



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.03.2008 Bulletin 2008/11

(51) Int Cl.:
B27C 1/10 (2006.01)

(21) Application number: **07017591.4**

(22) Date of filing: **07.09.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(72) Inventors:
• **Matsubara, Koji**
Anjo-shi
Aichi-ken 446-8502 (JP)
• **Kato, Takaaki**
Anjo-shi
Aichi-ken 446-8502 (JP)

(30) Priority: **11.09.2006 JP 2006245956**

(71) Applicant: **Makita Corporation**
Anjo-shi, Aichi-ken 446-8502 (JP)

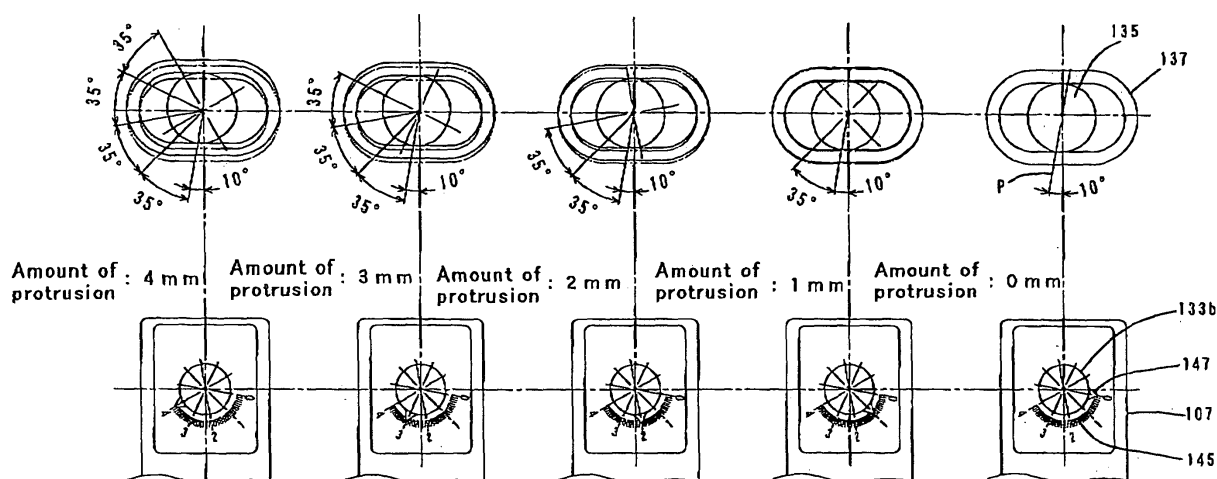
(74) Representative: **Kramer - Barske - Schmidtchen**
European Patent Attorneys
Landsberger Strasse 300
80687 München (DE)

(54) **Portable planer**

(57) It is an object of the invention to improve ease of operation of a portable planer (101). Representative portable planer includes a planer body (107), a planer blade member disposed in the planer body and rotates around its longitudinal axis and a front base (103) connected to the planer body for vertical movement with respect to the planer body. Further, the planer includes a cutting depth adjusting mechanism (131) operated by a user to change the vertical position of the front base (103) with respect to the planer body to adjust the amount of

protrusion of the planer blade member from the under-side of the front base. The cutting depth adjusting mechanism includes an operating member (133) manually turned, a cam member (135) rotating together with the operating member, and a height changing section that engages the cam member and changes the height of the front base based on an output of the amount of cam lift. The cam member has a cam curve that keeps constant the amount of cam lift per unit angle of rotation which is outputted by the cam member.

FIG. 6



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a portable planer in which the front base is held in contact with a working surface of a workpiece and slid forward in order to plane a workpiece by a rotating planer blade member, and more particularly, to a technique of adjusting the cutting depth of the planer blade member with respect to the working surface of the workpiece.

Description of the Related Art

[0002] A known electric portable planer is provided with a planer blade member that is rotated by a motor. The cutting depth (namely, planing dept) of the planer blade member with respect to a workpiece is adjusted by changing the vertical position of the front base with respect to the planer body having the planer blade member that rotates and thereby adjusting the amount of protrusion of the planer blade member from the underside of the front base. Such a portable planer is disclosed, for example, in Japanese utility model publication No. 38-21492. Within the known portable planer, the front base is disposed in front of the planer blade member in the planing direction and mounted to the planer body for relative movement such that its longitudinal movement is converted into vertical movement via an inclined surface. The vertical position of the front base is adjusted via a cutting depth adjusting mechanism. The cutting depth adjusting mechanism includes a cutting depth adjusting knob that is disposed on the planer body and can be turned by a user, an eccentric cam (eccentric shaft) that rotates together with the knob, and a guide member that is fixedly mounted on the front base and engages the eccentric cam. The front base is moved in the vertical direction by turning the knob. A portable planer of another type is also known which is provided with a cutting depth adjusting mechanism of the type which adjusts the height position of the front base by using a screw, for example, as disclosed in Japanese laid-open patent publication No. 62-273 804.

[0003] The above-described known cutting depth adjusting mechanism using an eccentric cam is advantageous over the screw-type one in that the number of turning operations of the knob can be reduced compared with the screw-type one. However, the front base is moved in the vertical direction by utilizing longitudinal displacement in the circular arc motion of the eccentric cam rotating around the axis of rotation of the knob. Therefore, the vertical displacement of the front base per unit angle of rotation of the knob cannot be constant. Specifically, the amount of displacement of the front base per unit angle of rotation of the knob changes in a sine curve, and is thus reduced in the vicinity of the raised end and the

lowered end of the front base. Therefore, the height position of the front base is not easily adjusted. In this point, a further improvement is required.

5 SUMMARY OF THE INVENTION

[0004] Accordingly, it is an object of the invention to provide an effective technique for improving ease of operation of a planer blade member cutting depth adjusting mechanism in a portable planer.

