PATENT SPECIFICATION (11) 1 592 432

1 592 432

(21) Application No. 507/78 (22) Filed 6 Jan. 1978
(31) Convention Application Nos.
7 700 540 (32) Filed 19 Jan. 1977
7 705 784 25 May 1977 in
(33) Netherlands (NL)
(44) Complete Specification published 8 July 1981
(51) INT. CL.³ A01D 55/18
(52) Index at acceptance
A1F 160 DH

(54) MOWING DEVICE

(71) We, VICON N.V. of No. 1278, Hoofdweg, Nieuw-Vennep, the Netherlands, a Body Corporate organised and existing under the Laws of the Netherlands, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a mowing device comprising a housing extending transversely of the direction of movement of the mowing device, a plurality of cutting members rotatably journalled on said housing and a driving gear arranged in said housing for driving the cutting members, in which each cutting member comprises at least one cutter carrier rotatable above the housing and at least one cutter fastened to the periphery of the cutter carrier co-operating with a subjacent, non-driven counter-cutter carried by the housing, part of the path of the tip of the cutter being located in front of the counter-cutter.

Such a mowing device is known from French patent specification 683,434 of Solness. The cutter has the shape of a sickle and the crop is essentially cut by the cutters being drawn like sickles through the stalks. The rotating crescent-shaped cutters essentially slide in contact with a non-rotating counter-cutter so that the crop is cut by a scissor-like action between the cutter and counter-cutter. Stones may be jammed between the crescent-shaped cutters and the counter-cutters which may give rise to serious damage of the mowing device, particularly of its driving gear. The counter-cutter is formed by a front edge of the housing. This front edge is an integral part of the housing. Due to wear of the counter-cutter this known mowing device gets worn out after a short time to an extent such that the co-operation between the cutter and the counter-cutter strongly diminishes irreparably.

A clean shearing effect requires only little energy if the cutting edges are sharp. In practice the cutting edges are found to be blunt after a short time to an extent such that the advantage of the low amount of energy required for cutting gets lost or is substantially annulled by the higher amount of frictional resistance between the relatively movable cutting edges with the crop fibres and other substances such as sand penetrating in between. However, in order to ensure the advantages of a shearing effect without the disadvantages thereof, the cutting edge of the counter cutter is located below and is vertically spaced from the path of the cutting edge of the cutter, the paths of cutters of adjacent cutting members intersecting each other in front of the housing in a region spacing two adjacent counter cutters. This arrangement differs from the known arrangement by the absence of sliding contact between the cutter and counter-cutter. Cutting therefore does not take place by a scissor-like action but instead the crop stalks cut by the stroke of the cutter are supported at a higher level than the ground so that they can deflect only to a lesser extent. This improves the mowing effect. On the other hand the frictional resistance between the cutter and the counter-cutter is slight. It should be noted that crop or dirt cannot stick to the counter-cutters because the cutters extend further than the counter-cutters so that any stalk or the like adhering to a counter-cutter will be immediately wiped off.

Preferably the difference in level (w) between the cutting edges of the cutter and of the counter-cutter is 20 to 80% of the height (v) of the cutting edge of the cutter above the ground.

In order to adapt the shear effect between the cutter and the counter-cutter to the conditions of the crop to be mown, the level of the counter-cutter is preferably adjustable or in the forward direction the counter-cutter is adjustable within the cutting path of the tip of the cutter.

Reference should be made to our co-pending application No. 506/78 (Serial No. 1 592 431) the specification of which describes similar subject matter.

By way of example the invention will be described more fully hereinafter with

reference to preferred embodiments of a moving device according to the invention.

In the drawing:

Fig 1 is a perspective elevational view partly broken away of a mowing device in accordance with the invention,

Fig. 2 is a plan view partly broken away of said mowing device on an enlarged scale,

Fig. 3 is a sectional view taken on the broken line III-III in Fig. 2,

Fig. 4 is a sectional view like Fig. 3 of a different embodiment of a device in accordance with the invention,

Fig. 5 is a plan view like Fig. 2 of a different mowing device in accordance with the invention,

Fig. 6 shows on an enlarged scale a variant of detail VI of Fig. 5,

Fig. 7 is a plan view of a detail of a further developed mowing device in accordance with the invention, and

Fig. 8 is a sectional view taken on the axis of one of the cutter members shown in Figure 7.

