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— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
MOTORIZED CUTTING TOOL

FIELD OF INVENTION
The present invention relates to a cutting apparatus/or tools, more particularly, to a motorized cutter including a cutting head driven by external power source and involving bevel gear adapted to achieve low vibrating linear back and forth movement of the cutting head during its operation. The motorized cutter of the invention is adapted for low vibration cutting involving cutters such as chisel or C-sickle which would benefit convenient cutting such as oil palm fronds and fresh fruit bunches (FFB) and the like.

BACKGROUND OF THE INVENTION
Mechanized harvesting devices/apparatuses are well known and from time to time advancements in the related field have taken place to benefit the end user of such devices.

US 5002134 recites a rotary impacting apparatus comprising of rotary member drivingly rotated about a rotational axis within a casing. An impact member is loosely held by the rotary member so as to be movable toward and away from the rotational axis within a limited range. A holder mounted to the casing slidably supports a reciprocative member to allow movement thereof toward and away from the rotational axis within a limited range. The rotary member is directly attached to the driving source through a transmission shaft thus the system does not involve any gear system for transmitting the rotation of the engine to the rotor.

US 5488997 discloses rotary impacting apparatus comprising a housing, a rotor rotated in the housing, an impact member eccentrically held by the rotor, and a main reciprocative implement held reciprocatively at a forward end portion of the housing. The rotor rotates to hit the impact member for driving the main reciprocative implement into the ground for instance. The apparatus further includes an auxiliary
oscillating mechanism for transmitting an impacting force from the impact member to pull the main reciprocative implement when the housing is pulled relative to the main reciprocative implement by a predetermined distance. The rotor of the apparatus is connected to the engine by an endless transmission loop such as a belt or chain for transmitting the revolutions of the engine to the rotor. A gear mechanism is also proposed in this art as an alternative approach for transmitting the rotation of the engine to the rotor but corresponding design to implement such gear mechanism has not been discussed in the said art.

US 6484815 directed to the improvement in the conventional impact generator by incorporating an impregnating member capable of impregnating the grease during the operation of the device. As per the system description as disclosed in the art, the engine associated with the system adapted to generate rotating force is connected to the impact generator by a rod member. The rod member is constituted by a hollow pipe in which the drive shaft $S_1$ penetrates. The rotating force generated by the engine is transmitted to the impact generator by the drive shaft $S_1$ penetrating the rod member. Thus the power transfer mechanism does not include any gear system for transferring the rotating power of the engine to the impact generator. Thus none of the above mentioned prior art documents suggest a motorized cutting or harvesting device having power transfer mechanism involving a gear system including a rotary cam with groove path in communication with a guide and in combination with sliders to ensure smooth linear reciprocate movement of cutting device to perform cutting action.

MY 136496-A discloses a mechanized harvesting device utilizing a rapid chopping method utilizing the sickle. More particularly, the said art relates to a mechanized harvesting device with a C-shaped sickle utilizing the rapid chopping method utilizing the harvesting pole with the C-shaped sickle in the plantation industry, especially in the oil palm industry.
In MY 127947-A there is disclosed a cutter more particularly a cutter used for the purpose of cutting oil palm fronds and fresh fruit bunches (FFB). In particular the said device for cutting oil palm fronds and fruit bunches comprises of a sickle; a cam; at least a guide to connect the sickle and cam to a vertical cylinder; said vertical cylinder having a hole with a convex part where a cam is located wherein when the cam is rotated by at least a pair of bevel gear and shaft, the vertical cylinder and sickle attached to it is adapted to be moved up and down to provide enough force to the sickle for cutting fresh fruit bunches. The pair of bevel gear and shaft are used to transfer rotational movement from the engine to the cam.

The motorized cutter as above presently available are found to suffer from unwanted vibration during the motion of the cutting head. This unwanted vibration in the cutting head develops during the cutting action and such vibration makes such apparatus unsuitable for long time operation. Apart from that, the existence of the friction in the system is found to develop frequent wear and tear to the metal as well as plastic components as they rub each other. The friction developed also requires extra power for activating the cutting head and this subsequently increasing wear and tear of components which affect durability of the apparatus.