[0005] The above-described problem can be solved by the features of the claimed invention. According to the invention, a representative portable planer is provided with a planer body, a planer blade member that is disposed in the planer body and rotates around a longitudinal axis of the planer blade member, and a front base connected to the planer body for vertical movement with respect to the planer body. A planer blade is attached to the planer blade member. The front base is held in contact with a working surface of a workpiece and slid forward in order to plane the workpiece by the planer blade which protrudes from the underside of the front base. The manner of "connecting the front base to the planer body for vertical movement with respect to the planer body" suitably includes both the manner of connecting the front base such that the front base can move obliquely in the vertical direction with respect to the planer body, and the manner of connecting the front base such that it can move linearly in the vertical direction with respect to the planer body. Further, the "vertical" direction here represents the direction in which the height position of the front base with respect to the planer body is changed because the front base is inherently located under the planer body in the portable planer. Therefore, the vertical direction here may be defined by the direction in which the relative positions of the front base and the planer body are changed in a direction that intersects with the planing direction.

[0006] The portable planer of this invention further includes a cutting depth adjusting mechanism that is operated by a user to change the vertical position of the front base with respect to the planer body and thereby adjusts the amount of protrusion of the planer blade from the underside of the front base. The cutting depth adjusting mechanism includes an operating member that is manually turned, a cam member that rotates together with the operating member, and a height changing section that engages the cam member and changes the height of the front base with respect to the planer body, based on an output of the amount of cam lift.

[0007] The cam member has a cam curve that keeps constant the amount of cam lift per unit angle of rotation which is outputted by the cam member. Specifically, according to the invention, the cam member may rotate around the rotation axis extending in any given direction between the vertical direction and the horizontal direction. When the cam member rotates around the rotation axis, the front base moves in the vertical direction with

respect to the planer body via the height changing section. The amount of cam lift according to the invention may be defined by the amount of displacement of the rotating cam member in a direction that intersects with the axis of rotation of the cam member. Further, the manner of keeping constant the amount of cam lift per unit angle of rotation according to the invention may preferably be defined by a manner of outputting a constant amount of cam lift to the height changing section by input of a constant angle of rotation of the cam member.

[0008] According to the invention, by provision of the cam member having a cam curve that keeps constant the amount of cam lift per unit angle of rotation which is outputted by the cam member, the relationship between the angle of rotation of the cam member and the amount of vertical displacement of the front base can be kept constant, when the height position of the front base is changed with respect to the planer body by turning the operating member in order to adjust the amount of protrusion of the planer blade member from the underside of the front base. Therefore, the amount of protrusion of the planer blade can be easily adjusted, so that ease of operation is enhanced. Preferably, the cam member to keep constant the amount of cam lift per unit angle of rotation may typically include a plate cam having a heart-shaped contour.

[0009] As one aspect of the invention, a position retaining mechanical part may further be provided which retains the operating member in a turned position after turning operation. The position retaining mechanical part includes a plurality of recesses arranged on a circular arc around an axis of rotation of the operating member, a protrusion that is removably engaged in the recesses, and a biasing member that elastically biases the protrusion in a direction of engagement with the recesses. The protrusion is engaged in any one of the recesses according to the turning operation of the operating member, so that the operating member is retained in the turned position. Because the recesses are equidistantly arranged, the durability can be increased.

[0010] Other objects, features and advantages of the present invention will be readily understood after reading the following detailed description together with the accompanying drawings and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a side view showing an entire portable planer according to an embodiment of the invention.

FIG. 2 is also a side view showing the entire portable planer according to the embodiment of the invention, in the state in which a front base is moved upward and a planer blade member protrudes from the underside of the front base.

FIG. 3 is a schematic view showing the structure of the planer blade member.

FIG. 4 is a sectional view showing a biasing spring that biases the front base upward.

FIG. 5 is a view illustrating preparation of the cam diagram

FIG. 6 is a view showing the relationship between the cam and the amount of protrusion (cutting depth) of the planer blade member.

FIG. 7 is a sectional view showing a position retaining mechanical part of an operating knob.

DETAILED DESCRIPTION OF THE INVENTION

[0012] Each of the additional features and method steps disclosed above and below may be utilized separately or in conjunction with other features and method steps to provide and manufacture improved portable planers and method for using such portable planers and devices utilized therein. Representative examples of the present invention, which examples utilized many of these additional features and method steps in conjunction, will now be described in detail with reference to the drawings. This detailed description is merely intended to teach a person skilled in the art further details for practicing preferred aspects of the present teachings and is not intended to limit the scope of the invention. Only the claims define the scope of the claimed invention. Therefore, combinations of features and steps disclosed within the following detailed description may not be necessary to practice the invention in the broadest sense, and are instead taught merely to particularly describe some representative examples of the invention, which detailed description will now be given with reference to the accompanying drawings.

[0013] A representative embodiment of the present invention is now described with reference to FIGS. 1 to 7. FIGS. 1 and 2 show a representative entire electric portable planer 101 according to the invention. As shown in FIGS. 1 and 2, the portable planer 101 includes front and rear bases 103, 105 which are disposed on the front and the rear in the direction of movement (travel) of the planer along the workpiece during planing operation, a body 107 which is disposed on the front and rear bases 103, 105, and a handle 109 which is connected to the upper surface of the body 107 and is held by the user. In FIGS. 1 and 2, the direction of travel of the electric planer 101 during planing operation is shown by an arrow. Specifically, the left side in the drawings is the front side in the direction of travel of the planer. The body 107, the rear base 105 and the handle 109 are the features that correspond to the "planer body" in this invention.

[0014] The body 107 includes a motor housing 111, a side housing 113 and a cover 115. The motor housing 111 houses a driving motor 121 and a planer blade member 123. The side housing 113 houses a power transmitting mechanism (not shown) that transmits the rotating output of the driving motor 121 to the planer blade member 123. The cover 115 is removably mounted to the side housing 113 to open and close the side opening of the

side housing 113. The planer blade member 123 is a feature that corresponds to the "planer blade member" according to the present invention.

