

PATENT SPECIFICATION (11)

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(54) "PORTABLE, POWERED PRUNING TOOL"

(71) I, Hee Yong Foo, a citizen of Republic of Singapore, residing at 111-C, Amber Road, Singapore (15), Republic of Singapore, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to powered tools for horticultural and agricultural use and more particularly to powered cutting tools for pruning plants having fronds with thick and highly rigid leafstalks or petioles such as oil palms.

In general, it is desirable to prune the old fronds of an oil palm for reasons such as the promotion of growth of young fronds. Accordingly, it is a common practice in the culture of oil palms to cut off the old fronds thereof at points in the vicinity of the root or base parts of their leafstalks. For this purpose, a tool comprising a cutting edge blade mounted at the working end of a rod or pole has been used, the user holding the rod at its other end and pushing the cutting edge blade against each leafstalk and cutting it off by manual power.

The leafstalk of an oil palm, however, is thick and, at the same time, very rigid. For this reason, this manual pruning procedure requires several reciprocating movements of the cutting edge blade, which thereby is caused to bite into the leafstalk gradually until, finally, the leafstalk is cut off. This procedure entails considerable and hard labour and difficulties.

It is a general object of this invention to provide a pruning tool for solving the above described problem, at specific object being to provide a powered pruning tool of portable type.

According to this invention there is provided a portable, powered, pruning tool comprising: a hollow handle bar; a first shaft rotatably supported within the handle bar

and adapted to be coupled at one end thereof to a portable power unit; conversion means coupled to the other end of the first shaft for converting the rotation thereof into a translational reciprocating vibratory motion in forward and rearward operative directions parallel to the axis of said first shaft as output; a casing fixed to the handle bar and housing the conversion means; a cutting blade supporting structure disposed outside of the casing and coupled to the conversion means to be driven in reciprocating vibratory motion by the output thereof; and cutting means in the form of a single plate-like cutting blade mounted on said structure and extending in the said operative directions of said vibratory motion, the cutting blade having a cutting edge only on the forward end thereof.

In the accompanying drawings:

Figure 1 is a perspective view, with an upper casing part indicated only by phantom lines, showing the essential parts of one example of a pruning tool according to the invention;

Figure 2 is a side view of the tool shown in Figure 1;

Figure 3 is a perspective view, with the upper casing part removed, showing the essential parts of another example of a pruning tool according to the invention;

Figure 4 is a rear view of a backpack type power unit including an engine for use as the motive power means for a pruning tool of this invention;

Figures 5 and 6 are planar views respectively showing shapes and dimensions of examples of a cutting blade suitable for use in cutting leafstalks of oil palms in conjunction with the tool according to the invention; and

Figure 7 is a view indicating the state of a cutting blade of the pruning tool of this invention in cutting the root or base part of a leafstalk of an oil palm.

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Terms denoting direction, such as "forward" and "rearward" and the like as used herein, relate to directions as viewed by the operator holding the pruning tool for pruning. That is for example, the "forward" direction is the longitudinal direction parallel to the axis of the said first shaft toward the working end of the tool (toward the right as viewed in Figure 2), and the "rearward" direction is the opposite direction.

Referring first to Figures 1 and 2, the power transmitting mechanism of the first example of the pruning tool shown therein is enclosed within a casing 1, which is made of a light material such as die-cast aluminum alloy, for example, and is divided into an upper casing 1a and a lower casing 1b of symmetrical configuration.

Within this case 1, a pair of roller bearings 2 and 3 are fixedly supported at spaced-apart positions with coaxial alignment and rotatably support the two ends of a horizontal transverse shaft 4. This shaft 4 fixedly supports a pair of eccentric cams 5 and 6 respectively near its two ends and a bevel gear 7 near its middle part.

A bearing such as a roller bearing 9 is fixedly supported in an opening 8 in the rear side of the casing 1 and rotatably supports a rotating shaft 10. This shaft 10 is coupled at its forward end to a bevel pinion 11 meshed with the above mentioned bevel gear 7 and at its part rearward of the bearing 9 is sheathed within a hollow handle bar 13 attached to the casing 1 by a flange 12.

At positions forward of and confronting the eccentric cams 5 and 6, respectively, there are provided actuating rods 16 and 17 slidably supported for movement in the fore-and-rear direction within respective bores each formed by symmetrically opposed grooves of semi-circular cross section formed in the upper and lower casings 1a and 1b. The rods 16 and 17 at their rear ends bear slidably as cam followers on the cam surfaces of the cams 5 and 6, respectively, and fixedly support spring-retaining flanges 14 and 15 at positions near the cam following ends thereof. Between these flanges 14 and 15 and shoulder ledge parts of the casing in the above mentioned bores, there are respectively provided return springs 18 and 19 of compressed coil type disposed around the rods 16 and 17, whereby these actuating rods 16 and 17 are urged toward the cams 5 and 6, and the rear ends of the rods thereby abut against and follow their respective cams.

