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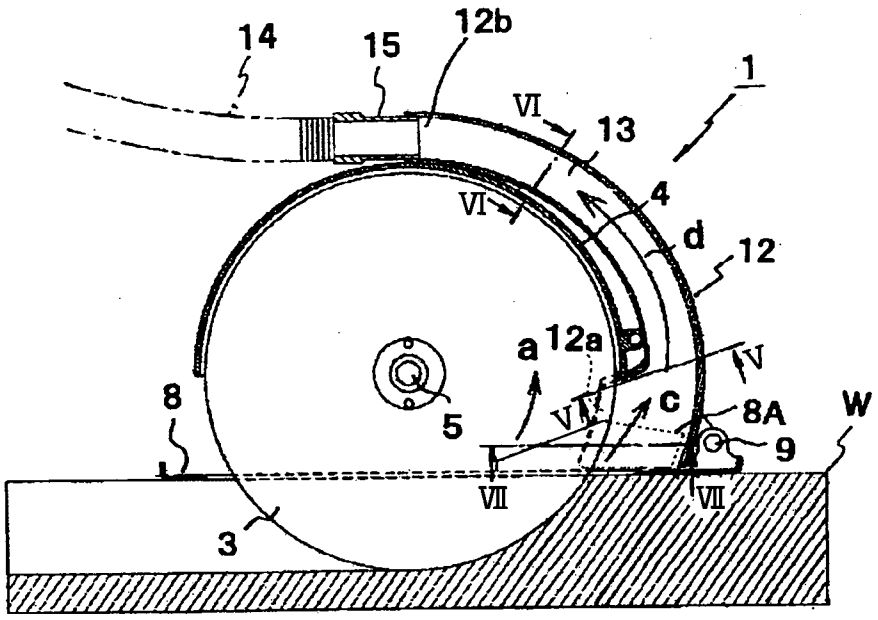
(54) Title: CUTTER



(57) Abstract: A cutter having a dust-collecting cover capable of avoid-ing damage to a workpiece even if the latter hits a workpiece, and capable of enhancing collecting efficiency of cutting chips. The cutter 1 includes a protection cover 4 covering a part of an outer circumference of the rotary blade 3, and a dust-collecting cover 12 defining cutting chip passage having a suction port 12a opening to a part of the outer circumfer-ence of the rotary blade 3. The dust-collecting cover 12 ex-tends along the outer circumference of the protection cover 4. At least a part of the dust-collecting cover 12 is made from an elastic material.

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DESCRIPTION

CUTTER

TECHNICAL FIELD

The present invention relates to a cutter having a dust-collecting cover for collecting cutting chips generated when the cutter cuts concrete, tiles and the like.

BACKGROUND ART

Hitherto, a disc grinder is used as a cutter for cutting concrete, and tiles. The disc grinder has a drive source such as an electric motor and an engine, and a rotary blade is coupled to a rotary shaft. A safety cover surrounding the outer circumference of the rotary blade is attached to prevent cutting chips from scattering. When cutting operation is performed with such a cutter, cutting chips scatters around and inevitably lowers visibility at the working site, particularly in a room, even if the cutting operation is performed for a short time. Therefore, the worker cannot perform the cutting unless he wears a dust-free mask and safety glasses. The work environment may be hazardous for the worker.

To improve the work environment, a cutter has been proposed in which a dust-collecting hose is attached to a part of the safety cover and is connected to an electric dust collector that is provided outside the cutter. The electric dust collector draws and collects the cutting chips generated during the cutting operation. Such conventional arrangement is described in laid open Japanese Patent Application Publication No. 2002-046018 and is shown in Fig.10.

As shown in Fig. 10, a dust-collecting cover 112 is provided in a cutter 101. A rotary blade 103 is rotatably provided in a main body of the dust-collecting cover 112. The rotary blade 103 cuts a workpiece W, while rotating in a clockwise direction indicated by an arrow.

The dust-collecting cover 112 has a suction duct 116 connected to an electric dust collector (not shown) through a dust-collecting hose 114. A dust bag (not shown) can be removably attached to the suction duct 116 in order to accumulate the cutting chips discharged through the suction duct 116.

For cutting a workpiece W with the cutter 101, the dust-collecting cover 112 and the cutter 101 are moved in a cutting direction (leftward in FIG. 10). The cutting chips generated when the cutter 101 is cutting the workpiece W is ejected toward the suction duct 116 in the dust-collecting cover 112. The cutting chips thus ejected are drawn by the electric dust collector through the dust-collecting hose 114 and is efficiently collected in the electric dust collector. Thus, cutting chips scattering around ambient region can be prevented.

The dust-collecting cover 112 attached to the conventional cutter 101 shown in FIG. 10 is made from high hardness material with high rigidity such as steel. Therefore, the dust-collecting cover 112 may damage to the workpiece W if the cover 112 hits the workpiece W during hand-carrying the cutter 101. There is another problem with such a conventional dust-collecting mechanism such that the cutting chips may partially leak out from the dust-collecting cover 112.