[0015] The driving motor 111 is disposed within the motor housing 111 such that its rotating shaft extends in a horizontal direction that intersects with the direction of travel of the electric planer 101 during planing operation. As schematically shown in FIG. 3, the planer blade member 123 includes a generally cylindrical rotary drum 123a which is supported rotatably on an axis parallel to the axis of rotation of the driving motor 121, and a plurality of cutting blades 123b which are mounted on the rotary drum at predetermined intervals in the circumferential direction and extend in the axial direction of the rotary drum 123a. The cutting blade 123b is a feature that corresponds to "planer blade" according to the invention. The planer blade member 123 is disposed between the front base 103 and the rear base 105, and a lower edge of the planer blade member 123 is exposed together with the cutting blade 123b below from an opening between the front base 103 and the rear base 105.

[0016] When the user depresses a trigger 109a while holding a handle 109 and an operating knob 133 of a cutting depth adjusting mechanism 131 which will be described below, the driving motor 121 is driven and the planer blade member 123 is rotated. In this state, the user places the front base 103 on the working surface of the workpiece and slides it forward along the workpiece, so that the planing operation of the cutting blades 123b of the planer blade member 123 can be performed. In order to adjust the cutting depth of the cutting blade 123b attached to the planer blade member 123 during a plane operation, the cutting depth adjusting mechanism 131 is manually operated to adjust the vertical position of the front base 103 with respect to the body 107. Thus, the amount of protrusion H of the cutting blade 123b of the planer blade member 123 which protrudes from the underside of the front base 103 can be changed. In this manner, the cutting depth of the planer blade member 123 can be adjusted.

[0017] The cutting depth adjusting mechanism 131 for adjusting the cutting depth of the planer blade member 123 is now be described. As shown in FIGS. 1 and 2, the front base 103 is connected to the body 107 such that it can move vertically along guide surfaces in the form of inclined surfaces 103a, 107a extending obliquely upward toward the front at a predetermined angle (η) with respect to a horizontal line (the underside of the base). Specifically, the inclined surface 103a is formed on the right and left side surfaces of the front base 103 and slidably contacts the inclined surface 107a formed on the right and left side surfaces of the body 107. Further, the inclined surface 103a of the front base 103 is normally pressed against the inclined surface 107a of the body 107 by the spring force of a plate spring 141 as shown in FIG. 4. The plate spring 141 is mounted to the front base 103 generally at the middle in its extending direction by a screw 143. Further, the both extending ends of the plate

spring 141 press spring receiving portions 107b of the body 107 from above by the spring force. Thus, the plate spring 141 normally applies an upward spring force to the front base 103. The front base 103 is moved along the inclined surface 107a of the body 107 while being prevented from moving in the lateral direction via a guide member (not shown).

[0018] As shown in FIGS. 1 and 2, the cutting depth adjusting mechanism 131 includes the operating knob 133 that is operated by the user within a generally horizontal plane, a cam 135 that rotates together with the operating knob 133 within a generally horizontal plane, and an engagement recess 137 that engages the cam 135. The operating knob 133 and the cam 135 are features that correspond to the "operating member" and the "cam member", respectively, according to the present invention. The operating knob 133 is disposed on the outside upper surface of the body 107 and includes a knob shaft 133a extending downward from the underside of the operating knob 133 toward the front base 103 through the inside of the body 107. The knob shaft 133a is rotatably mounted to the body 107, and the cam 135 is integrally formed on the extending end or the lower end of the knob shaft 133a. Alternatively, the knob shaft 133a and the cam 135 may be formed separately and thereafter joined so as to rotate together.

[0019] The engagement recess 137 is integrally formed in the middle of the upper surface of the planar section of the front base 103 and has an oblong shape elongated in the lateral direction (that intersects with the planing direction) (see FIG. 6). The engagement recess 137 engages with the front end and the rear end of the outer periphery of the cam 135 in surface contact. Specifically, the front base 103 engages the outer periphery of the cam 135 via the engagement recess 137 and linearly moves in the longitudinal direction by rotation of the cam 135. A longitudinal movement (Y) of the front base 103 is converted into a vertical movement (H) via the above-described inclined surfaces 103a, 107a. As a result, the vertical position of the front base 103 with respect to the body 107 is changed, so that the amount of protrusion H (see FIG. 3) or the cutting depth of the cutting blade 123b of the planer blade member 123 is adjusted. The relationship between the longitudinal displacement Y and the vertical displacement H of the front base 103 is constant and represented by an equation of $H = Y \tan \eta$. The engagement recess 137 and the inclined surfaces 103a, 107a are features that correspond to the "height changing section" according to the present invention.

[0020] FIG. 5 is a cam diagram of the cam 135 according to the representative embodiment. In FIG. 5, the horizontal axis indicates an angle of rotation θ , and the vertical axis indicates the amount of cam lift Y. The vertical displacement of the front base 103 is determined by the amount of cam lift Y outputted when the cam 135 rotates. The cam curve is set such that the amount of cam lift y_1 per unit angle of rotation θ_1 which is outputted by the cam 135 is kept constant, or such that the vertical dis-

placement y_1 of the front base 103 per unit angle of rotation θ_1 of the cam 135 is kept constant. In other words, the cam curve of the cam 135 is formed such that the uniform rotation of the cam 135 is converted into uniform linear motion of the front base 103. Within the embodiment, the cam 135 is contoured such that the front base 103 can be raised by the same displacement y_1 for every constant angle of rotation θ_1 during half turn of the cam 153, and such that the front base 103 can be lowered by the same displacement y_1 for every constant angle of rotation θ_1 during the remaining half turn of the cam 153. As a result, as shown in FIG. 5, the cam 135 has a generally heart-shaped contour.

