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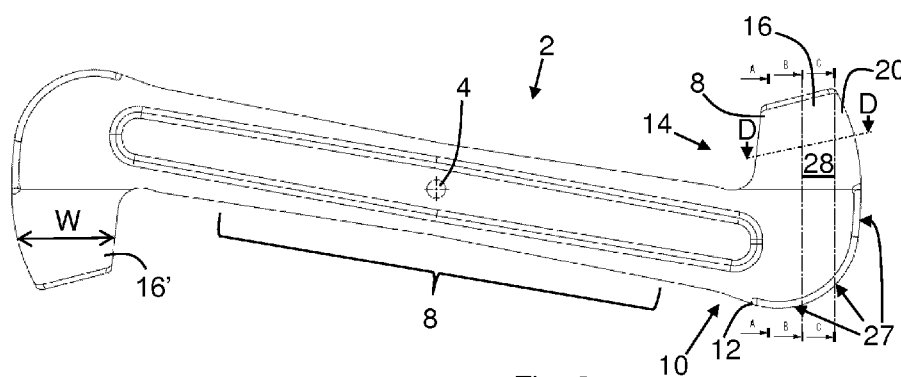


Fig. 2

(57) Abstract: Herein a cutting blade (2) for a rotary lawn mower (30) is disclosed. A trailing portion (14) of the cutting blade comprises a rearwardly projecting wing (16) arranged inclined to the cutting plane (6), the wing (16) having a radially inner portion (18) and a radially outer portion (20) seen in a direction from the rotational axis (4). The wing (16, 16') extends at a steeper angle (a) to the cutting plane (6) at the radially inner portion (18) than at the radially outer portion (20). The wing (16, 16') extends a farther distance (L) from the cutting plane (6) at the radially outer portion (20) than at the radially inner portion (18).



Cutting Blade and Lawn Mower

TECHNICAL FIELD

The present invention relates to a cutting blade for a rotary lawn mower and to a rotary lawn
5 mower comprising a cutting blade.

BACKGROUND

A rotary lawn mower comprises a cutting blade, which rotates in a substantially horizontal
plane during cutting of e.g. a lawn. The primary function of the cutting blade is to cut grass
10 straws. The cutting blade may be configured for performing further tasks during cutting of a
lawn, such as e.g. cutting the grass straws into shorter pieces, transporting grass clippings to
an outlet end of the lawn mower, etc.

The cutting blade is driven by an engine, such as a combustion engine or an electric motor. In
15 case of an electric motor, the electric motor may be connected via a cable to be powered by
power mains, or the electric motor may be battery powered by an on-board battery. Power
consumption of a rotary lawn mower depends inter alia on the type of cutting blade being
used. In battery powered lawn mowers power consumption is of particular interest in order to
provide long periods of cutting in between recharging the battery.

20 During operation of a lawn mower, not only the engine produces noise, but also the rotating
cutting blade. In rotary lawn mowers driven by an electric motor, the noise from the rotating
cutting blade may even be the major source of noise of the relevant lawn mower.

25 A cutting blade may be provided with at least one wing at its trailing edge for producing an air
stream towards an outlet end of a relevant lawn mower during rotation of the cutting blade.
EP 1459616 discloses an example of such a cutting blade provided with at least one cutting
edge and at least one fan blade (wing) which protrudes above a plane of the cutting blade
during lawn mower operation.

30

SUMMARY

It is an object of the present invention to reduce power consumption of a rotary lawn mower.

According to an aspect of the invention, the object is achieved by a cutting blade for a rotary
35 lawn mower, the cutting blade being configured for rotation about a rotational axis in a cutting
plane. The cutting blade includes a base portion, configured for connecting the cutting blade

to a rotatable shaft of the lawn mower. The cutting blade includes a cutting portion, the cutting portion being arranged at a radially outer end portion of the cutting blade and comprising a leading edge and a trailing portion, seen along a direction of rotation about the rotational axis. The trailing portion comprises a rearwardly projecting wing arranged inclined to the cutting plane, the wing having a radially inner portion and a radially outer portion seen in a direction from the rotational axis. The wing extends at a steeper angle to the cutting plane at the radially inner portion than at the radially outer portion. The wing extends a farther distance from the cutting plane at the radially outer portion than at the radially inner portion.

Since the wing extends at a steeper angle to the cutting plane at the radially inner portion than at the radially outer portion, and since the wing extends a farther distance from the cutting plane at the radially outer portion than at the radially inner portion, rotating the cutting blade at a particular rotational speed consumes less power while producing an equal or greater air stream towards an outlet end of a lawn mower than a prior art cutting blade being rotated at the particular rotational speed. As a result, the above mentioned object is achieved.

More specifically, it has been realised by the inventor that providing a steeper angle to the cutting plane at the radially inner portion than at the radially outer portion of the wing may provide an airflow over the wing, which airflow may be substantially within the same magnitude at the radially inner portion as at the radially outer portion of the wing, despite the cutting blade having a lower speed at the radially inner portion than at the radially outer portion of the wing. Moreover, due to the provision of the steeper angle to the cutting plane at the radially inner portion than at the radially outer portion of the wing, the wing does not have to extend as far from the cutting plane at the radially inner portion as at the radially outer portion. The airflow over the wing may still be provided within the same magnitude at the radially inner portion as at the radially outer portion.