DISCLOSURE OF INVENTION

It is therefore an object of the invention to provide a cutter capable of avoiding any damage to a workpiece even if the dust-collecting cover hits the workpiece, while enhancing cutting chips collecting efficiency.

This and other object of the present invention will be attained by a cutter for cutting a workpiece including a main body, a rotary blade, a protection cover and a dust-collecting cover. The main body accommodates therein a drive source. The rotary blade is rotationally driven by the drive source. The

protection cover covers a part of an outer peripheral edge of the rotary blade. The dust-collecting cover is attached to and extending along an outer peripheral end portion of the protection cover. The dust-collecting cover defines therein a cutting chip passage extending along the protection cover and a suction port at one end of the cutting chip passage and open to the rotary blade. The dust-collecting cover has a portion made from an elastic material. Preferably, the portion of the dust-collecting cover includes a first region defining the suction port.

With this arrangement, since the dust-collecting cover has a portion made from the elastic material, at least the portion of the dust-collecting cover is deformable to avoid damage to the workpiece even if the portion of the dust-collecting cover hits the workpiece at the time of conveying the cutter. Further, the cutter can be made compact since the dust-collecting cover is formed, extending along the outer circumference of the protection cover. Moreover, the area at which the dust-collecting cover contacts the workpiece can be reduced. This helps to suppress damages to the workpiece.

Preferably, the first region has a radially inner end portion positioned radially inwardly from the outer circumferential edge of the rotary blade, and the radially inner end portion is formed with a notch to allow the outer circumferential edge of the rotary blade to pass therethrough.

With this arrangement, the first region prevents the cutting chips generated as the rotary blade cuts the workpiece, from moving toward the center of the rotary blade as the rotary blade rotates. Accordingly, cutting chips can be efficiently drawn into the suction port of the dust-collecting cover. Consequently, cutting chip can be collected at a high efficiency. Moreover, mechanical interference between the

circumferential edge of the rotary blade and the first region can be avoided because of the formation of the notch. In addition, since the first region is made from the elastic material, the portion defining the suction port can be easily deformed when the rotary blade is replaced by a new rotary blade. Hence, the cover does not hinder the replacement of the rotary blade.

The cutter further includes a base to be mounted on the workpiece to be cut, a coupling member, and a guide segment. The coupling segment is made from a rigid material and has one end pivotally supported to the base and another end connected to the protection cover. The guide segment is made from a rigid material and upstands from the base at a position adjacent to the outer circumferential edge of the rotary blade for guiding travel of cutting chips. The first region is held between the coupling segment and the guide segment.

With this arrangement, deformation of the first region is avoidable because the first region is held between the coupling segment and the guide segment both being made from rigid material. Therefore, the first region is reliably prevented from interfering with the rotary blade even if the first region is positioned near the rotary blade in order to increase the collecting efficiency of the cutting chips. This ensures stable cutting operation. Preferably, the guide segment is adapted to hold the inner surface of the first region, and the coupling segment is adapted to hold the outer surface of the first region.

Preferably, the dust-collecting cover has a tubular shape defining therein the cutting chip passage separate from the protection cover.

With this arrangement, the cutting chip passage can have a smooth surface having no discontinuous steps. The cutting chips drawn into the dust cover can therefore be smoothly

flowed through the cutting chip passage without resistance until the cutting chips are collected. This accomplishes high cutting chips collecting efficiency. Further, the cutting chip passage is shut off from an outside even if the dust-collecting cover is forcibly deformed. Therefore, accidental leakage of the cutting chips does not occur, while the workpiece is being cut.

Preferably, the protection cover has one end portion provided with a projection protruding toward the suction port, and the cutter further including the above-described base and the above-described coupling segment. The above-described first region is held between the coupling segment and the projection.

The elastic material is made from a material selected from the group consisting of a rubber, a urethane resin, and a thermoplastic resin. With this arrangement, the dust collecting cover can be provided at low cost.

Preferably, the portion of the dust-collecting cover and made from the elastic material further includes an outer peripheral end region of the dust-collecting cover. With this arrangement, any damage to the workpiece can be avoided even if the outer peripheral end of the dust-collection cover hits against the workpiece.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings;

Fig. 1 is a schematic side view of a cutter according to a first embodiment of the present invention, and showing a state where deep cutting operation is performed;

Fig. 2 is a schematic side view of the cutter according to the first embodiment, and showing a state where shallow cutting operation is performed;

Fig. 3 is a side view particularly showing a rotary blade

and a dust collection cover in the cutter according to the first embodiment and showing a state where deep cutting operation is performed;

Fig. 4 is a cross-sectional view taken along the line IV-IV in Fig. 2;

Fig. 5 is a cross-sectional view taken along the line V-V in Fig. 3;

Fig. 6 is a cross-sectional view taken along the line VI-VI in Fig. 3;

Fig. 7 is a cross-sectional view taken along the line VII-VII in Fig. 3;

Fig. 8 is a schematic side view of a cutter according to a second embodiment of the present invention and showing a cutting state of the cutter.