[0021] The cutting depth adjusting mechanism 131 according to this embodiment is constructed as described above. Therefore, the front base 103 is moved in the vertical direction via the engagement recess 137 that engages the cam 135 and via the inclined surfaces 103a, 107a when the user turns the operating knob 133 clockwise or counterclockwise to thereby rotate the cam 135. In this manner, the height position of the front base 103 with respect to the body 107 can be determined and the protrusion H of the planer blade member 123 can be adjusted.

[0022] At this time, according to this embodiment, the amount of cam lift y_1 per unit angle of rotation θ_1 of the cam 135 is kept constant. Therefore, the protrusion H of the planer blade member 123 can be more readily adjusted, and ease of operation is improved.

[0023] Further, in this embodiment, as shown in FIG. 6, a scale 145 for indicating the amount of protrusion H (for example, 0 mm minimum to 4 mm maximum) of the planer blade member 123 is provided, for example, in the range of about 140° around the operating knob 133, on the upper surface of the body 107 on which the operating knob is mounted. In this embodiment, the scale 145 is calibrated equidistantly, for example, in increments of 0.1 mm. A pointer 147 for reading off the scale 145 is provided on a circular flange 133b of the operating knob 133. According to this embodiment, the user can adjust the amount of protrusion H of the planer blade member 123 in tenths of 1 mm. Further, the user can check the amount of protrusion H of the planer blade member 123 by reading off the scale 145 indicated by the pointer 147. FIG. 6 shows the relationship between the angle of rotation of the heart-shaped cam 135 (shown on the upper side) and the amount of protrusion H of the planer blade member 123 (shown on the lower side).

[0024] In this embodiment, when the amount of protrusion H of the planer blade member 123 (and the cutting blade 123b) is 0.0 mm (minimum), the engagement recess 136 engages the cam 135 in the position rotated, for example, 10° from a line P connecting the maximum diameter portion and the minimum diameter portion of the cam 135. This state is shown in FIG. 6 on the right end. The amount of protrusion H increases in increments of 1 mm each time the cam 135 (the operating knob 133) is turned 35° clockwise (as viewed in the drawing) from

the engaged position. This state is shown in FIG. 6 in sequence from right to left. Specifically, according to this embodiment, the amount of cam lift y_1 per unit angle of rotation θ_1 is set constant, so that the scale 145 can be calibrated equidistantly. In the known structure in which the front base is moved by using an eccentric cam, the displacement of the front base for every unit angle of rotation of the operating knob varies and as a result, the scale indicating the amount of protrusion of the planer blade member must be calibrated at irregular intervals. Thus, the amount of protrusion cannot be easily checked. On the other hand, according to the representative embodiment of this invention, such a problem is eliminated and the amount of protrusion H of the planer blade member 123 can be easily adjusted.

[0025] Further, in this embodiment, the portable planer 101 includes a position retaining mechanical part 151 that retains the operating knob 133 in a turned position after turning operation. As shown in FIG. 7, the position retaining mechanical part 151 includes a steel ball 153, a plurality of spherical recesses 155 that engage the steel ball 153, and a biasing spring 157 that biases the steel ball 153 in a direction of engagement with the recesses 155. The steel ball 153, the spherical recesses 155 and the biasing spring 157 are features that correspond to the "protrusion", the "recess" and the "biasing member", respectively, according to this invention. The spherical recesses 155 are formed in the underside region of the circular flange 133b of the operating knob 133 which is opposed to the outside upper surface of the body 107. The spherical recesses 155 are arranged on a circular arc around the axis of rotation of the operating knob 133, at intervals corresponding to the intervals of the markings of the scale 145, or at intervals corresponding to 0.1 mm protrusion of the planer blade member 123. The steel ball 153 is received in a cylindrical steel-ball receiver 107c formed on the body 107 and having an open top. The steel ball 153 is elastically urged upward by the biasing spring 157 disposed within the steel-ball receiver 107c, and is pressed against the associated spherical recess 155.

[0026] In the position retaining mechanical part 151 thus constructed, when the operating knob 133 is turned in order to adjust the amount of protrusion H of the planer blade member 123, the spherical recesses 155 and the steel ball 153 move with respect to each other in the circumferential direction around the axis of rotation of the operating knob 133. Specifically, the steel ball 153 moves with respect to the spherical recesses 155 while climbing over the partitions between the spherical recesses 155 against the biasing force of the biasing spring 157. When the turning operation of the operating knob 133 is completed, the steel ball 153 is fitted in one of the spherical recesses 155 located in a position corresponding to the turned position, and retains the operating knob 133 in the turned position.

[0027] According to this embodiment, with the construction in which the amount of cam lift y_1 per unit angle

of rotation θ_1 of the cam 135 is kept constant, the spherical recesses 155 of the position retaining mechanical part 151 can be equidistantly arranged like the scale 145. For example, in the known structure in which the height adjustment of the front base is performed by utilizing an eccentric cam, the recesses are arranged at irregular intervals. Therefore, according to the known art, it is difficult to secure a sufficient strength for a partition between narrowly-spaced adjacent recesses and the durability decreases. To the contrary, according to this embodiment, the spherical recesses 155 can be equidistantly arranged, so that the partitions between the adjacent spherical recesses 155 can be formed in uniform thickness and can obtain increased durability.

[0028] While the cam 135 is defined by a plate cam according to the embodiment, it may be defined by a grooved cam.