Referring to Fig. 1 the mowing device 1 is connected by means of an auxiliary frame 24 with a framework 22 suspended to the suspension rods 20 of a tractor (not shown) and is driven through a bevel gear drive 15 and a belt drive 26 via a universal joint 18 by a power take-off shaft of the tractor.

The mowing device 1 embodying the invention comprises a housing 3 in the form of a flat, elongated beam extending transversely of the direction of movement 2 and consisting mainly of a trough 4 and a cover 5 secured to the latter. The housing 3 has a plurality of rotatable cutter members 7 adapted to rotate about upright axes 8. The cutter members 7 are arranged near and above the housing 3 and rotate pairwise in opposite senses 17. Each cutter member 7 is rigidly connected by means of a shaft 9 with a pinion 10 of a driving gear 63 accommodated in the housing 3 and comprising a series of pinions 10 and being driven through a shaft 28 by the bevel gear drive 15.

Fig. 3 shows that the shaft 9 of each cutting member 7 is rotatably journalled in an upright bearing collar 31 of the cover 5 by means of a bearing 30. A hub 35 is connected by means of a transverse pin 33 with a shaft 9.

Each cutting member 7 comprises a preferably substantially triangular cutter carrier 36 fastened to the hub 35 by means of bolts 34 and at least one, but preferably three cutters 37 fastened to the periphery of the cutter carrier 36.

Beneath each cutter carrier 36 and above the housing 3 a rotatable ring 21, which is not driven, is arranged around a bearing collar 31 of the housing 3. When the hub 35 is removed, the ring 21 can be slipped onto the bearing collar 31 and be enclosed by means of a resilient guard ring 27 in engagement with an external groove 25 of the bearing collar 31. The ring 21 constitutes a counter-cutter, whose outer edge which is milled and ground as illustrated in Fig. 2, cooperates with each rapidly moving cutter 37 located at a small distance above it to effect cutting of the crop. The ring 21 constitutes so to say a counter-support retaining the crop whilst it is cut by the rapidly rotating cutter 37. When a stone 11 gets in between a ring 21 and a cutter 37, the cutter 37 first deflects substantially in a tangential direction 29 opposite the direction of rotation 17 of the cutting member 7 concerned and according as the cutting angle k between the cutter 37 and the cutting edge 40 becomes appreciably more obtuse the cutter 37 deflects more towards the rotary axis 8 as far as beyond the cutting range of the ring 21. As a result the stone 11 cannot be jammed so that serious damage of the mowing device 1, paricularly of the driving gear 63 is avoided. During this deflection the cutter 37 skims past between the cutter carrier 36 and the ring 21 without touching them. The cutter 37 can deflect away under any condition because the angle (see Fig. 5) between the cutting edge 51 and the line 52 which passes through the centre of gravity Z and first point 53 of the cutter is greater than 90°. In the event that this angle r is 180°, the cutting edge 51 is parallel to said line 52 (see Fig. 2).

The cutters 37 of neighbouring cutting members 7 are relatively ofl-set through an angle of 60° so that they do not touch one another, though the cutter parts overlap one another. Each cutter 37 is freely rotatable about a pin 38.

In all embodiments shown the mowing device 1 has a low structure and the shape of the cutting members 7 is such that the mowing device 1 can readily pass below the cut crop. The circumferential speed of the cutters 37 is very high, for example, about 80 metres/sec with an outer diameter e of 45 to 50 cms.

During the mowing operation the mowing device 1 is held in a slightly forwardly sloping position so that the cutting members are at an angle f to the ground surface 66.

The ring 21 prevents stones and other objects from being jammed between the rotating cutting member 7 and the non-rotating housing 3. If objects get in between a cutting member 7 and the ring 21, the ring 21 can turn as required. The ring 21 may be made of thinner sheet material when it is protected underneath by a supporting skid 23 extending beneath the

housing 3 and at the front upwardly to the proximity of the cutting edge 40 of the ring 21, said skid gripping by a front hook 41 around a tag fastened to the housing 3 and being fastened by means of bolts 43 to the rear edge 44 of the housing 3.