Thus, and even airflow speed may be provided over the wing. This promotes an efficient generation of an air stream towards an outlet end of a lawn mower. Accordingly, such a cutting blade requires comparatively less energy to be rotated for producing a corresponding air stream than a prior art cutting blade having the radially inner portion of the wing extending the same distance from the cutting plane as, or a larger distance than, the radially outer portion of the wing, e.g. as in EP 1459616. Further, the cutting blade according to the present invention generates less noise than a cutting blade having the radially inner portion

of the wing extending the same distance from the cutting plane as, or a larger distance than, the radially outer portion of the wing.

5 The term "extending a distance from the cutting plane" entails a distance extending in a direction perpendicularly to the cutting plane. The cutting portion may comprise a cutting edge configured for cutting grass straws when the cutting blade is rotated.

10 According to embodiments, the wing may be evenly curved in a direction from the cutting plane. In this manner an even airflow is achieved over the wing. Thus, less noise is generated by the wing than by a wing generating a turbulent airflow.

The cutting blade may comprise two wings, one at each radial outer end of the cutting blade. Thus, according to some embodiments the cutting blade may comprise a further wing of the same kind as the wing defined in any one of aspects and/or embodiments discussed herein
15 arranged at a diametrically opposite side of the rotational axis.

20 According to a further aspect of the present invention, the above mentioned object is achieved by a rotary lawn mower comprising a cutting blade according to any one of aspects and/or embodiments discussed herein.

The rotary lawn mower may be of any kind, such as a walk-behind lawn mower, a riding lawn mower, an autonomous lawn mower, etc. It may be powered by an electric motor or by a combustion engine.

25 Further features of, and advantages with, the present invention will become apparent when studying the appended claims and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Various aspects of the invention, including its particular features and advantages, will be readily understood from the example embodiments discussed in the following detailed description and the accompanying drawings, in which:

Figs. 1 and 2 illustrate embodiments of a cutting blade for a rotary lawn mower,

Figs. 3A - 3C illustrate cross sections through a cutting portion of the cutting blade of Figs. 1 and 2,

35 Fig. 3D illustrates a cross section through a wing of a cutting blade,

Figs. 4A and 4B illustrate air speed at a trailing edge of wing of a cutting blade,

Fig. 5 illustrates a rotary lawn mower according to embodiments, and

Figs. 6A and 6B illustrate cutting blades according to alternative embodiments.

DETAILED DESCRIPTION

Aspects of the present invention will now be described more fully. Like numbers refer to like
5 elements throughout. Well-known functions or constructions will not necessarily be described in detail for brevity and/or clarity.

Figs. 1 and 2 illustrate embodiments of a cutting blade 2 for a rotary lawn mower. **Fig. 1** illustrates a top view of the cutting blade 2. **Fig. 2** illustrates a side view of the cutting blade
10 2. When mounted in a rotary lawn mower, the cutting blade 2 is rotatable about a rotational axis 4. When the cutting blade 2 is rotated about the rotational axis 4, the cutting blade rotates in a cutting plane 6. When the cutting blade 2 is in operation in a rotary lawn mower, grass straws are cut in the cutting plane 6 by the cutting blade 2. When the cutting blade 2 is in operation in a rotary lawn mower, the rotational axis 4 may extend substantially vertically
15 and the cutting plane 6 may extend substantially horizontally. The cutting blade 2 comprises a base portion 8 and a cutting portion 10. The base portion 8 is configured for connecting the cutting blade 2 to a rotatable shaft of a relevant rotary lawn mower. The cutting blade 2 comprises a cutting portion 10. The cutting portion 10 is arranged at a radially outer end portion of the cutting blade 2, seen in a direction from the rotational axis 4. The base portion
20 8 is arranged radially inside the cutting portion 10. In these embodiments the base portion 8 extends from the rotational axis 4 to the cutting portion 10. According to alternative embodiments, the base portion 8 may extend only a partial distance from the cutting portion 10 towards the rotational axis 4. In such embodiments the base portion 8 is configured for connecting the cutting blade 2 indirectly to the rotational axis 4 via at least one further
25 member.

The cutting portion 10 comprises a leading edge 12 and a trailing portion 14, seen along a direction of rotation about the rotational axis 4. That is, the leading edge 12 forms the foremost part of the cutting portion 10 when the cutting blade 2 is rotated about the rotational
30 axis 4. The trailing portion 14 forms the tracking part of the cutting portion 10 when the cutting blade 2 is rotated about the rotational axis 4. The trailing portion 14 comprises a rearwardly projecting wing 16 arranged inclined to the cutting plane 6, see further below with reference to **Figs. 3A - 3C**.

35 The wing 16 has a radially inner portion 18 and a radially outer portion 20 seen in a direction from the rotational axis 4. The wing 16 extends a farther distance from the cutting plane 6 at the radially outer portion 20 than at the radially inner portion 18. More specifically, the wing

16 extends from the cutting portion 10 to a trailing edge 22 of the wing 16. The trailing edge 22 of the wing 16 extends above the cutting plane 6 when the cutting blade 2 is arranged in a lawn mower positioned ready for operation. The trailing edge 22 has a radially outer corner portion 24 and a radially inner corner portion 26, again seen from the rotational axis 4. The
5 radially outer corner portion 24 is positioned at a first distance L1 from the cutting plane 6. The radially inner corner portion 26 is positioned at the second distance L2 from the cutting plane 6. The first distance L1 is longer than the second distance L2.