It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges. Description of Numerals

101	portable planer	
103	front base	
103a	inclined surface (height changing section)	
105	rear base	
107	body (planer body)	
107a	inclined surface (height changing section)	
107b	spring receiving portion	
107c	steel-ball receiver	
109	handle	
109a	trigger	
111	motor housing	
113	side housing	
115	cover	
121	driving motor	
123	planer blade member	
123a	rotary drum	
123b	cutting blade	
131	cutting depth adjusting mechanism	
133	operating knob (operating member)	
133a	knob shaft	
133b	circular flange	
135	cam (cam member)	
137	engagement recess (height changing section)	
141	plate spring	
143	screw	
145	scale	
147	pointer	

151	position retaining mechanical part
153	steel ball (protrusion)
155	spherical recess (recess)
157	biasing spring (biasing member)

Claims

1. A portable planer comprising:

a planer body,
a planer blade member that is disposed in the planer body and rotates around a longitudinal axis of the planer blade member, wherein a planer blade is attached to the planer blade member, a front base connected to the planer body for vertical movement with respect to the planer body, the front base being held in contact with a working surface of a workpiece and slid forward to plane the workpiece by the planer blade which protrudes from the underside of the front base and
a cutting depth adjusting mechanism that is operated by a user to change the vertical position of the front base with respect to the planer body to adjust the amount of protrusion of the planer blade from the underside of the front base, the cutting depth adjusting mechanism including an operating member that is manually turned, a cam member that rotates together with the operating member, and a height changing section that engages the cam member and changes the height of the front base with respect to the planer body, based on an output of the amount of cam lift

characterized in that the cam member has a cam curve that keeps constant the amount of cam lift per unit angle of rotation outputted by the cam member.

2. The portable planer as defined in claim 1, further comprising a position retaining mechanical part that retains the operating member in a turned position after turning operation, wherein the position retaining mechanical part includes a plurality of recesses arranged on a circular arc around an axis of rotation of the operating member, a protrusion that is removably engaged in the recesses, and a biasing member that elastically biases the protrusion to engage with the recesses, and the protrusion is engaged in any one of the recesses according to the turning operation of the operating member, whereby the operating member is retained in the turned position.

3. The portable planer as defined in claim 2, wherein the cam member has a cam curve that keeps constant the amount of cam lift per unit angle of rotation and the spherical recesses is equidistantly arranged.

4. The portable planer as defined in any one of claims 1 to 3, wherein the cam has a generally heart-shaped contour such that the uniform rotation of the cam is converted into uniform linear motion of the front base.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