The co-operative shear effect of the cutter 37 and the ring 21 is intensified according as the angle *g* between the cutting edge 40 of the ring 21 and the cutting edge 51 of the cutter 37 is more acute. For this purpose, as is shown in Fig. 5, the ring 21 is eccentrical to the axis 8 and rotatable about the axis 50, which is shifted over a small distance *t* towards the other cutting member 7 of the same pair rotating in the opposite sense away from the axis 8.

The cutting edge 51 is at an obtuse angle *r* to the line 52 going through the centre of gravity Z and the fastening point 53 of the cutter 37 so that the cutting edge 51 is at an acute angle *g* of about 80° to the cutting edge of the ring 21. In a longitudinal sectional view the cutters 37 preferably exhibit a downwardly extending S-bend so that the cutting edge 51 of the cutters 37 cuts the crop with a small clearance *w* above the top face of the ring 21. Owing to the acute angle *g* the cutting edge 40 of Fig. 5 can extend uniformly.

Referring to Fig. 6 the cutting edge 40 may be serrated, for example, in a saw-tooth-like manner.

The cutter 37 of Fig. 6 has two cutting edges 51 and two fastening holes 57 so that after wear of one cutting edge 51 the cutter 37 can be inverted and be fastened to the cutter carrier 36 in a different hole 57. The cutting edges 51 are at an angle *m* of about 135° to one another. The cutting angle *g* between the cutting edges 51 and 40 is about 60°.

A highly preferred embodiment of the mowing device 70 according to the invention is shown in Figs. 7 and 8. This mowing device 70 differs from the mowing device 1 in that the rings 21 are replaced by segment-shaped, curved counter-cutters 71 arranged at a distance *d* eccentrically to the axes 8 and being fastened by means of bolts 72 held in elongated holes 75 at adjustable levels to a mounting fillet 73, which is secured in turn by bolts 74 to the housing 3. According to the conditions of the crop to be mown the gap width *w* or the level difference between the cutting edges 40 and 51 can be set between 20 and 80% of the height *v* at which the cutting edge 51 of the cutter 37 moves above the ground 80 during the mowing operation. The bolts 72 can be passed through round, fitting holes, if adjustment of the gap width is not necessary. The cutter 37 is preferably twisted between the handle 77 and the blade 76 and preferably has two cutting edges 51 being at an acute angle *n* of 45° to each other so that each time an acute angle *g* between the cutting edges 51 and 40 is obtained.

A sliding plate 78 hooking into the mounting fillet 73 and bearing on the ground 80 is arranged beneath the housing 3. The sliding plate 78, like each segment-shaped counter-cutter 71 and each cutter 37, can be replaced by a new one after heavy wear.

WHAT WE CLAIM IS:

1. A mowing device comprising a housing extending transversely of the direction of movement of the mowing device, a plurality of cutting members rotatably journalled on said housing and a driving gear arranged in said housing for driving the cutting members, in which each cutting member comprises at least one cutter carrier rotatable above the housing and at least one cutter fastened to the periphery of the cutter carrier, a non-driven counter-cutter carried by the housing, the cutter end counter-cutter cooperating during rotation of the former to cut crop, part of the path of the tip of the cutter being located in front of the counter-cutter is 20 to 80% of the the counter-cutter being located below and vertically spaced from the path of the cutting edge of the cutter, the paths of cutters of adjacent cutting members intersecting each other in front of the housing in a region spacing two adjacent counter cutters.

2. A mowing device as claimed in claim 1, wherein the difference in level (w) between the cutting edges of the cutter and of the counter-cutter is 20 to 20% of the height (v) of the cutting edge of the cutter above the ground.

3. A mowing device as claimed in any preceding claim, wherein the level of the counter-cutter is adjustable.

4. A mowing device as claimed in any preceding claim, wherein in the forward direction the counter-cutter is adjustable within the cutting path of the tip of the cutter.