The front ends of these rods 16 and 17 extend outside of the casing in the forward direction and are there coupled together by a cross piece adapted to be a cutting blade support member 20, which supports a cutting blade 21 in the form of a plate mounted at its rear edge thereon and having a V-shaped cutout part 21a at its front part.

When the shaft 10 of the above described mechanism is rotated by a motive power source as described hereinafter, the transverse shaft 4 rotates together with the cams 5 and 6, whereupon the actuating rods contacting and following these cams undergo reciprocating movement in the forward and rearward directions. Consequently, the cutting blade 21 undergoes the same reciprocating movement. Accordingly, when using the tool for pruning, the operator holds it by the handle bar 13 and directs it so that V-shaped cutout part 21a of the cutting blade 21 contacts a leafstalk to be cut. The operator thus holds the tool while the cutting blade 21 is reciprocating as described above, whereby the blade progressively bites into the leafstalk until it is cut off.

While rotational motion is converted into reciprocating motion by cams 5 and 6 in the above described example, it will be apparent that this conversion can be accomplished also by a number of other mechanisms, one example of which is a crank mechanism as described below and illustrated in Figure 3. In Figure 3, parts which are the same as those in Figures 1 and 2 are designated by the same reference numerals, and detailed description of these parts is omitted in the following description.

In the mechanism shown in Figure 3, the transverse shaft 4 is formed with a pair of crank parts 22 and 23, which are coupled to the rear ends of connecting rods 24 and 25, respectively. The forward ends of these connecting rods 24 and 25 are pivotally connected by pins 26a and 27a to the rear, clevis ends of sliding rods 26 and 27, respectively. A cutting blade support member supporting a cutting blade (both not shown) is mounted on the forward ends of these sliding rods 26 and 27 similarly as in the preceding example.

Also similarly as in the preceding example, rotation of the shaft 10 is transmitted through the bevel gears 7 and 11, the transverse shaft 4, the crank parts 22 and 23, the connecting rods 24 and 25, and the sliding rods 26 and 27 to cause the cutter blade to undergo reciprocating motion.

The motive power source for driving the shaft 10 can be of any type provided that it is a portable or easily mobile power generating machine. One example of such a power source is a backpack type power unit, as shown in Figure 4, which comprises a fuel tank 31, an internal combustion engine 32 supplied with fuel from the fuel tank, a backpack frame 30 supporting the fuel tank and the engine, and a shoulder strap 33 secured to the frame for carrying the power unit on the back of the operator.

The output shaft of the engine 32 is coupled to the rear end of a flexible shaft (not shown) enclosed within a flexible tube 34. The

forward end of this flexible shaft is coupled to the rear end of the shaft 10. Accordingly, the rotational output power of the engine 32 is transmitted by way of the flexible shaft to the shaft 10 thereby to operate the tool as described above.

I have found the most suitable planar shape of the cutting blade 21 is one having a V-shaped cut out part 21a at the foremost part, this front edge part of the blade being formed into a cutting edge. I have found further that a preferred cutting blade for cutting the leafstalks of an oil palm is one in which the angle between the sides of the V-shaped cut-out, central part is of the order of 70 degrees; the bottom of said central part is rounded with a radius of curvature of the order of 15 mm.; the depth of said central part is of the order of 40 mm.; and the width of the foremost part of the cutting blade is from 70 mm. to 90 mm. Two preferred blades are shown in Figures 5 and 6. The distances indicated in Figures 5 and 6 are as follows:

$C_1 = 120$ mm.; $C_2 = 135$ mm., $d = 40$ mm., $e_1 = 13$ mm., $e_2 = 15$ mm., $f = 50$ mm., $g = 13$ mm., $h = 120$ mm., $R = 15$ mm., $\alpha = 70^\circ$.

Since a leafstalk of an oil palm has a cross section as shown in Figure 7 and designated by reference numeral 35, the cutting blade can be readily moved so that its V-shaped cut out part engages the leafstalk and is not easily dislodged therefrom when the blade undergoes its forward-and-rearward reciprocation. Accordingly, pruning work can be carried out with high efficiency.

I have found still further that the optimum speed of reciprocation of the cutting blade when cutting the leafstalk of an oil palm with a cutting blade 21 of the shape and dimensions shown in Figure 5 or 6 is from 35 to 40 strokes per second. By selecting the gear ratio of the gears 7 and 11 so that this reciprocation speed is produced by a rotational speed of the shaft 10 from 2,200 to 2,400 rpm., it is possible to utilize directly an internal combustion engine power unit of the back pack type available on the market.