Thus there has been always a need for the improvement in the design of the existing motorized cutter to minimize such operational hazard due to unwanted vibration of the cutting head of the device.

SUMMARY OF THE INVENTION

It is therefore the basic aspect of the present invention to provide a motorized low vibration cutting tool or apparatus the cutting operation.

Thus, according to the invention there is provided a motorized cutter comprising of a cutting head for the cutting operation defining a line of cutting; bevel gear involving a driving and main gear adapted to operatively connected to a power source for
generating a rotational motion; means for converting and transmitting said rotational motion into linear motion and facilitate a linear movement of said cutting head during the cutting operation, said bevel gear comprising of said main gear having the teeth on the top side cooperating with said drive gear such that the action line of said rotary motion of said drive gear is substantially in line with said line of cutting for reduced vibration during cutting operation.

According to as aspect of the invention provides a low vibration motorized cutter comprising of a cutting head for the cutting operation, bevel gear means involving driving and main gear for transmitting the rotational power of the motor to the apparatus and means for converting rotational motion into linear motion to facilitate the linear movement of the cutting head during the cutting operation and to minimize the unwanted vibration of the cutting tools during the cutting operation the main gear is specially designed to have the teeth on the top side of line of cutting.

According to another aspect in the present invention, the motorized portable cutting apparatus or harvester comprises of a C shaped sickle for the harvesting operation, bevel gear involving driving and main gear for transmitting the rotational power of the motor to the apparatus and means for converting rotational motion into linear motion to facilitate the linear movement of the sickle during the harvesting operation is characterized by the main gear having the teeth on the top side of line of cutting for reducing the vibration in the apparatus.

According to another important aspect in the motorized cutting apparatus, the placement of the main gear having teeth on the top side of the line of cutting is adapted to minimize the offset in the action line and thereby reduction of the vibration of the apparatus during the operation.

According to a further aspect in the motorized cutting apparatus, the means for converting rotational motion into linear motion includes a connecting rod and a sleeve
for converting the rotational motion of the main gear into the linear simple harmonic motion.

According to yet another aspect in the motorized cutting apparatus, one end of the said connecting rod is operatively connected to the main gear and other end of the connecting rod is attached to the sleeve by a pin.

In accordance with another aspect in the motorized cutting apparatus the front end of the sleeve attached to bottom of the cutting head by a stopper and passes through a slider to favor the linear motion of the cutting head and the sleeve.

According to another aspect in the motorized cutting apparatus, the rotation of the main gear activates the connecting rod to oscillate which pushes the pin which carries the sleeve and the cutting head to move in linear direction.

According to a further aspect in the motorized cutting apparatus, the motor used for rotating the driving gear is anyone or more of petrol engine, diesel engine, electrical motor, hydraulic, pneumatic or battery powered motor.

The details of the invention, its objects and advantages are explained hereunder in greater detail in relation to the following non-limiting exemplary illustrations of the low vibration motorized cutter in accordance with the present invention.

**BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS**

The drawings constitute part of this specification and include an exemplary or preferred embodiment of the invention, which may be embodied in various forms. It should be understood, however, the disclosed preferred embodiments are merely exemplary of the invention. Therefore, the figures disclosed herein are not to be interpreted as limiting, but merely as the basis for the claim and for teaching one skilled in the art of the invention.
In the appended drawings:

**FIG.1** is a schematic illustration of a preferred embodiment of the motorized cutter in accordance with the present invention.

**FIG.2** shows a schematic representation of the essential mechanical components of the said motorized cutter.

**FIG.3** illustrates the schematic arrangement showing the comparison in the construction of action line conventional cutter versus the motorized cutter of the present invention.

**FIG.4** illustrates the magnified photographic representation of the action lines as illustrated in FIG.3.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

The present invention is thus directed to provide an automated cutting tool/apparatus i.e. a motorized cutter, which can be used for harvesting purpose in agricultural work. More specifically, the present invention is intended for developing a low vibration motorized cutting tools or a portable harvester comprising a cutting head and driving means including a specially designed gear system to facilitate the back and forth motion of the said cutting head keeping the vibration of the cutting head as minimum as possible during the cutting operation.

