

[54] **CUTTING WHEEL ASSEMBLY**
 [76] Inventor: **Barrie F. Regan**, 1760 Manor Dr., Hillsborough, Calif. 94010

3,053,424	9/1962	Reinhard	206/303 X
3,080,964	3/1963	Robinson	206/303
3,691,707	9/1972	Von Arx	51/206 R

[22] Filed: **Oct. 17, 1974**

FOREIGN PATENTS OR APPLICATIONS

[21] Appl. No.: **515,594**

195,045	12/1970	Germany	125/39
---------	---------	---------------	--------

Related U.S. Application Data

Primary Examiner—Harold D. Whitehead

[63] Continuation-in-part of Ser. No. 376,536, July 5, 1973, abandoned.

[57] ABSTRACT

[52] U.S. Cl. **125/15**; 51/206 R; 206/303
 [51] Int. Cl. **B28d 1/04**
 [58] Field of Search 125/11 R, 11 CD, 15; 51/206 R, 207; 206/303

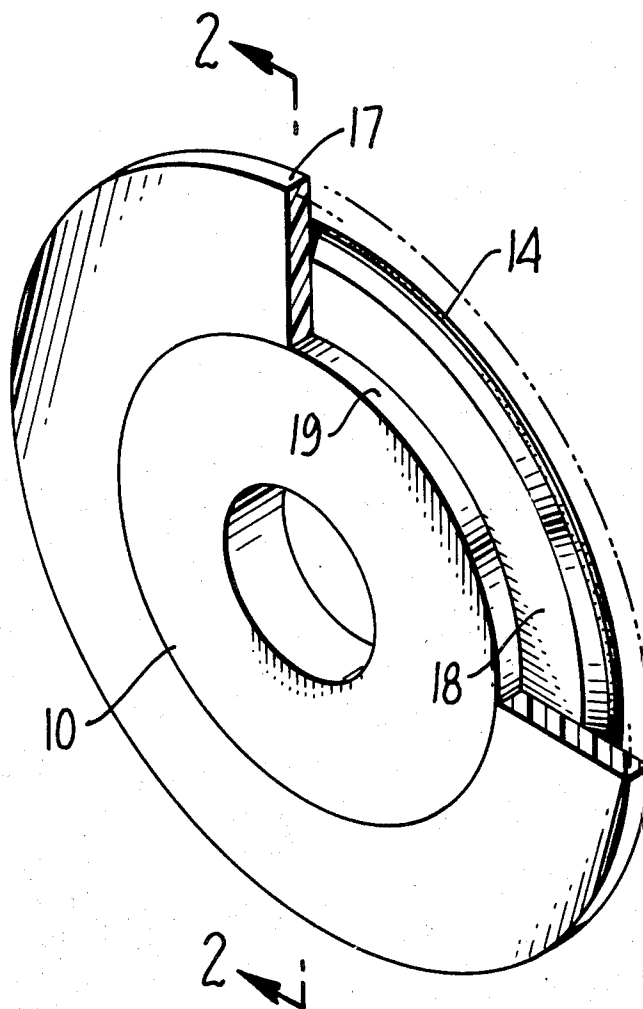
A cutting wheel for dicing semiconductor wafers having a thin cutting disc consisting of abrasive particles in a metal matrix bonded to a flange preformed on a hub and having a diameter larger than that of a flange, the hub having a shoulder extending axially from the flange, a flexible protective washer having a diameter greater than that of the cutting disc is fitted snugly on the hub and in close proximity to the cutting disc.

[56] References Cited

UNITED STATES PATENTS

1,422,200	7/1922	Harris	51/207
2,468,241	4/1949	Scrivener	125/11 CD

2 Claims, 4 Drawing Figures



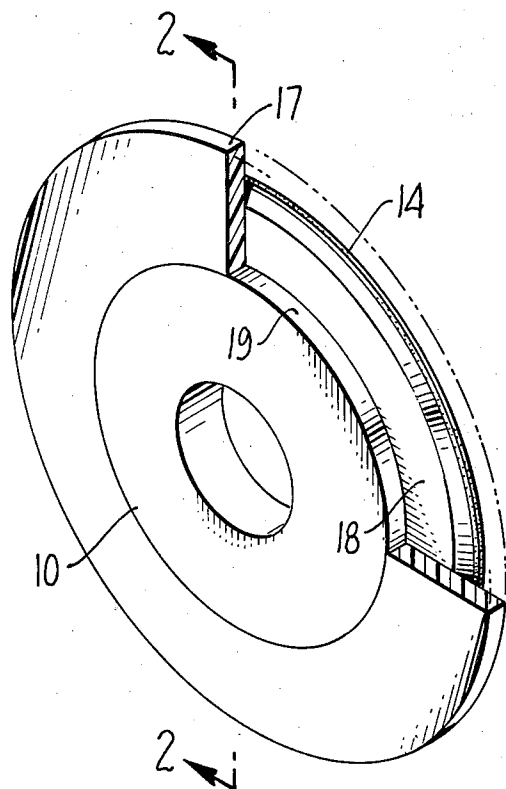


FIG. 1.