Suitably, the cutting portion 10 comprises a cutting edge 27 extending at least along a
10 portion of the leading edge 12 in the cutting plane 6. Thus, cutting of grass straws may be performed in an energy efficient manner. According to the embodiments illustrated in Figs. 1 and 2, the cutting edge 27 may extend from the leading edge 12 towards the wing 16. In this manner a so called dragging cut may be performed with the cutting blade 2 when the cutting blade 2 is used in a lawn mower, i.e. the cutting blade 2 may cut not only with its leading
15 edge, but also with at least part of its radially outer edge, towards the wing 16. This may be advantageous to provide an efficient cutting of grass straws as a relevant lawn mower is moved forwards during use thereof. Further, a better quality cut of grass straws thus may be provided than with a cutting blade having a cutting edge extending only along the leading
20 edge.

Figs. 3A - 3C illustrate cross sections through the cutting portion 10 of the cutting blade 2 of **Figs. 1 and 2**. **Fig. 3A** illustrates a cross section along line A – A in **Fig. 2**, towards the radially inner portion 18 of the wing 16. **Fig. 3B** illustrates a cross section along line B – B in **Fig. 2**, at a middle portion of the wing 16. **Fig. 3C** illustrates a cross section along line C - C
25 in **Fig. 2**, towards the radially outer portion 20 of the wing 16.

The wing 16 extends at a steeper angle α to the cutting plane 6 at the radially inner portion 18 of the wing 16 than at the radially outer portion 20 of the wing 16. More specifically, at its radially inner portion 18, the wing 16 extends at a first angle α_1 to the cutting plane 6. At its
30 radially outer portion 20, the wing 16 extends at second angle α_2 to the cutting plane 6. The first angle α_1 is larger than the second angle α_2 . At a middle portion of the wing 16, it extends at a third angle α_3 to the cutting plane 6. Suitably, the third angle α_3 is smaller than the first angle α_1 , but larger than the second angle α_2 . Thus, the angle of the wing 16 to the cutting plane 6 decreases from its radially inner portion 18 to its radially outer portion 20. Put
35 differently, the wing 16 has a higher pitch at the radially inner portion 18 than at the radially outer portion 20 of the wing 16.

The wing 16 is evenly curved in a direction from the cutting plane 6. Thus, the wing 16 extends with an even curve towards its trailing edge 22. This may be achieved e.g. as mentioned below with an upper surface of the wing 16 forming a partial surface of an imaginary cone. An even curve provides inter alia an even airflow over the wing as the cutting blade rotates.

In embodiments with a curved wing 16 the angles $\alpha_1 - \alpha_3$ may be measured along a tangent of the curved wing 16. The angles $\alpha_1 - \alpha_3$ may in such embodiments be measured at the trailing edge 22 of the wing 16.

Fig. 3D illustrates a cross section through the wing 16 along line D – D in **Fig. 2**. The Line D – D extends in a plane parallel with the cutting plane 6. According to embodiments, the wing 16 may have a substantially straight cross section seen in a plane parallel with the cutting plane 6. In this manner the wing 16 may be bent at an angle to the cutting plane 6 about one axis. Thus, during manufacturing of the cutting blade 2, providing the wing 16 at an angle of the cutting pane 6 may be easily performed. The substantially straight cross section is shown in **Fig. 3D**.

According to some embodiments, the wing 16 may have an upper surface 28, wherein the upper surface 28 is concave and forms a partial surface of an imaginary cone with a tip of the imaginary cone arranged radially inwardly and with its base arranged radially outwardly. In this manner the steeper angle α to the cutting plane 6 at the radially inner portion 18 of the wing 16 than at the radially outer portion 20 of the wing 16 may be provided during manufacturing of the cutting blade 2.

According to some embodiments, the cutting blade 2 may comprise two wings 16, 16', one at each radial outer end of the cutting blade. The cutting blade 16 comprises a further wing 16' of the same kind as the wing 16 discussed above arranged at a diametrically opposite side of the rotational axis 4. In this manner an efficient cutting blade 2 may be provided.

Figs. 4A and 4B illustrate the air speed of an airflow over the trailing edge 22 of the wing 16. **Fig. 4A** illustrates the air speed at the radially inner portion 18 of the wing 16. **Fig. 4B** illustrates the air speed at the radially outer portion 20 of the wing 16. The air speed passing the trailing edge 22 is shown with bold arrows V1, V2 in **Figs. 4A and 4B**. Despite the radially inner portion 18 of the wing 16 having a lower speed, measured in length units per time unit, than the radially outer portion 20 of the wing 16, the air speed V1 at the radially

inner portion 18 is substantially the same as the air speed V2 at the radially outer portion 20. That is, the absolute value of the air speeds V1, V2 is substantially the same due to the steeper angle α to the cutting plane 6 at the radially inner portion 18 of the wing 16 than at the radially outer portion 20 of the wing 16. Moreover, due to the steeper angle α to the cutting plane 6 at the radially inner portion 18 of the wing 16 than at the radially outer portion 20 of the wing 16, the radially inner portion 18 may extend a shorter distance from the cutting plane 6 at the radially inner portion 18 than at the radially outer portion 20, as discussed above with reference to Figs. 3A - 3C, while still providing the substantially same air speeds V1, V2 at the radially inner and outer portions 18, 20 of the wing 16.

The above discussed substantially same air speeds V1, V2 at the radially inner portion 18 and the radially outer portion 20 of the wing 16 ensure that an air stream produced by the cutting blade 2, when rotating in a rotary lawn mower, may be energy efficiently produced, and with comparatively low noise.

