end faces that are located substantially at a right angle with regard to each other.