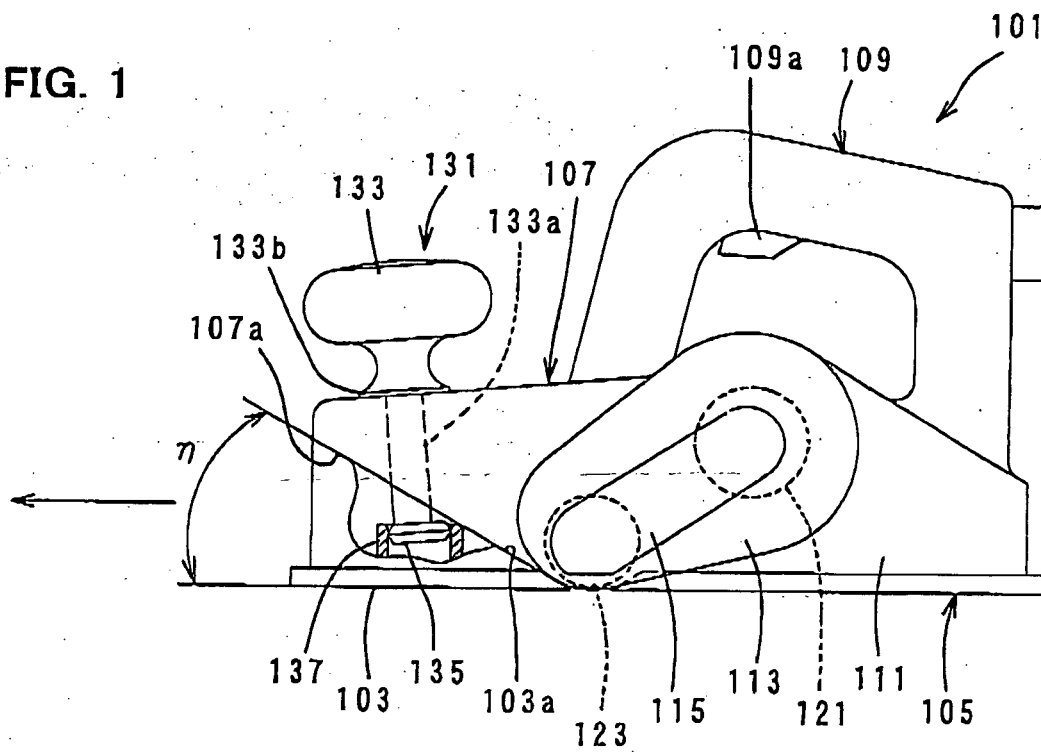


FIG. 2

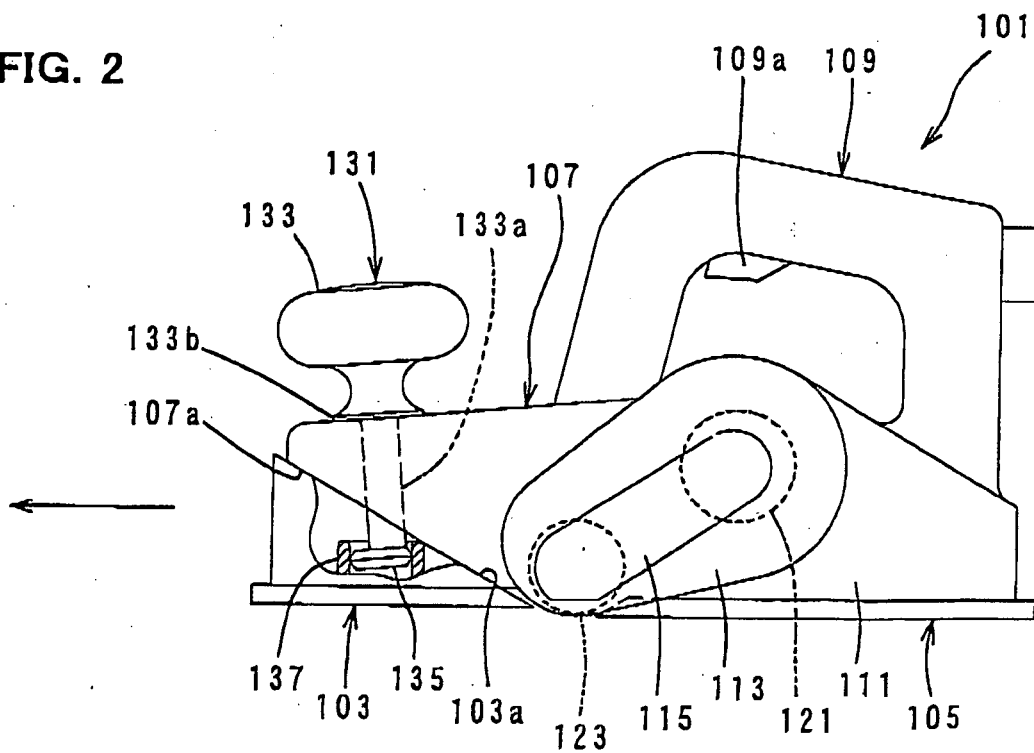


FIG. 3

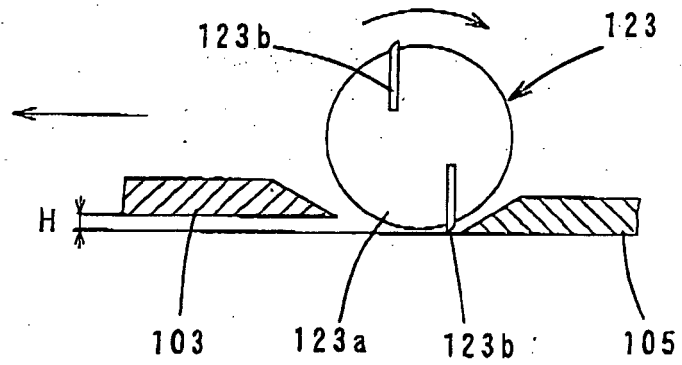
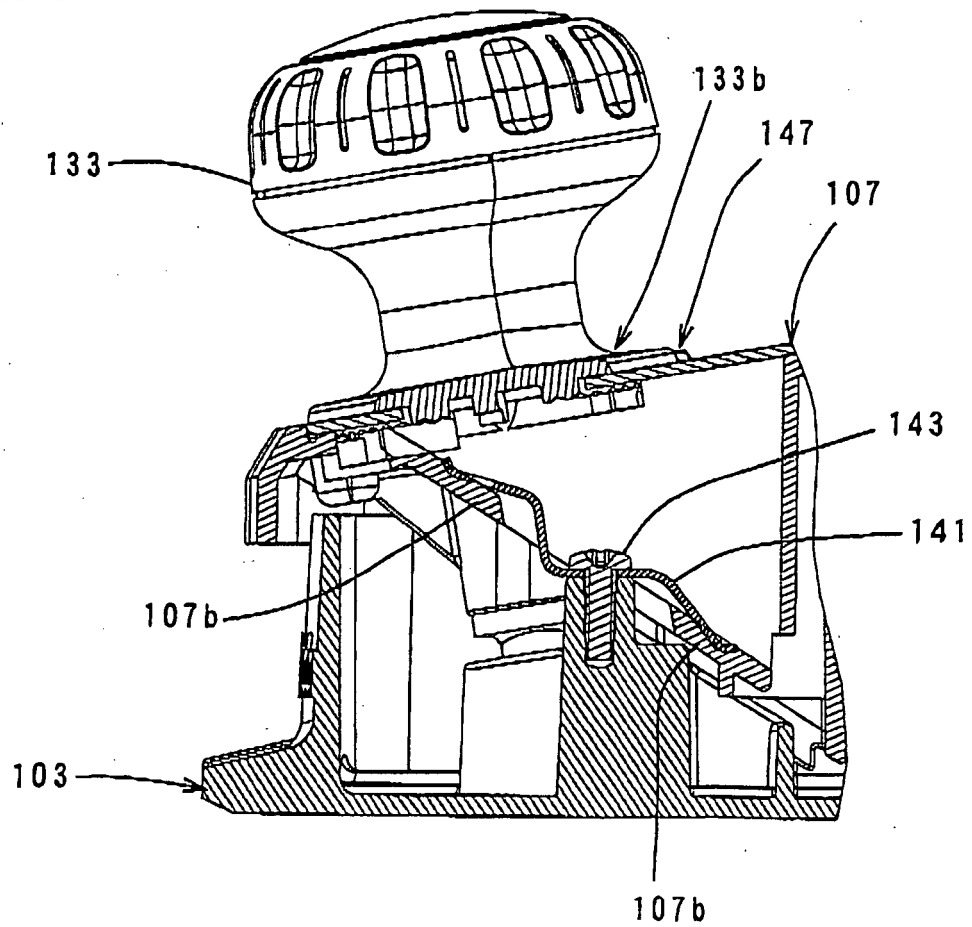