The above discussed substantially same air speeds V1, V2 at the radially inner portion 18 and the radially outer portion 20 of the wing 16 may be produced by a number of different wings 16 having the above discussed angle difference between the radially outer portion and the radially inner portion of the wing, as well as the radially inner portion extending a lesser distance from a cutting plane than the radially outer portion. That is, the first angle α_1 and the second distance L2 depend on the second angle α_2 , the first distance L1, and a width W of the wing 16, i.e. the radial distance between radially inner portion 18 and the radially outer portion 20 of the wing 16. Accordingly, the first angle α_1 and the second distance L2 may be calculated if the second angle α_2 , the first distance L1, and the width W of the wing 16 are known, or vice versa. That is, the second angle α_2 and the first distance L1 may be calculated if the first angle α_1 , the second distance L2 and the width W of the wing 16 are known.

Mentioned purely as an example, comparison of air streams through a lawn mower of the type Gardena © PowerMaxx 37 having a 230 V electric motor of 1600 W power and a cutting blade diameter of approximately 370 mm may demonstrate the efficiency of cutting blades according to the present invention. The air stream through an outlet for grass clippings of the lawn mower is measured in a test bed, without any grass. The standard cutting blade provided together with the Gardena © PowerMaxx 37 (referred to as Dura Edge Blade TM), which comprises one wing at each radially outer end, the wing being bent at a straight angle (not curved) to the cutting plane of the cutting blade. The wing is bent at the same angle to

the cutting plane along the wing. The wing extends the same distance from the cutting plane along the cutting plane. Such a blade produces an air stream of approximately 7100 slpm (standard litre per minute) at 230 V, at approximately 1020 W power consumption, and approximately 3650 rpm. A cutting blade 2 according to the present invention according to the embodiments of **Figs. 1 and 2**, wherein each wing 16, 16' has a projected area of 980 mm², a width of approximately 40 mm, and a curve radius of approximately 50 mm, produces an air stream of approximately 9200 slpm at 230 V, at approximately 1020 W power consumption, and approximately 3660 rpm. A cutting blade 2 according to the present invention according to the embodiments of **Figs. 1 and 2**, wherein each wing 16, 16' has a projected area of 975 mm², a width of approximately 40 mm, and a curve radius of approximately 62 mm, produces an air stream of approximately 9400 slpm at 230 V, at approximately 970 W power consumption and approximately 3660 rpm.

Figs. 6A and 6B illustrate cutting blades 2 according to alternative embodiments. The cutting blades 2 comprise wings 16 according to any aspect and/or embodiment discussed herein, which discussion accordingly will not be repeated. The cutting blades 2 according to these embodiments differ from the previous embodiments in the configuration of the cutting edges 27', 27'' arranged at the cutting portions 10 of the cutting blades 2.

In the embodiments of **Fig. 6A** the cutting edge 27' extends from the leading edge 12 in a curve partially towards the trailing portion 14. In the embodiments of **Fig. 6B** the cutting edge 27'' extends from the leading edge 12 in straight line at least partially towards the trailing portion 14. That is, the cutting edge 27'' extends at an angle β to the leading edge 12. The angle β may be within e.g. a range of 5 – 70 degrees.

In the embodiments of **Figs. 1 and 2** as well as in the embodiments of **Figs. 6A and 6B**, the cutting edges 27, 27', 27'' extend in the cutting plane 6 of the relevant cutting blade 2. A common denominator of the cutting edges 27, 27', 27'' of all these embodiments is that each of them extends from a leading edge 12 of the cutting blade 12 at least partially towards a trailing portion of the cutting blade 2. Thus, a dragging cut may be provided by the cutting blade 2, as discussed above.

Returning to **Figs. 1 and 2**, according to some embodiments, the cutting blade 2 may have a diameter within a range of 30 – 200 cm. In this manner a cutting blade 2 may be provided in which the wings 16, 16' generating an efficient air stream towards an outlet of a rotary lawn mower may be provided in accordance with the present invention.

According to some embodiments, the wing 16 may have a projected area within a range of 300 – 10000 mm². In this manner provisions for wings 16, 16' generating an efficient air stream towards an outlet of a rotary lawn mower may be provided within the constraints of a cutting compartment at an underside of the lawn mower where the cutting blade 2 is
5 mounted. The projected area of the wing 16 is the area of the wing projected onto the cutting plane 6.

Returning to **Figs. 3A – 3C**, according to embodiments, the wing 16 may extend at an average angle α to the cutting plane 6 within a range of 10 – 60 degrees. In this manner
10 wings 16, 16' generating an efficient air stream towards an outlet of a rotary lawn mower may be provided within the constraints of a cutting compartment at an underside of a lawn mower where the cutting blade 2 is mounted. At the lower end of the range, a lower air stream is produced than at the higher end of the range. However, also less energy is consumed with wings 16, 16' extending at an angle α at the lower end of the range in comparison with wings
15 extending at an angle α at the higher end of the range.

Fig. 5 illustrates a rotary lawn mower 30 according to embodiments. The rotary lawn mower 30 comprises a chassis 32, a motor 34, and a cutting blade 2 according to any one of the aspects and/or embodiments discussed herein. The cutting blade 2 is arranged in a cutting
20 compartment arranged in the chassis 32 at an underside thereof. The motor 34 is arranged on an upper side of the chassis 32 and is connected to the cutting blade 2 via a shaft. The shaft and thus, the cutting blade 2 are rotated by the motor 34.