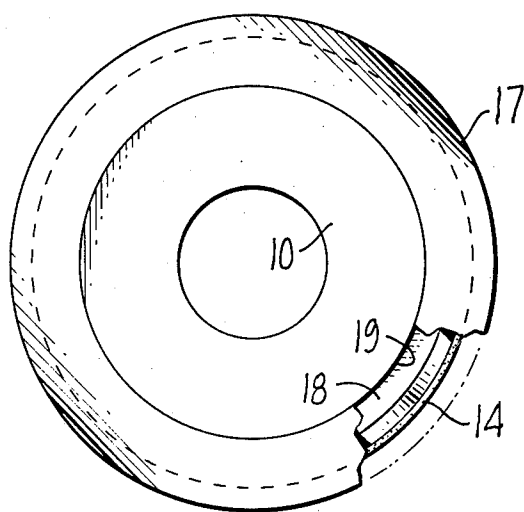


FIG. 3.

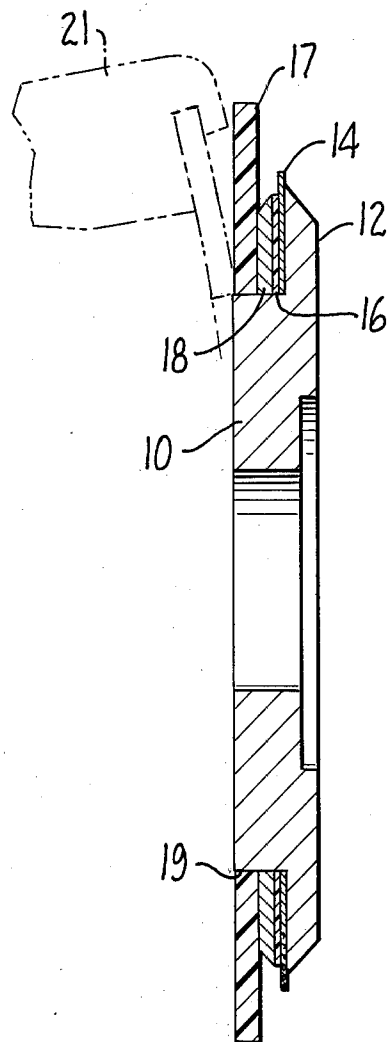


FIG. 2.

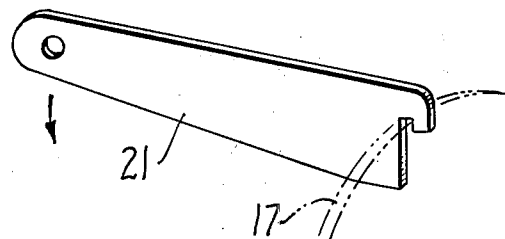


FIG. 4.

CUTTING WHEEL ASSEMBLY

This application is a continuation-in-part of application Ser. No. 376,536 filed July 5, 1973 and now abandoned.

BACKGROUND OF THE INVENTION

Rotary cutting wheels for dicing semiconductor wafers are well-known in the art as indicated, for instance, in U.S. Pat. No. 3,691,707. Such discs may be formed by electrodeposition techniques or electroless plating, see U.S. Pat. No. 3,617,363.

The cutting discs of these wheels are very thin, commonly being only 0.001 to 0.01 inch thick. Being so thin they are easily damaged by bending or breaking while the wheel is being fitted on the drive mechanism, by accidentally dropping or by rough handling in shipment. These wheels are expensive and cannot usually be repaired after the cutting disc has been bent or broken. It is the purpose of this invention to provide protection for the cutting disc using a flexible protective washer that is removed only when the wheel is fitted on the drive mechanism and the cutting operation is about to start.