Thus, this invention provides a pruning tool whereby the leafstalks of plants such as oil palms can be easily and rapidly cut without imposing a great physical load on the operator, and efficiency of pruning work can be greatly increased.

WHAT I CLAIM IS:

1. A portable, powered, pruning tool comprising: a hollow handle bar; a first shaft rotatably supported within the handle bar and adapted to be coupled at one end thereof to a portable power unit; conversion means coupled to the other end of the first shaft for converting the rotation thereof into a translational reciprocating vibratory motion in forward and rearward operative directions

parallel to the axis of said first shaft as output; a casing fixed to the handle bar and housing the conversion means; a cutting blade supporting structure disposed outside of the casing and coupled to the conversion means to be driven in reciprocating vibratory motion by the output thereof; and cutting means in the form of a single plate-like cutting blade mounted on said structure and extending in the said operative directions of said vibratory motion, the cutting blade having a cutting edge only on the forward end thereof.

2. A portable, powered, pruning tool as set forth in claim 1 in which said conversion means comprises: a first bevel gear coupled coaxially to said other end of the first shaft; a transverse shaft rotatably supported by the casing perpendicularly to the first shaft; a second bevel gear coaxially fixed to the transverse shaft and meshed with the first bevel gear; at least one cam shaped to produce reciprocating motion and fixed to the transverse shaft; an actuating rod supported so as to be slidable in said operative directions in the casing and functioning at one end thereof as a cam follower in contact with the cam thereby to undergo sliding translation motion in the forward operative direction, as hereinbefore defined, said cutting blade supporting structure being secured to the other end of the actuating rod; and a return spring for continually urging the actuating rod toward the cam and for returning the rod rearward after each said motion in the forward operative direction, whereby the actuating rod is caused to undergo reciprocating motion.

3. A portable, powered, pruning tool as set forth in claim 1 in which said conversion means comprises: a first bevel gear coupled coaxially to said other end of the first shaft; a transverse shaft rotatably supported by the casing perpendicularly to the first shaft and having at least one crank part; a second bevel gear coaxially fixed to the transverse shaft and meshed with the first bevel gear; a connecting rod rotatably connected at one end thereof to said crank part of the transverse shaft; and a sliding rod pin connected at one end thereof to the other end of the connecting rod, said cutting blade supporting structure being secured to the other end of the sliding rod.

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4. A portable, powered, pruning tool as set forth in any preceding claim in which the cutting edge of the cutting blade has a V-shaped cut-out, central part.

5. A portable, powered, pruning tool as set forth in claim 4 in which: the angle



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forward end of this flexible shaft is coupled to the rear end of the shaft 10. Accordingly, the rotational output power of the engine 32 is transmitted by way of the flexible shaft to the shaft 10 thereby to operate the tool as described above.

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parallel to the axis of said first shaft as output; a casing fixed to the handle bar and housing the conversion means; a cutting blade supporting structure disposed outside of the casing and coupled to the conversion means to be driven in reciprocating vibratory motion by the output thereof; and cutting means in the form of a single plate-like cutting blade mounted on said structure and extending in the said operative directions of said vibratory motion, the cutting blade having a cutting edge only on the forward end thereof.

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5. A portable, powered, pruning tool as set forth in claim 4 in which: the angle



- between the sides of the V-shaped cut-out, central part is of the order of 70 degrees; the bottom of said central part is rounded with a radius of curvature of the order of 15 mm.;
- 5 the depth of said central part is of the order of 40 mm.; and the width of the foremost part of the cutting blade is from 70 mm. to 90 mm.
6. A portable, powered, pruning tool as set forth in any preceding claim in which the
- 10 cutting blade undergoes said reciprocating motion with a frequency of from 35 to 40 strokes per second.
7. A portable, powered, pruning tool as set forth in any preceding claim which further
- 15 comprises, in combination therewith, said portable power unit.
8. A portable, powered, pruning tool as set forth in claim 7 in which said portable power unit is of a back-pack type comprising
- a backpack frame, a fuel tank mounted on the frame, an internal combustion engine mounted on the frame and supplied with fuel from the fuel tank, and a shoulder strap secured to the frame for carrying the power unit on the back of an operator, and the
- 25 output power of the engine is transmitted therefrom to the first shaft by a flexible shaft enclosed within a flexible tube.
9. A portable, powered, pruning tool, substantially as herein described with
- 30 reference to any of the embodiments illustrated in the accompanying drawings.
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