FIG. 4



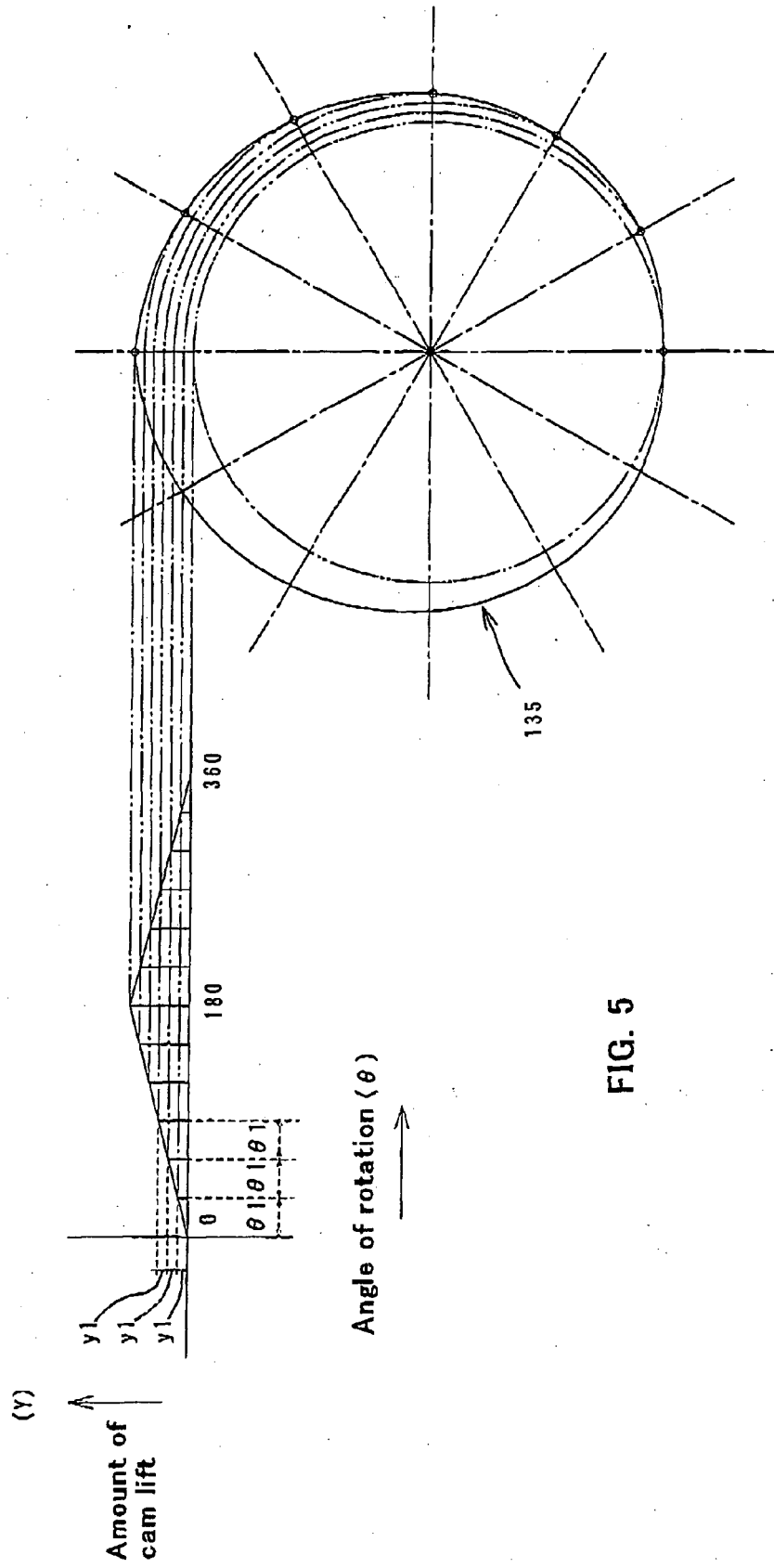


FIG. 5

FIG. 6

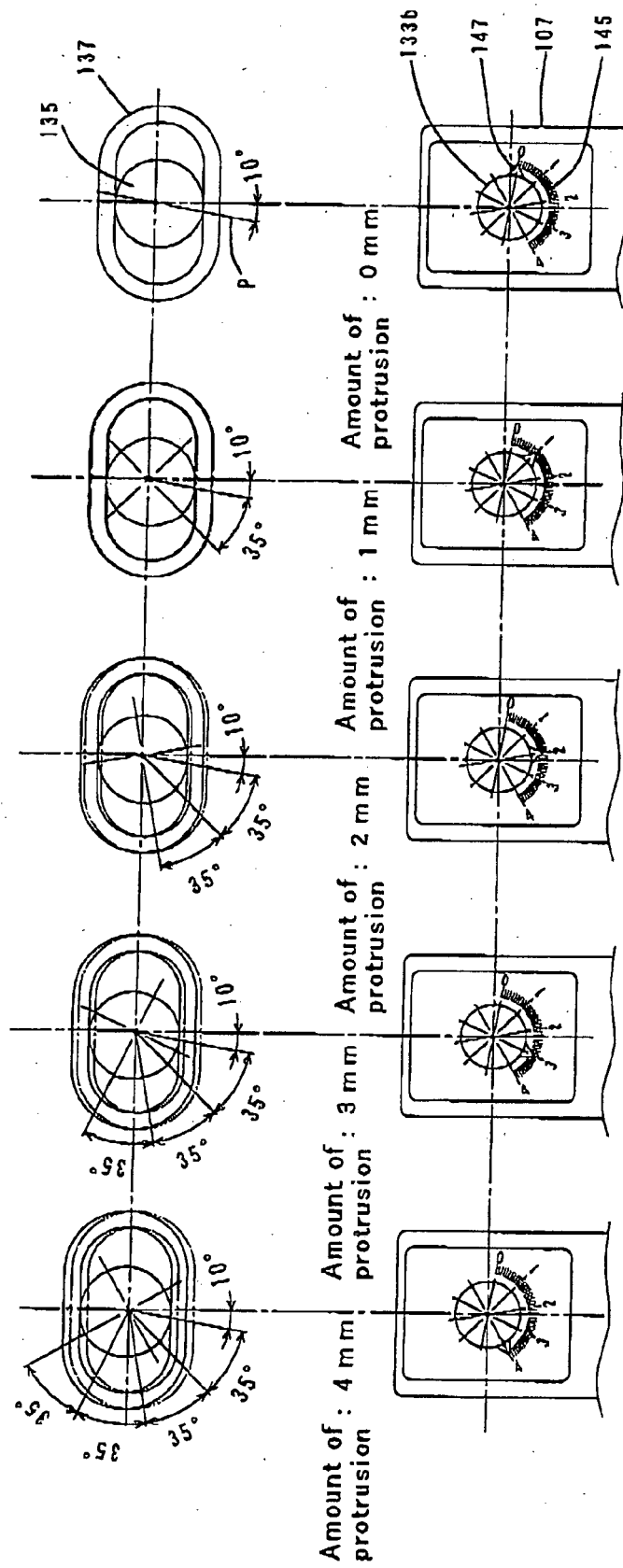
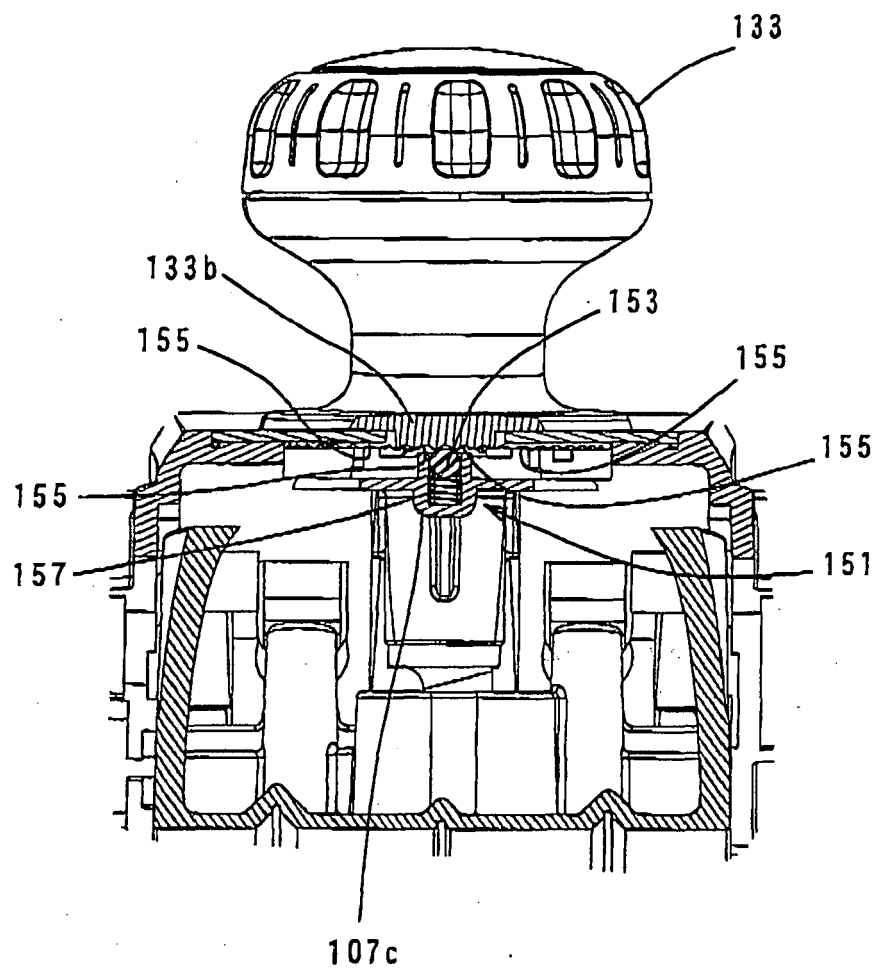


FIG. 7





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 7591

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 34 41 943 A1 (LICENTIA GMBH [DE]) 28 May 1986 (1986-05-28) * page 5, paragraph 2 * * page 7, last paragraph; figures 1-3,5 * -----	1-3	INV. B27C1/10
A	SU 785 036 A1 (ARTAMONOV VALERIJ N [SU]) 7 December 1980 (1980-12-07) * figure * -----	1	
A	DE 86 19 361 U1 (MAFELL MASCHINENFABRIK RUDOLF MEY GMBH & CO KG, 7238 OBERNDORF, DE) 25 September 1986 (1986-09-25) -----		
A	GB 2 323 809 A (BOSCH GMBH ROBERT [DE]) 7 October 1998 (1998-10-07) -----		
A	DE 35 42 095 A1 (FESTO KG [DE]) 4 June 1987 (1987-06-04) -----		
A	US 5 427 483 A (WUENSCH STEFFEN [DE] ET AL) 27 June 1995 (1995-06-27) -----		TECHNICAL FIELDS SEARCHED (IPC)
A	US 3 407 857 A (GORDON BENTLEY JOHN) 29 October 1968 (1968-10-29) -----		B27C
A	US 2 774 399 A (EMMONS ARTHUR N) 18 December 1956 (1956-12-18) -----		
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 December 2007	Examiner Huggins, Jonathan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

2

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 01 7591

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-12-2007

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 3441943	A1	28-05-1986	NONE		
SU 785036	A1	07-12-1980	NONE		
DE 8619361	U1	25-09-1986	NONE		
GB 2323809	A	07-10-1998	CN	1196284 A	21-10-1998
			DE	19713845 A1	08-10-1998
			IT	MI980512 A1	05-10-1998
			JP	10291118 A	04-11-1998
DE 3542095	A1	04-06-1987	NONE		
US 5427483	A	27-06-1995	DE	4204775 A1	02-09-1993
			WO	9315885 A1	19-08-1993
			EP	0581920 A1	09-02-1994
			JP	3320724 B2	03-09-2002
			JP	6506886 T	04-08-1994
US 3407857	A	29-10-1968	DE	1628946 A1	11-11-1971
US 2774399	A	18-12-1956	NONE		

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 3821492 A [0002]
- JP 62273804 A [0002]