Fig. 9 is a cross-sectional view taken along the line IX-IX in Fig. 8; and

Fig. 10 is a schematic side view showing a cutting state of a conventional cutter.

DESCRIPTION OF REFERENCE NUMERALS

1 cutter
2 main body
3 rotary blade
4 protection cover
5 drive shaft
8 base
8A, 8B guide segments
9 pivot shaft
10 coupling rod
12 dust-collecting cover
12a suction port
12b outlet port
12c notch

13 cutting chip passage

54a projection

BEST MODE FOR CARRYING OUT THE INVENTION

A cutter according to a first embodiment of the present invention will be described with reference to Figs. 1 through 7.

As shown in Figs. 1 to 3, a cutter 1 has a main body 2 and a disc-shaped rotary blade 3 rotatably supported at a front end portion of the main body 2. The upper half of the circumferential edge and one-side part (i.e., back part in Figs. 1 and 2) of the rotary blade 3 are covered with an arcuate protection cover 4. The protection cover 4 is made from high hardness material such as aluminum and is an integrally molded article. The main body 2 accommodates therein an electric motor (not shown) serving as a drive source. A drive shaft 5 is rotationally driven by the motor, and the rotary blade 3 is secured to an end portion of the drive shaft 5. The main body 2 has a rear portion provided with a handle unit 2a where a switch 6 is provided. The switch 6 is adapted to turn on and off the electric motor. A power cord 7 extends from the handle unit 2a for supplying electric power to the electric motor.

A base 8 made from a metal is disposed below the main body 2. The base 8 has a lower surface in contact with a workpiece W. The base 8 has a front end where a pivot shaft 9 is rotatably supported. Right and left coupling rods 10 extend between the base 8 and the protection cover 4. That is, each coupling rod 10 is made from a metal and has one end connected to the pivot shaft 9 and another end connected to the protection cover 4. Thus, the main body 2 and the protection cover 4 are pivotally movable about the pivot shaft 9 with respect to the base 8 for adjusting a cutting depth of the rotary blade 3

and for stabilizing cutting operation. The base 8 has a channel shaped guide segments 8A and 8B upstanding from the front and rear edges of the base 8, respectively. Each guide segment has a U-shaped cross section for covering a part of lateral sides and outer peripheral edge of the rotary blade 3. The guide segment 8B has one lateral side formed with an arcuate guide slot 8a.

An adjuster 11 is provided between the guide segment 8B and the main body 2 and extends through the arcuate guide slot 8a. That is, the adjuster 11 has a knob portion adapted to be in pressure contact with the surface of the guide segment 8B and a thread portion threadingly engaged with the main body 2. The main body 2 is pivotally movable up and down about the pivot shaft 9 together with the rotary blade 3, as long as the base 8 remains mounted on the workpiece W as shown in Figs. 1 to 3. Further, a desired pivot posture of the main body 2 can be fixed by tightening the adjuster 11.

A dust-collecting cover 12 is attached to the outer peripheral portion of the protection cover 4. The cover 12 is formed into an arcuate shape as viewed from the side and extends along the outer circumference of the protection cover 4. Further, the dust-collecting cover 12 is an integral tubular member having a rectangular cross-section (see Fig. 6). A cutting chip passage 13 which is independent of the protection cover 4 is formed in the protection cover 12. The dust-collecting cover 12 is made from a soft elastic material such as rubber, soft urethane resin and thermoplastic resin. Other examples of the soft elastic material are thermoplastic resins (TPEs) such as styrene-based elastomer (SBC), olefin-based elastomer (TPO), urethane-based elastomer (TPU), polyvinyl chloride-based elastomer (TPVC), polyester-based elastomer (TPEE), polyamide-based elastomer (TPAE), and fluorine-based

elastomer.

One end (lower end) of the dust-collecting cover 12 has a suction port 12a that opens to a part of the outer circumference of the rotary blade 3. The other end (upper end) of the cover 12 has an outlet port 12b. A hose cap 15 attached with one end of a hose 14 is inserted in and connected to the outlet port 12b. The hose 14 has another end connected to a dust collector (not shown).

Since the dust-collecting cover 12 is made from the soft elastic material such as rubber, the hose 14 can be reliably connected to the dust-collecting cover 12 by simply inserting the hose cap 15 attached to the end thereof, into the outlet port 12b. Even if the main body 2 is moved, the hose cap 15 remains firmly attached to the outlet port 12b of the dust-collecting cover 12. Therefore, the hose 14 is prevented from being slipped off from the dust-collecting cover 12 and the cutting chips are reliably prevented from leaking through the gap between the outlet port 12b of the cover 12 and the hose cap 15.