In my application, Ser. No. 371,712, filed June 20, 1973, now abandoned, I describe an improved cutting wheel in which the hub and flange are preformed as a metal element and the abrasive disc composed of metal with abrasive particles embedded therein is formed on the inside surface of the flange by electrodeposition or electroless deposition. Thereafter, an elastomeric material is applied to the abrasive disc and a support ring is pressed into place and held against the flange while the elastomeric material sets. The elastomeric material is usually a silicone resin which sets at room temperature. It functions to dampen standing vibrational waves in the cutting disc which are experienced at high rotational speeds of the wheel (10,000 - 20,000 rpm) and which cause chipping of the work piece along the edges of the cut.

The abrasive disc portion of the wheel may be formed of a variety of materials, for instance, electrolytically or electroless nickel deposited as in the above identified patents with any of a variety of abrasive materials incorporated into the metal. For instance, very finely divided particles of diamond, boron carbide, silicon carbide and aluminum oxide are suitable abrasives. In the preferred construction, however, I manufacture the abrasive wheel with aluminum hubs, silicone rubber elastomeric materials and an abrasive disc formed of electrolytically deposited nickel containing particles of diamond. However formed, the cutting disc is fragile.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of the wheel assembly with a portion of the flexible protective washer cut away.

FIG. 2 is a section of the wheel assembly along line 2-2 of FIG. 1.

FIG. 3 is a plan view of the cutting wheel assembly with a portion of the protective washer cut away.

FIG. 4 shows a simple wrench for removing the protective flexible washer from the wheel after it has been fitted on the drive mechanism.

DETAILED DESCRIPTION OF THE INVENTION

Referring now in detail to the drawings, the cutting

wheel consists of a hub 10 carrying a flange 12 on which is electrolytically deposited an abrasive layer 14 formed of high purity nickel which may be deposited as indicated in Technical Brochure 11-644312 A-357 published by International Nickel, Inc., New York. The nickel solutions described in the brochure would have finely divided abrasive particles suspended in them. The abrasive particles are laid down with and enmeshed in the electroplate.

The electroplate preferably covers the entire interior flange surface but the portion of the flange adjacent hub 10 may be masked if desired so that the abrasive plating covers the flange only in the area adjacent its periphery.

After the plating has been deposited usually to a thickness in the range 0.001 to 0.02 inch and preferably 0.002 to 0.01 inch, the outer periphery of the flange is etched away exposing the periphery of the electroplate to a depth of 0.001 to 0.20 inch, preferably 0.005 to 0.03 inch, the exposed portion constituting the cutting element of the wheel.

After the flange is electroplated, sufficient silicone resin paste to produce a thin layer on the surface of the flange may be spread along the junction of flange 12 and hub 10. Sealing ring 18, which has an outside diameter smaller than the diameter of the flange and an aperture just large enough to permit it to be slid onto the shoulder part of the hub, may then be fitted on the hub and pressed against the flange spreading the elastomer into a thin layer 16 lying between the sealing ring and the flange and the sealing ring may be pressed firmly against the flange until the resin has set and adheres strongly to flange and sealing ring surfaces.

While the resin layer and sealing ring impart superior properties to the cutting wheel, they are not essential to the present invention. Many cutting wheels otherwise similar in construction omit them, but these wheels require the protection provided by the present invention.

Flexible washer 17 fits snugly on hub shoulder 19 which extends axially from flange 12 and at its periphery extends beyond the circumference of the cutting disc protecting it from bending or breaking forces. The washer is a thin, flexible material and may be a plastic such as nylon, polyethylene, terephthalate, polypropylene and the like, or it may be a thin, flexible metal washer of aluminum, steel, brass or the like. Wrench 21 is slotted at the end to engage the protective washer and remove it as shown in phantom in FIG. 2.

The flexible washers provide cheap, simple effective protection for the fragile and expensive cutting wheels described. The washers remain in protective engagement until the cutting wheel assembly is mounted on the drive mechanism of the cutting machine and only then is removed using wrench 21 as shown in phantom in FIG. 2 of the drawings. Most cutting wheel damage occurs during the mounting of the cutting wheel on the drive mechanism. Since flexible washer 17 is removed only after the mounting of the wheel on the drive mechanism is completed, damage to the wheel during mounting is eliminated.

What is claimed is:

1. A cutting wheel assembly comprising a wheel body having a circular hub with an integral peripheral flange, the hub having a shoulder extending axially from said flange, a thin cutting disc formed of abrasive particles embedded in a metal matrix firmly bonded to said

3

4

flange on the same side thereof as said shoulder and projecting radially from said flange and a protective readily removable flexible washer having a diameter slightly greater than that of the cutting disc fitted on said hub shoulder and in close contact with the cutting

disc.
2. A cutting wheel assembly as defined in claim 1 in which the thin cutting disc has a thickness in the range about 0.001 to 0.01 inch.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65