5. A mowing device, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1981.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1592432 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

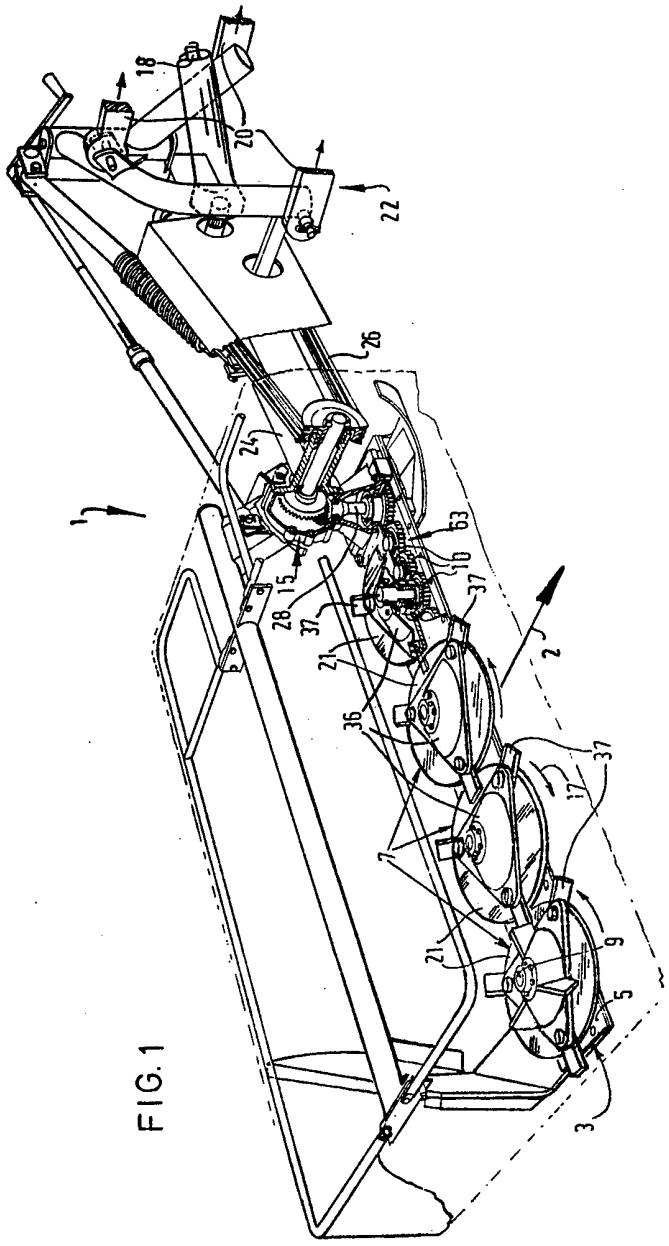


FIG. 1

1592432 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

FIG. 5

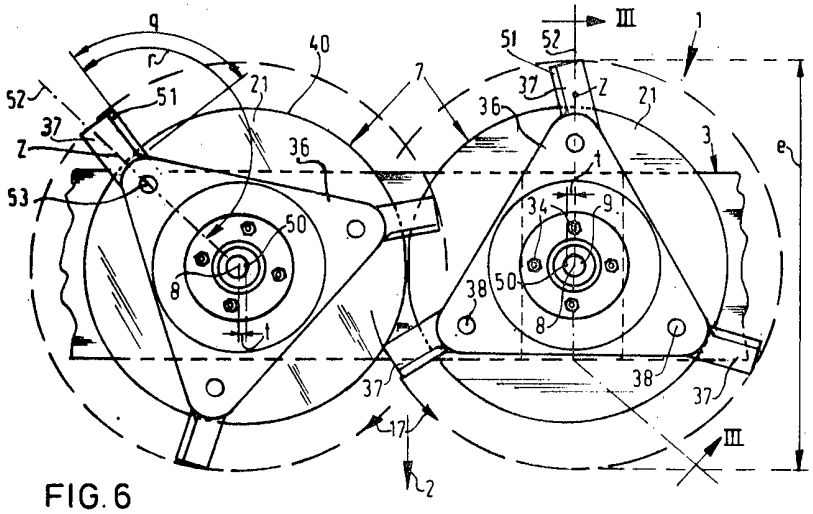


FIG. 6