The suction port 12a is defined at the end portion of the dust-collecting cover 12. Further, the end portion has a radially inner side which is positioned radially inwardly from the outer circumference of the rotary blade 3 as shown in Figs. 3 and 5 by a distance "x". The end portion of the cover 12 has a notch 12c at a middle portion of the cover in a widthwise direction of the cover 12, so that the rotary blade 3 can pass through the notch 12c during rotation of the blade 3. The guide segment 8A upstanding from the base 8 partly lies in an interior of the suction port 12a of the dust-collecting cover 12, as shown in Figs. 3 and 7. Further, as shown in Fig. 4, the end portion of the dust-collecting cover 12 defining the suction port 12a has an outer surface held by the coupling

rods 10 and an inner surface held by the guide segment 8A. That is, the end portion is sandwiched between the guide segment 8A and the coupling rods 10.

Cutting operation of the cutter 1 will be described. Note that, the cutting operation includes grooving. To cut the workpiece W with the cutter 1, the user first mounts the base 8 on the workpiece W, thus setting the cutter 1 on the workpiece W as shown in Figs. 1 through 3. The user then holds the handle unit 2a and turns the switch 6 on. The electric motor (not shown) accommodated in the main body 2 is thus energized. The rotation of the motor is transmitted to the drive shaft 5. As a result, the rotary blade 3 fixedly mounted on the drive shaft 5 is driven to rotate in the direction of arrow a (counterclockwise direction). Then, the user moves the main body 2 in the cutting direction (the direction of arrow b, in Figs. 1 and 2). The rotary blade 3 therefore gradually cuts the workpiece W. (In this instance, a groove is cut in the workpiece W.)

In the state depicted in Fig. 1, large cutting depth h1, i.e., the depth of a groove to be cut in the workpiece W is provided. This depth can be adjusted to such a small value h2 (< h1) as shown in Fig. 2 by loosening the adjuster 11 and pivotally moving the main body 2 upwards about the pivot shaft 9 and by tightening the adjuster 11. With such operation, the pivot posture of the main body 2 is changed for providing shallow cutting depth h2.

As the rotary blade 3 cuts the workpiece W, cutting chips are generated. The chips are drawn into the cutting chip passage 13 provided in the dust-collecting cover 12, through the suction port 12a, by virtue of the rotation of the rotary blade 3 and the suction force generated by the dust collector (not shown). In this case, the cutting chips are guided by the

guide segment 8A in the direction of arrow C in Fig. 3. Therefore, the cutting chips drawn into the cutting chip passage 13 in the dust-collecting cover 12 will flow toward the outlet port 12b in the direction of arrow d in FIG. 3. The cutting chips are then drawn out of the outlet port 12b into the dust collector (not shown) through the hose 14. Thus, the cutting chips can be collected in the dust collector without being scattered. Accordingly, degradation of work environment can be avoided.

As described above, in the present embodiment, the dust-collecting cover 12 as a whole is made from a soft elastic material such as rubber. Hence, the dust-collecting cover 12 undergoes elastic deformation even if the cover 12 hits the workpiece W at the time of conveying the cutter 1. Therefore, any damage to the workpiece W can be avoided. In particular, the cutter 1 can be configured compact in its entirety, since the dust-collecting cover 12 extends along the outer circumference of the protection cover 4. Moreover, an area at which the cover 12 contacts the workpiece W can be reduced. This suppresses damages to the workpiece W.

In the present embodiment, the end portion of the dust-collecting cover 12, which defines the suction port 12a, protrudes radially inwardly from the outer circumference of the rotary blade 3 toward the center thereof. This protruding portion (by the distance x) can prevent the cutting chips from moving toward the center of the dust-collecting cover 12 as the rotary blade 3 rotates for cutting. The dust can thus be efficiently drawn into the suction port 12a of the dust-collecting cover 12. As a result, high efficiency of collecting cutting chips can be obtained. Further, the protruding part of the dust-collecting cover 12 does not cause mechanical interference with the outer circumference of the rotary blade

3, because of the formation of the notch 12c. In addition, the radially inwardly protruding part of the dust-collecting cover 12 is easily deformable since the entire dust-collecting cover 12 is made from elastic material, which facilitates replacement of the rotary blade 3 by a new blade. Hence, the cover 12 does not hinder the replacement of the rotary blade 3.

Moreover, in the present embodiment, deformation of the end portion of the cover 12 defining the suction port 12a can be prevented during cutting operation. This is because the portion of the suction port 12a of the dust-collecting cover 12 is held between the guide segment 8A made from a metal and provided inside the cover 12 and the coupling rods 10 made from a metal and provided outside the cover 12. Therefore, this part of the suction port 12a of the cover 12 can be positioned close to the rotary blade 3 in order to enhance collection efficiency of the cutting chips, yet avoiding mechanical interference with the rotary blade. Consequently, stabilized cutting operation can be performed.