As the cutting blade 2 rotates, an air stream is generated from the sides of the chassis 32 to
25 an outlet 36 of the lawn mower 30. The outlet 36 may be provided at a rear end of the chassis 32. A collection container 38 may be connected to the lawn mower 30 and may communicate with the outlet 36 for collecting grass clippings in the collection container 38.

In particular the wing 16 of the cutting blade 2 contributes to the generation of the air stream.
30 More specifically, the cutting blade 2 causes the air stream to flow between the chassis 32 and the ground into the cutting compartment as indicated by arrows 40. The cutting blade 2 causes the air flow to flow out from the cutting compartment through the outlet 36 as indicated by arrows 42.

35 According to some embodiments, the cutting blade 2 may be rotated at an operating rotational speed within a range of 1500 – 10000 rpm. The operating rotational speed is the

rotational speed of the cutting blade 2 during cutting of grass with the lawn mower 30. The cutting blade 2 is optimised for use at the operating rotational speed. In particular, the cutting blade 2 produces the desired air stream when rotated at the operating rotational speed.

5 In these embodiments the rotary lawn mower 30 is of the walk-behind type and comprises a handle bar 44. However, the rotary lawn mower may be of any other suitable kind, wherein an air stream generated by a cutting blade 2 according to the present invention may be utilised.

10 It is to be understood that the foregoing is illustrative of various example embodiments and that the invention is defined only by the appended claims. A person skilled in the art will realize that the example embodiments may be modified, and that different features of the example embodiments may be combined to create embodiments other than those described herein, without departing from the scope of the present invention, as defined by the
15 appended claims.

CLAIMS

1. A cutting blade (2) for a rotary lawn mower (30), the cutting blade (2) being configured for rotation about a rotational axis (4) in a cutting plane (6), wherein the cutting blade (2) includes a base portion (8), configured for connecting the cutting blade (2) to a rotatable shaft of the lawn mower (30), wherein the cutting blade (2) includes a cutting portion (10), the cutting portion (10) being arranged at a radially outer end portion of the cutting blade (2) and comprising a leading edge (12) and a trailing portion (14), seen along a direction of rotation about the rotational axis (4), wherein the trailing portion (14) comprises a rearwardly projecting wing (16, 16') arranged inclined to the cutting plane (6), the wing (16, 16') having a radially inner portion (18) and a radially outer portion (20) seen in a direction from the rotational axis (4),

characterised in that

the wing (16, 16') extends at a steeper angle (α) to the cutting plane (6) at the radially inner portion (18) than at the radially outer portion (20), and wherein the wing (16, 16') extends a farther distance (L) from the cutting plane (6) at the radially outer portion (20) than at the radially inner portion (18).

2. The cutting blade (2) according to claim 1, wherein the wing (16, 16') has a substantially straight cross section seen in a plane parallel with the cutting plane (6).

3. The cutting blade (2) according to claim 1 or 2, wherein the wing (16, 16') is evenly curved in a direction from the cutting plane (6).

4. The cutting blade (2) according to any one of the preceding claims, wherein the wing (16, 16') has an upper surface (28), wherein the upper surface (28) is concave and forms a partial surface of an imaginary cone with a tip of the imaginary cone arranged radially inwardly and with its base arranged radially outwardly.

5. The cutting blade (2) according to any one of the preceding claims, wherein the cutting portion (10) comprises a cutting edge (27, 27', 27'') extending at least along a portion of the leading edge (12) in the cutting plane (6).

6. The cutting blade (2) according to claim 5, wherein the cutting edge (27, 27', 27'') extends from the leading edge (12) towards the wing (16, 16').

7. The cutting blade (2) according to any one of the preceding claims, having a diameter within a range of 30 – 200 cm.

5 8. The cutting blade (2) according to any one of the preceding claims, wherein the wing (16, 16') extends at an average angle (α) to the cutting plane (6) within a range of 10 – 60 degrees.

9. The cutting blade (2) according to any one of the preceding claims, wherein the wing (16, 16') has a projected area within a range of 300 – 10000 mm².