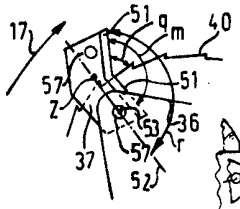


FIG. 7

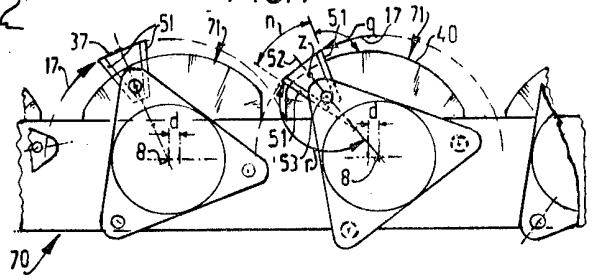
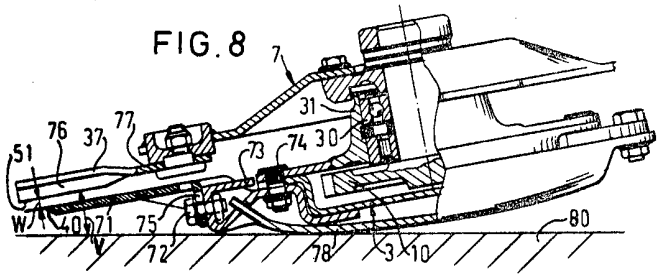


FIG. 8



1592432 COMPLETE SPECIFICATION
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Sheet 3

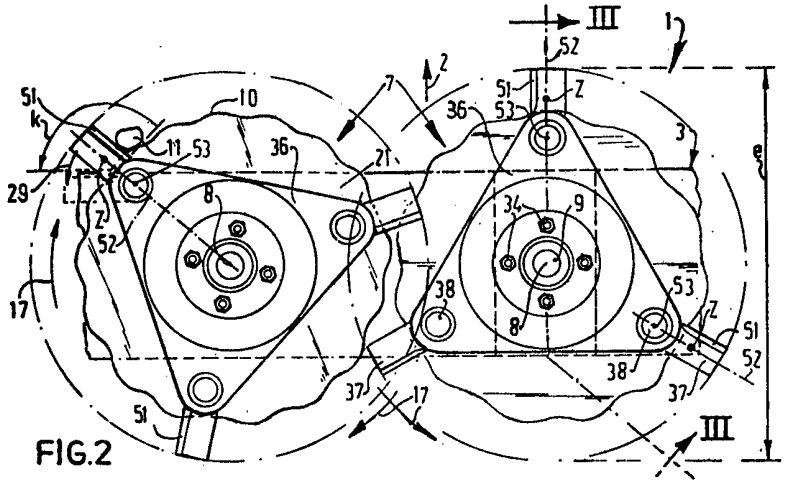

FIG.2

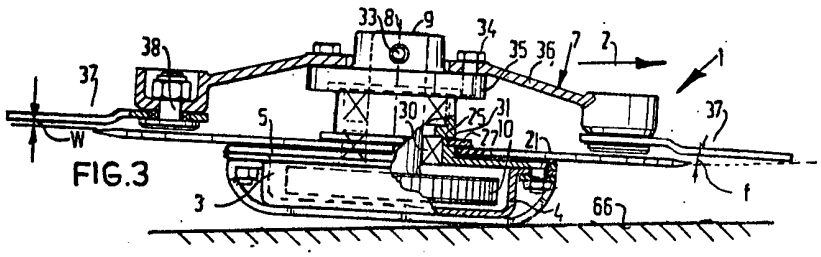

FIG.3

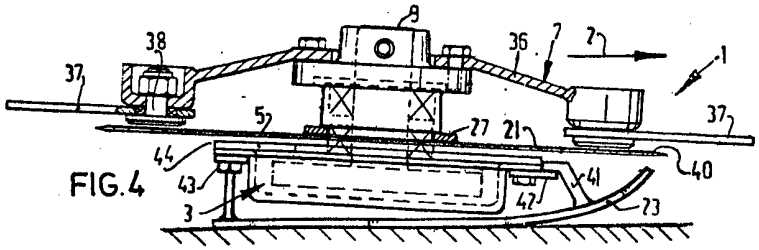

FIG.4