In the present embodiment, the dust-collecting cover 12 made from elastic material has a tubular shape having a rectangular cross-section and defines the cutting chip passage 13, which is independent of the protection cover 4. The cutting chip passage 13 therefore can have a smooth surface with no discontinuous steps. Therefore, the dust drawn into the dust-collecting cover 12 can smoothly flow through the cutting chip passage 13 without any resistance, until the dust is collected. This achieves high dust collecting efficiency. Further, the cutting chip passage 13 never communicate with outside even if the dust-collecting cover 12 is forcibly deformed, and no cutting chips will leak outside from the cutting chip passage 13 while the workpiece W is being cut.

Moreover, in the present embodiment, the dust-collecting

cover 12 can be manufactured at low cost because the cover 12 is made from inexpensive elastic material such as soft rubber or soft urethane resin.

A cutter according to a second embodiment of this invention will be described with reference to Figs. 8 and 9 wherein like parts and components are designated by the same reference as those shown in the first embodiment. The second embodiment is similar to the first embodiment except that the guide segments 8A are dispensed with, and instead, a shape of a protection cover 54 is different from that of the protection cover 4 of the first embodiment.

More specifically, an end portion of the protection cover 54 protrudes toward the suction port 12a of the dust-collecting cover 12 to form a pair of projections 54a that guides cutting chips toward the suction port 12a. Further, as shown in Fig. 9, the projection 54a and the coupling rods 10 hold the portion defining the suction port 12a from both sides. That is, each projection 54a holds the inner surface of the end portion, and the connection rods 10 hold the outer surface thereof.

With this arrangement, since the end portion of the dust-collecting cover 12 defining the suction port 12a can be held between the coupling rod 10 and the projection 54a, mechanical interference between the end portion and the rotary blade 3 can be prevented even if the end portion is positioned close to the rotary blade 3 in order to increase the dust collecting efficiency. Accordingly, the second embodiment provides an advantage the same as that of the first embodiment.

In the above-described embodiments, the dust-collecting cover as a whole is entirely made from elastic material such as rubber. Nonetheless, the same advantage as mentioned above can be achieved if at least the outer circumferential part and

the part providing the suction port of the dust-collecting cover are made from the elastic material.

INDUSTRIAL APPLIABILITY

The cutter according to the present invention is particularly available for cutting a workpiece while clean working environment is required in spite of cutting operation.

CLAIMS

1. A cutter for cutting a workpiece comprising:

a main body accommodating therein a drive source;

a rotary blade rotationally driven by the drive source, the rotary blade having an outer circumferential edge;

a protection cover covering a part of the outer peripheral edge, the protection cover having an outer peripheral end portion; and

a dust-collecting cover attached to and extending along the outer peripheral end portion, the dust-collecting cover defining therein a cutting chip passage extending along the protection cover and a suction port at one end of the cutting chip passage and open to the rotary blade, the dust-collecting cover having a portion made from an elastic material.

2. The cutter as claimed in claim 1, wherein the portion of the dust-collecting cover includes a first region defining the suction port.

3. The cutter as claimed in claim 2, wherein the first region has a radially inner end portion positioned radially inwardly from the outer circumferential edge of the rotary blade, the radially inner end portion being formed with a notch to allow the outer circumferential edge of the rotary blade to pass therethrough.

4. The cutter as claimed in claim 3, further comprising:

a base to be mounted on the workpiece to be cut;

a coupling segment made from a rigid material and having one end pivotally supported to the base and another end connected to the protection cover; and

a guide segment made from a rigid material and upstanding from the base at a position adjacent to the outer circumferential edge of the rotary blade for guiding travel of cutting

chips, wherein the first region is held between the coupling segment and the guide segment.

5. The cutter as claimed in claim 1, wherein the dust-collecting cover has a tubular shape defining therein the cutting chip passage separate from the protection cover.

6. The cutter as claimed in claim 2, wherein the protection cover has one end portion provided with a projection protruding toward the suction port, and the cutter further comprising:

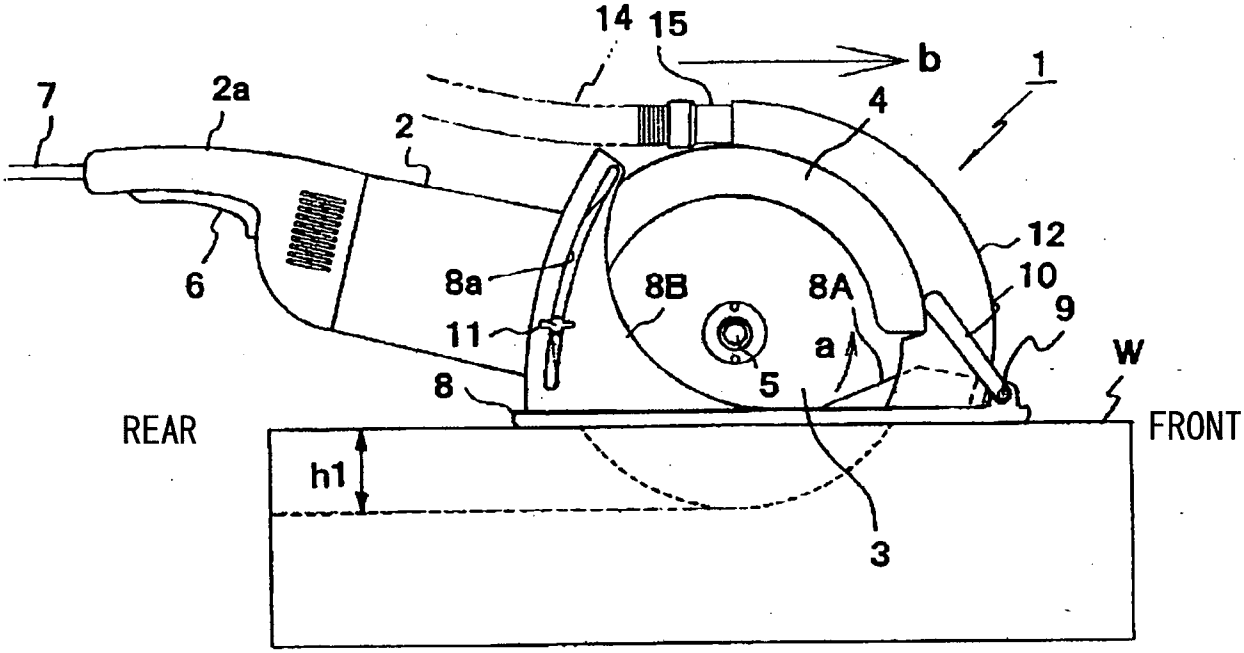
a base to be mounted on the workpiece to be cut; and

a coupling segment made from a rigid material and having one end pivotally supported to the base and another end connected to the protection cover, wherein the first region is held between the coupling segment and the projection.

7. The cutter as claimed in claim 1, wherein the elastic material is made from a material selected from the group consisting of a rubber, a urethane resin, and a thermoplastic resin.

8. The cutter as claimed in claim 2, wherein the portion of the dust-collecting cover further includes an outer peripheral end region of the dust-collecting cover.

FIG.1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REAR
FRONT
h1
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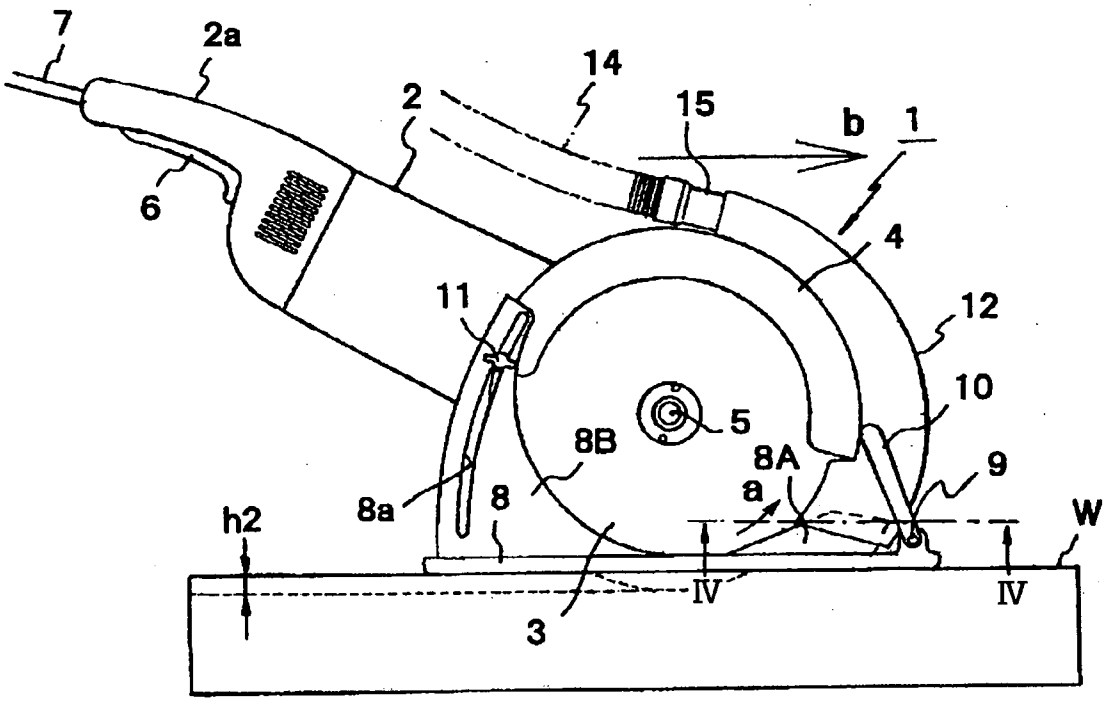
FIG.2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IV
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FIG.3