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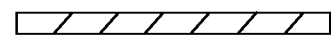
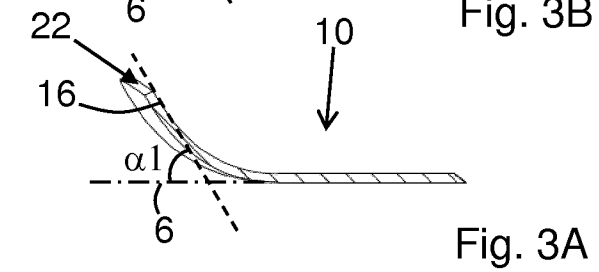
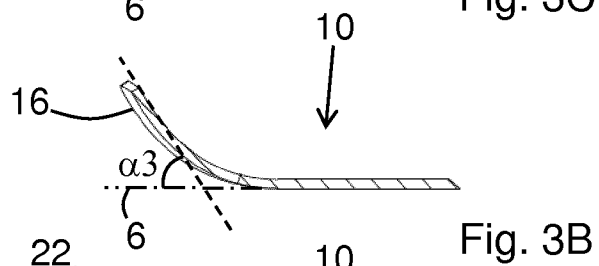
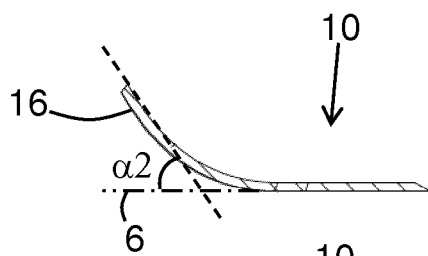
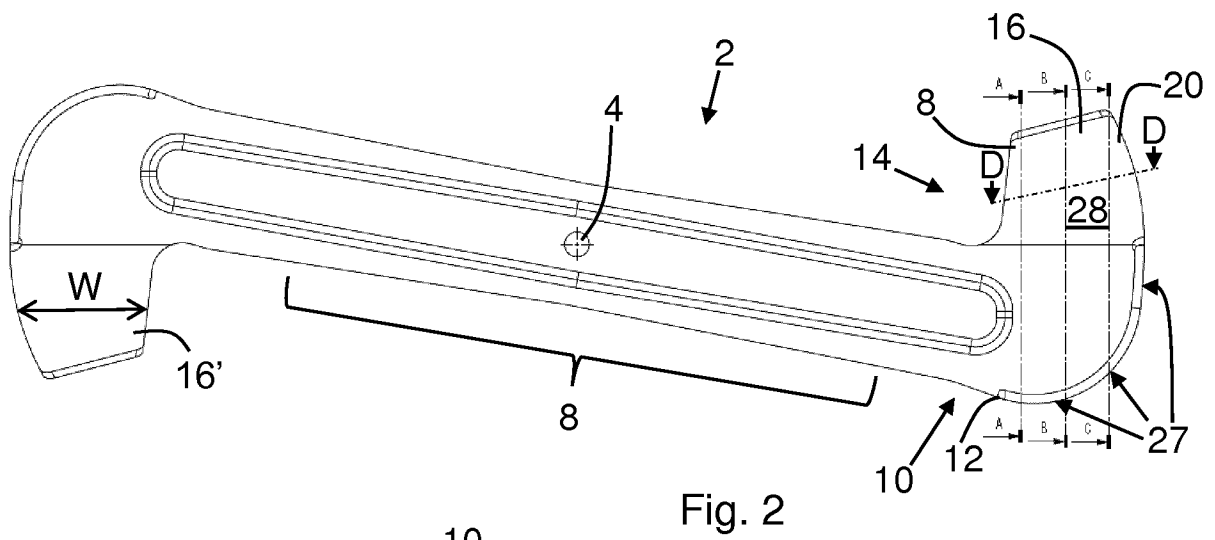
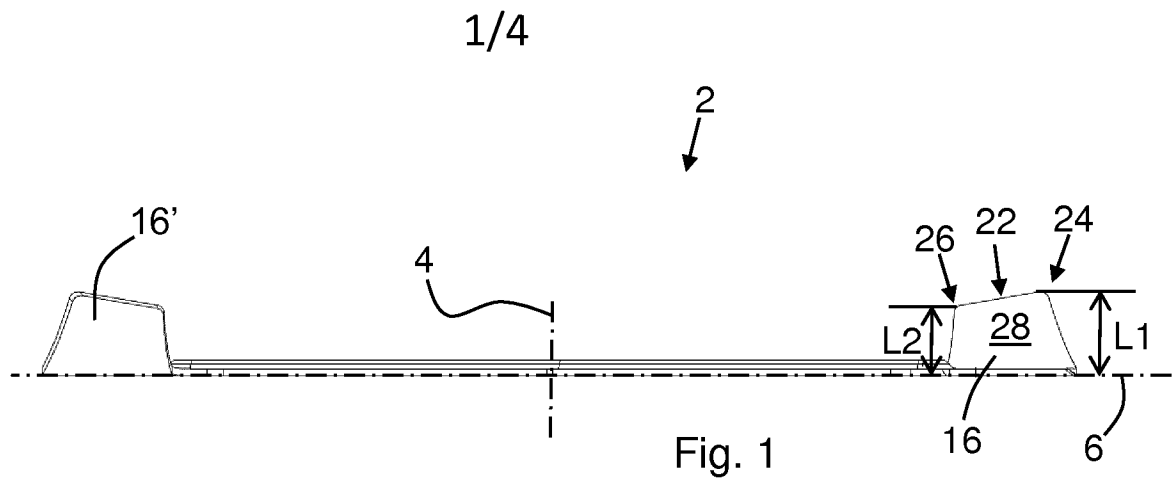
10. The cutting blade (2) according to any one of the preceding claims, wherein the cutting blade (2) comprises a further wing (16') of the same kind as the wing (16) defined in any one of the preceding claims arranged at a diametrically opposite side of the rotational axis (4).