Accordingly, the present invention to provide a low vibration motorized cutter to perform comfortable and easy to handle cutting operation. The present invention also provides a low vibration motorized cutter involving a cutting head cooperating with a pair of bevel gear to activate the linear movement of the cutting head to facilitate the cutting operation for cutting oil palm fronds and fresh fruit branches.
The present invention also provides a low vibration motorized cutter involving bevel gear adapted to reduce the development of vibration in the cutting apparatus during the cutting operation.

Reference is first invited from the FIG.1 which illustrates the said motorized cutter or harvester adapted for cutting oil palm fronds and fresh fruit branches in with an embodiment of the present invention. As shown in the said figure the motorized cutter basically comprises a C-shaped sickle which is used as cutting head and a driving means provided at the bottom end of the cutting head adapted to move the cutting head in a linear back and forth motion to facilitate the cutting operation.

Reference is next invited from the FIG.2 wherein the said cutting tool as disclosed in the previous figure in more vividly illustrated, showing the detailed mechanical assembly incorporated in the said driving means. As shown in the said figures the present cutting tool includes a cutting head and a driving means. The cutting head of the tools is a C-shaped sickle 3 wherein bottom end of the C-shaped sickle is clamped to a sickle sleeve 5 by a sickle stopper 4. The bottom end of the said sickle is designed to stack firmly in the groove 6. The sickle stopper 4 which is placed over the sickle sleeve 5 is tightened by bolts and nuts. A sickle slider 7 is provided at the front end of the sickle sleeve 5 to facilitate the linear motion of the sickle sleeve in combined with the sickle 3 during the cutting operation. A pair of bevel gear including a main gear 13 and a driving gear 15 driven by external power source is provided at the back end of the sickle sleeve 5 to transmit the rotational power of the external power source to the apparatus and to activate the linear movement of the sickle sleeve and the cutting head. More specifically, the back end of the sickle sleeve is operatively connected to the main gear 13 by a connecting rod 9 and a pin 11 wherein the main gear 13 is operatively connected to the driving gear 15.

During the cutting operation the driving gear 15 is rotated at high speed by using any power source including petrol engine, diesel engine, electrical motor, hydraulic,
pneumatic or battery powered motor. As the main gear 13 of the cutting tools is
operatively connected to the driving gear, the main gear also starts to rotate with the
rotation of the driving gear 15. The pin and the connecting rod assembly which is
operatively connected to the main gear 13 translates the rotational motion of the
main gear into linear simple harmonic motion which sets off the linear back and forth
motion of the cutting head of the tools. The revolution of the said bevel gear (i.e.
combination of the driving and main gear) is directly proportional to the speed of the
back and forth linear motion of the cutting head. Thus the high speed rotation of the
bevel gear causes the high speed motion of the cutting head which enables the the
cutting head to perform cutting.

Reference is next invited from the FIGs. 3 and 4 shows the difference in the
construction of action line between conventional cutters and motorized cutter of the
present invention. As shown in the, in the present invention, the main gear has been
designed to have teeth on the top side of the action line of cutting (x-x), in particular
the main gear cooperating with said drive gear is designed such that the action line of
said rotary motion of said drive gear is substantially in line with said line of cutting for
reduced vibration during cutting operation. On the contrary in the existing cutters the
teeth of the main gears are positioned at the bottom of the line of cutting which
results an offset (d) in the action line (x-y). This offset in the action line causes
vibration in the system. Thus, placing of the teeth of the main gear over the cutting
line reduces the offset in the action line results a significant reduction in the
unwanted vibration of the tools during operation.

It is thus possible by way of the present advancement to provide for an automated
cutting tool/ apparatus which can be used for harvesting operations in the agriculture
work. Furthermore apart from using as agricultural harvester the said cutting tools
can be modified for different types of cutting operation by incorporating cutting head
shaping appropriate to the required job. The advantageous design of the pair of bevel
gear of the invention reduces the unwanted vibration during the operation of the said
cutting apparatus which makes the apparatus user friendly and adapted for long time use.