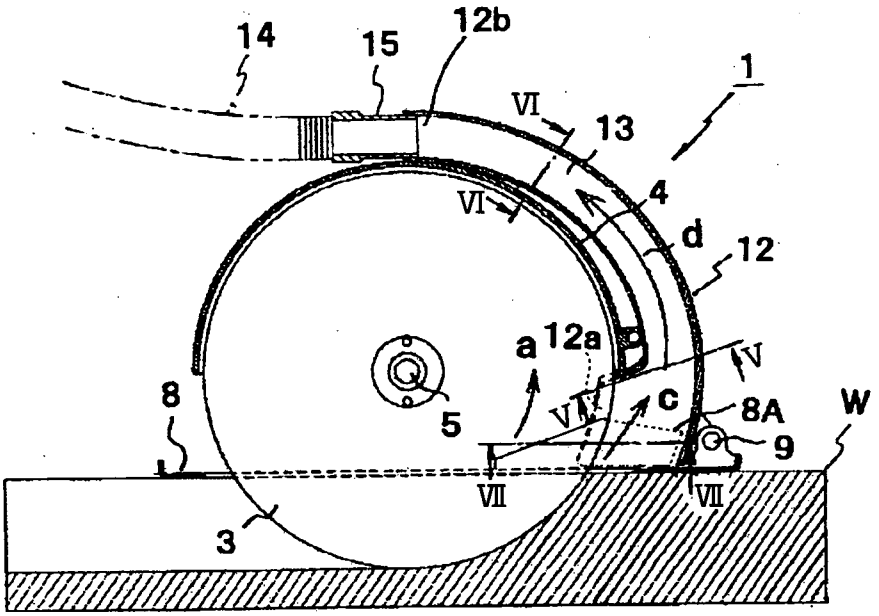
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FIG.4

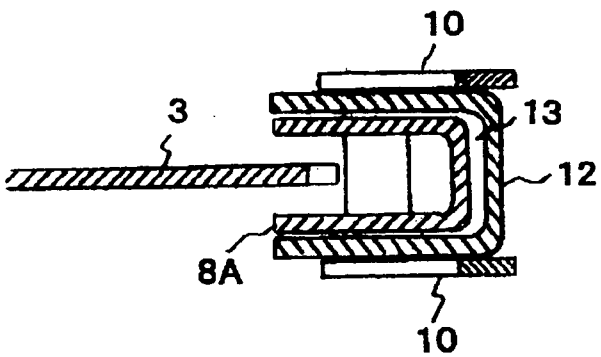
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FIG.5