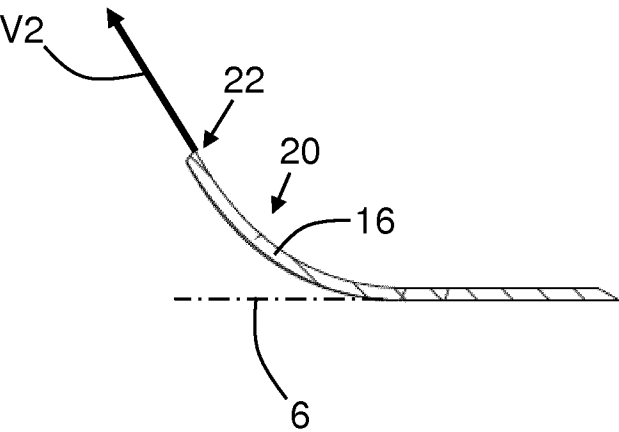
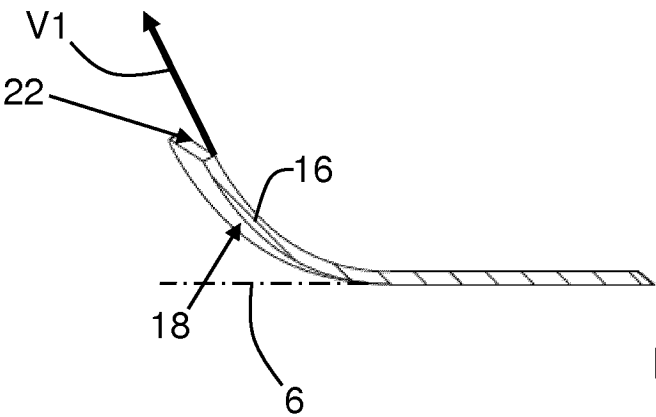
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11. A rotary lawn mower (30) comprising a cutting blade (2) according to any one of the preceding claims.

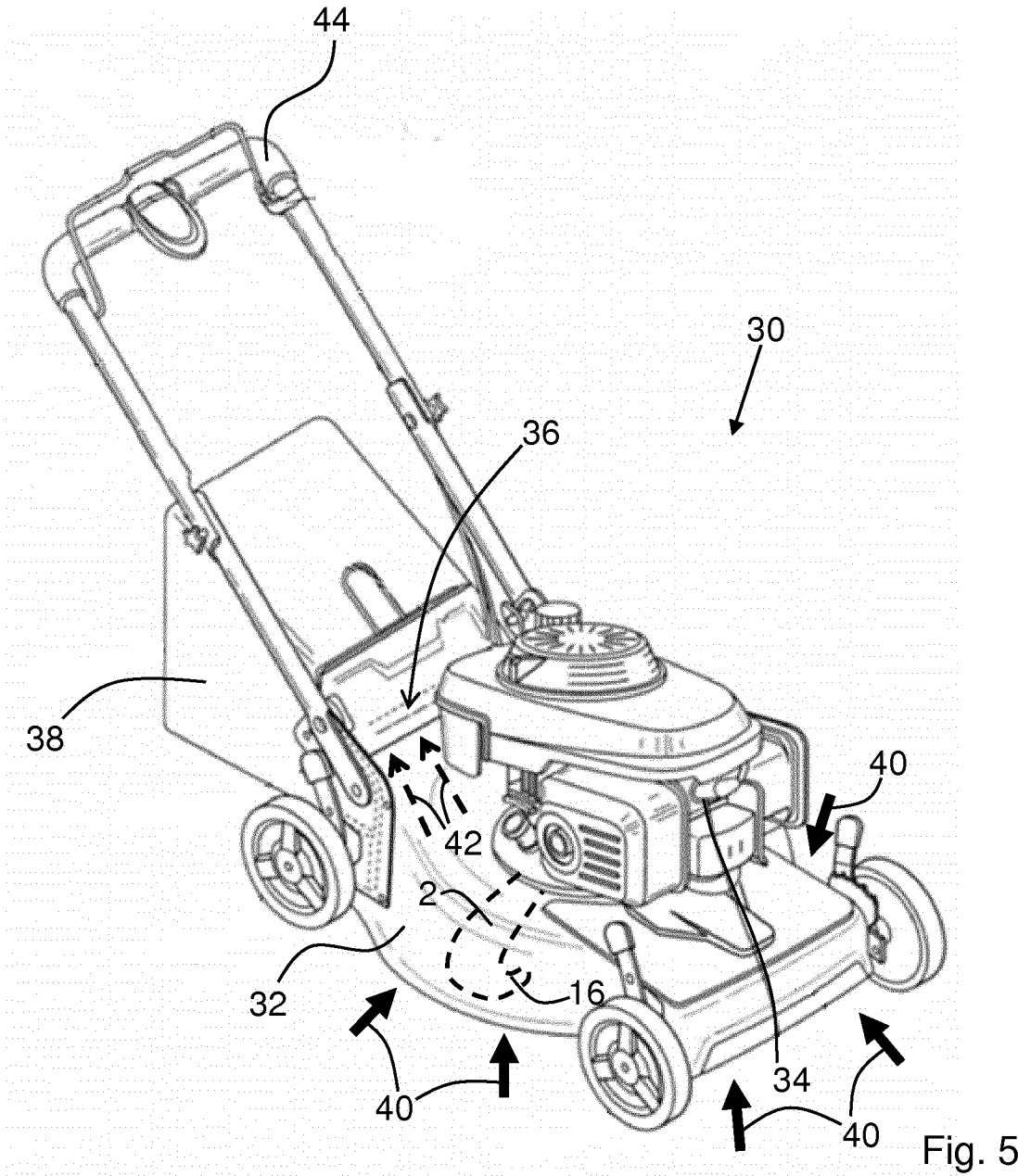
12. The rotary lawn mower according to claim 11, wherein the cutting blade (2) is rotated at an operating rotational speed within a range of 1500 – 10000 rpm.