Additional modifications and improvements of the present invention may also be apparent to those skilled in the art. Thus, the particulars combination of parts described and illustrated herein is instead to represent preferred embodiments of the present invention, and is not intended to serve as limitations of alternative devices or/and combinations within the spirit and scope of the invention.
A motorized cutter comprising of a cutting head for the cutting operation defining a line of cutting; bevel gear involving a drive gear and main gear adapted to be operatively connected to a power source for generating a rotational motion; means for converting and transmitting said rotational motion into linear motion and to facilitate a linear movement of said cutting head during the cutting operation characterized by said bevel gear comprising of said main gear having the teeth on the top side cooperating with said drive gear such that the action line of said rotary motion of said drive gear is substantially in line with said line of cutting for reduced vibration during cutting operation.

A motorized cutter according to claim wherein said cutting head comprises of a C shaped sickle for the harvesting operation.

A motorized cutter according to anyone of claims wherein the placement of the main gear having teeth on the top side such that the action line of said rotary motion of said drive gear is substantially in line with said line of cutting to minimize the offset in said action line and thereby facilitate reduction of the vibration during the cutting operation.

A motorized cutter according to anyone of claims wherein said means for converting and transmitting said rotational motion into linear motion includes a connecting rod and a sleeve for converting the rotational motion of the main gear into a linear simple harmonic motion.

A motorized cutter according to claim wherein one end of the said connecting rod is operatively connected to the main gear and other end of the connecting rod is attached to said sleeve by a pin.
6. A motorized cutter (10) according to anyone of the claims 4 to 5 wherein the front end of the sleeve (5) is attached to bottom of the cutting head by a stopper (4) and which front end passes through a slider (7) to favor the linear motion of the cutting head and the sleeve (5).

7. A motorized cutter (10) according to anyone of the claims 4 to 6 wherein the rotation of the main gear (13) activates the connecting rod (9) to oscillate which in turn pushes the pin (11) which carries the sleeve and the cutting head to move in linear direction.

8. A motorized cutter (10) according to anyone of the claims 1 wherein the said power source comprises a motor for rotating the driving gear (15), and which is selected from anyone of petrol engine, diesel engine, electrical motor, hydraulic, pneumatic or battery powered motor.

9. A motorized cutter (10) according to anyone of the claims 1 to 8 which is a portable motorized cutter.
A. CLASSIFICATION OF SUBJECT MATTER
A01D 34/30(2006.01)i, A01D 46/24(2006.01)i

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)
A01D 34/30; A01D 34/01; A01D 46/00; B25D 9/08; A01D 46/26; A01D 1/00; A01D 46/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords motorized cutter, cutting head, bevel gear, linear motion, teeth, action line, vibration

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>X</td>
<td>EP 0933015 A1 (MESHEK ADVANCED SOLUTIONS FOR AGRICULTURE LTD.) 4 August 1999</td>
<td>1-3,8</td>
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<td></td>
<td>See abstract; paragraphs [0021H0022], [0026], [0032H0033], [0041]; and figures 1A-1B, 2-3, 5A-5B.</td>
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<td>A</td>
<td>FR 2357168 A1 (P00, HEE YOUNG) 3 February 1978</td>
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<td>See page 3, line 30 - page 4, line 11, page 5, lines 9-36, page 6, lines 12-19; and figures 1-5.</td>
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<td>See abstract; column 3, lines 15-30, column 4, lines 34-43, column 5, lines 1-7, column 5, line 43 - column 6, line 23; and figures 1,3A-3B.</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search: 24 March 2014 (24.03.2014)

Date of mailing of the international search report: 25 March 2014 (25.03.2014)

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea
Facsimile No. +82-42-472-7140

Authorized officer
SONG, Ho Keun
Telephone No. +82-42-481-5580

Form PCT/ISA/210 (second sheet) (July 2009)
Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos. :
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos. : 5
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
   Claim 5 is unclear, because it refers to multiple dependent claim 4 which does not comply with PCT Rule 6.4(a).

3. ☒ Claims Nos. : 4, 6-7, 9
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos. :

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos. :

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.
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