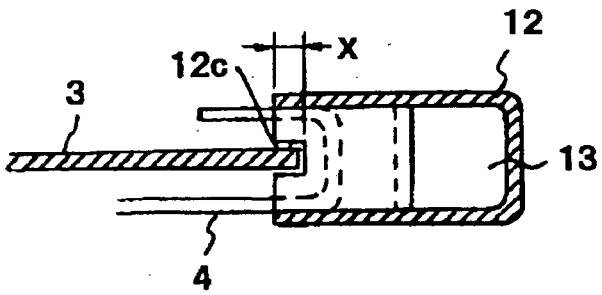


FIG.6

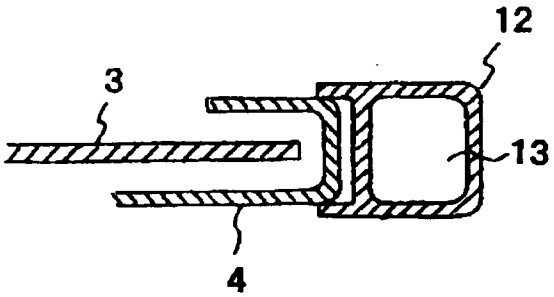


FIG.7

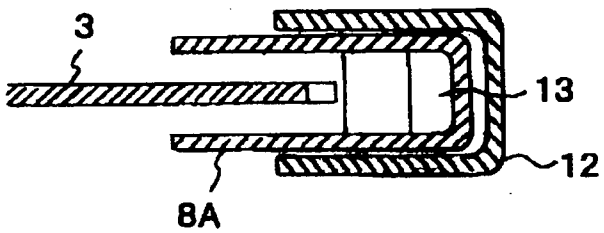
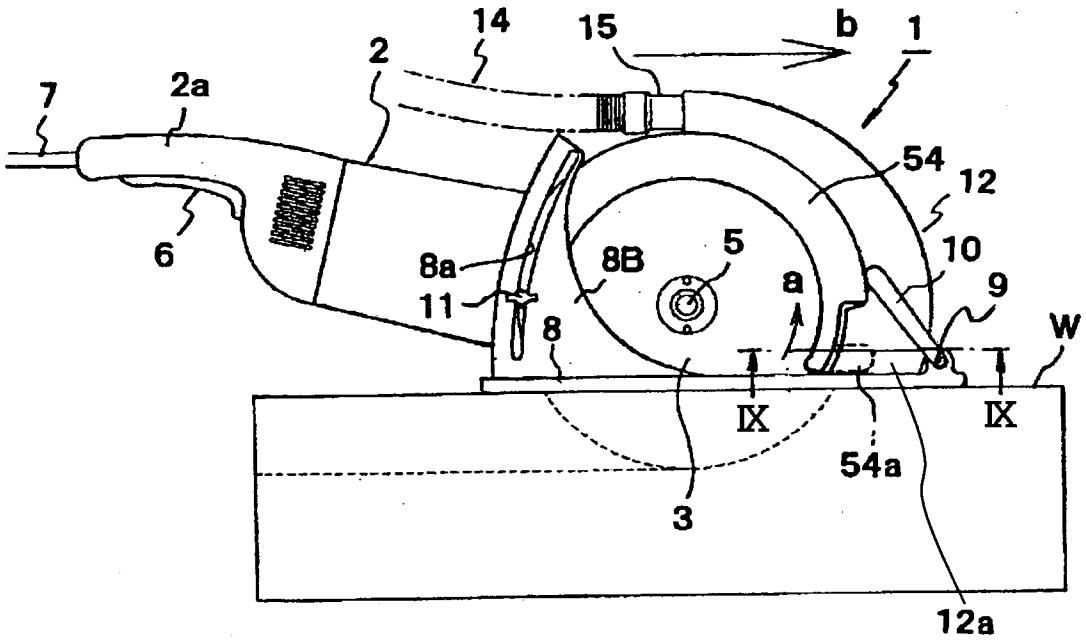


FIG.8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8
W
IX
IX
54a
3
12a

FIG.9

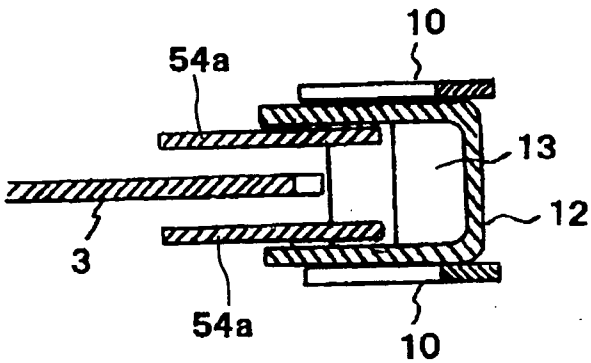
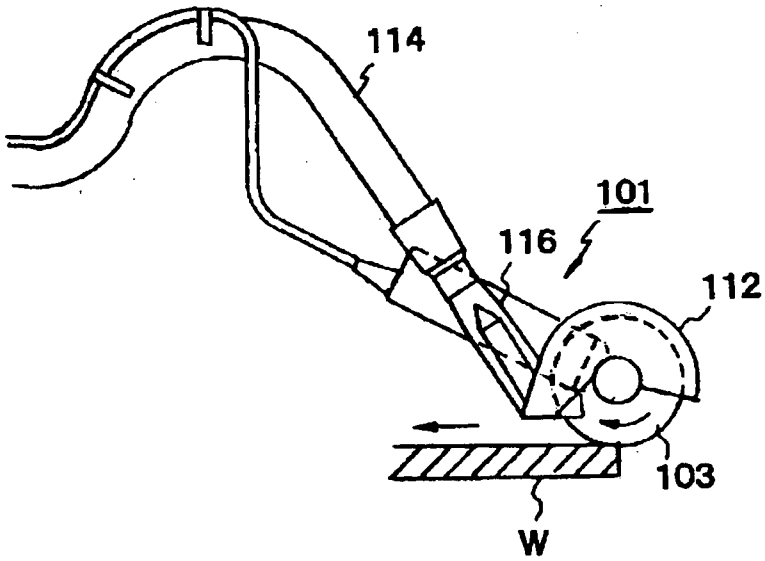

10
54a
13
12
3
54a
10

FIG.10



PRIOR ART

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2007/074770

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23D59/00 B28D7/02

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)
B23D B27B B28D B24B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 327 649 A (SKINNER CHRISTOPHER L [US]) 12 July 1994 (1994-07-12) the whole document	1-3,5,8
Y		7
A		4,6
Y	US 5 537 748 A (TAKAHASHI SHOJI [JP] ET AL) 23 July 1996 (1996-07-23) column 7, line 6 - line 19 column 7, line 33 - line 39 figures 6,7	7

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 March 2008	12/03/2008

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/JP2007/074770

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5327649 A	12-07-1994	NONE	
US 5537748 A	23-07-1996	NONE	