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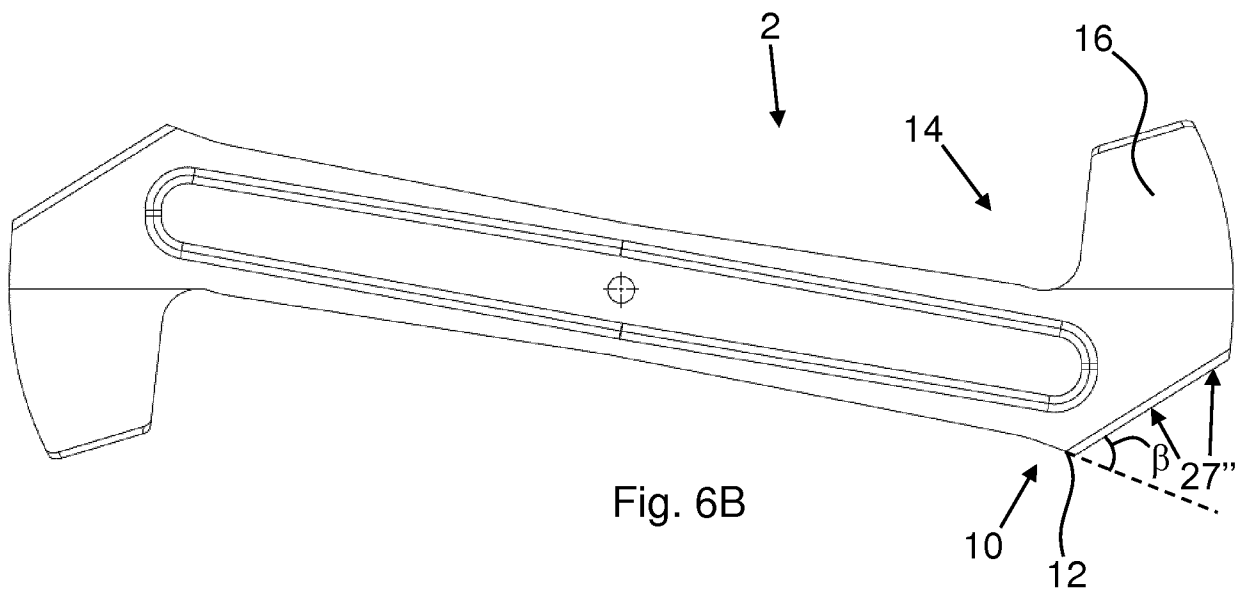
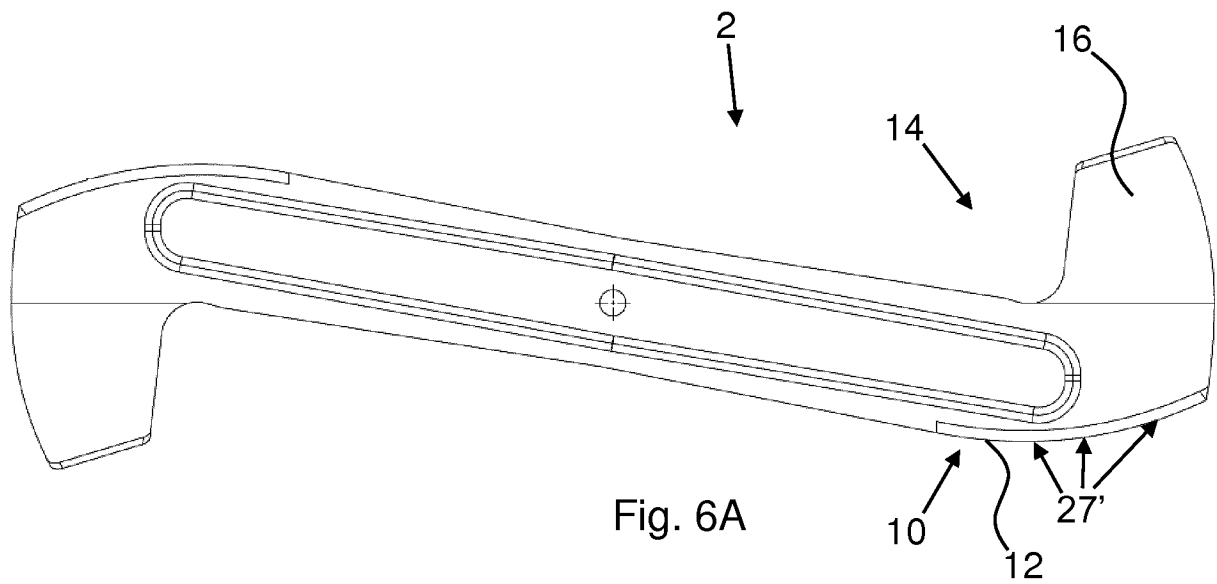




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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. A01D34/73
ADD.

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

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 459 616 A2 (KRESS WERNER [DE]) 22 September 2004 (2004-09-22) cited in the application page 2, line 46; figures 1-8 -----	1-12
A	GB 1 183 174 A (MASON & PORTER LTD [NZ]) 4 March 1970 (1970-03-04) figures 1-2 -----	1-12
A	US 2013/247531 A1 (CAMPIONE ANTHONY C [US]) 26 September 2013 (2013-09-26) paragraphs [0024], [0030]; figures 8-10 -----	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 October 2017

Date of mailing of the international search report

07/11/2017

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Authorized officer

Lang, Denis

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/070308

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1459616	A2	22-09-2004	NONE
GB 1183174	A	04-03-1970	NONE
US 2013247531	A1	26-09-2013	NONE