United States Patent

Reichert

[15] **3,680,213**

[45] **Aug. 1, 1972**

[54] **METHOD OF GROOVING SEMICONDUCTOR WAFER FOR THE DIVIDING THEREOF**

[72] Inventor: **Karl O. Reichert,** 1179 Lochinvar Ave., Sunnyvale, Calif. 94086

[22] Filed: **Feb. 3, 1969**

[21] Appl. No.: **796,127**

[52] **U.S. Cl.** ....**33/18 R,** 33/32 C

[51] **Int. Cl.** **B43l 13/00**

[58] **Field of Search** 33/18, 26, 32; 83/5, 6; 30/164.9

[56] **References Cited**

UNITED STATES PATENTS

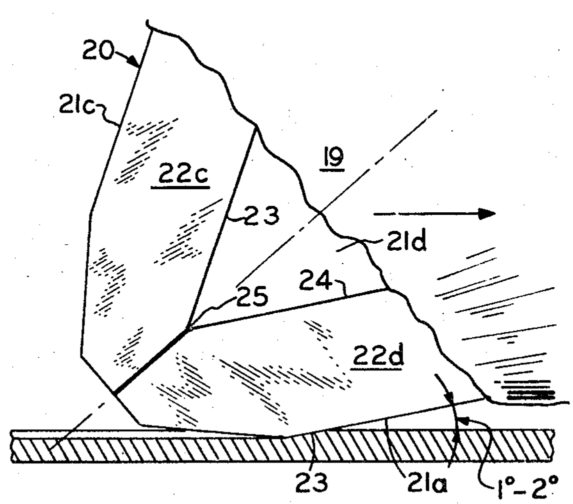
2,137,333	11/1938	Colburn	33/32 A
2,812,579	11/1957	Arck	33/32 C
3,094,785	6/1963	Kulicke	33/19 A
3,138,875	6/1964	Christensen	33/18 A
3,230,625	1/1966	Meyer	33/32 A
1,373,635	4/1921	Rammelsberg	274/38

Primary Examiner—Harry N. Haroian
Attorney—Leslie M. Hansen

[57] **ABSTRACT**

The method of uniformly shaving identical side walls of V grooves in silicon wafers by subjecting such wafer to the diverging cutting edges of one triangular facet of a diamond cutting head with such facet set at an acute angle relative to the surface of the wafer and the apex of such facet in a trailing disposition at the desired depth of groove to be made such that the diverging cutting edges divert silicon shavings toward center of the groove and the trailing apex scrapes the shavings out of the groove in the direction of movement of the cutting head preparatory to the breaking of such V grooved wafers into independent dies by supporting such wafer grooved face down on a pad under a plastic cover stretched tightly thereover and while subjecting the wafer to the rolling action of a roller of a diameter determined by the distance between the V grooves formed on such wafer.

6 Claims, 18 Drawing Figures



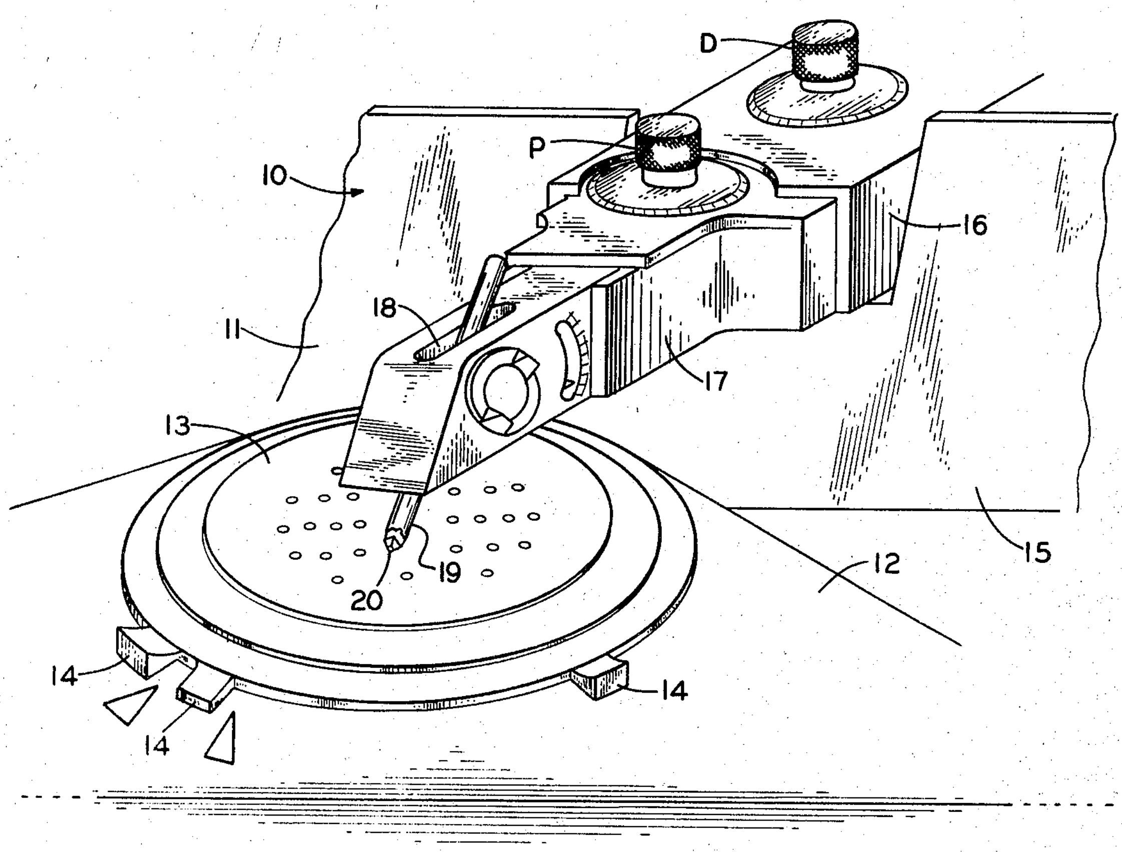


Fig.1.

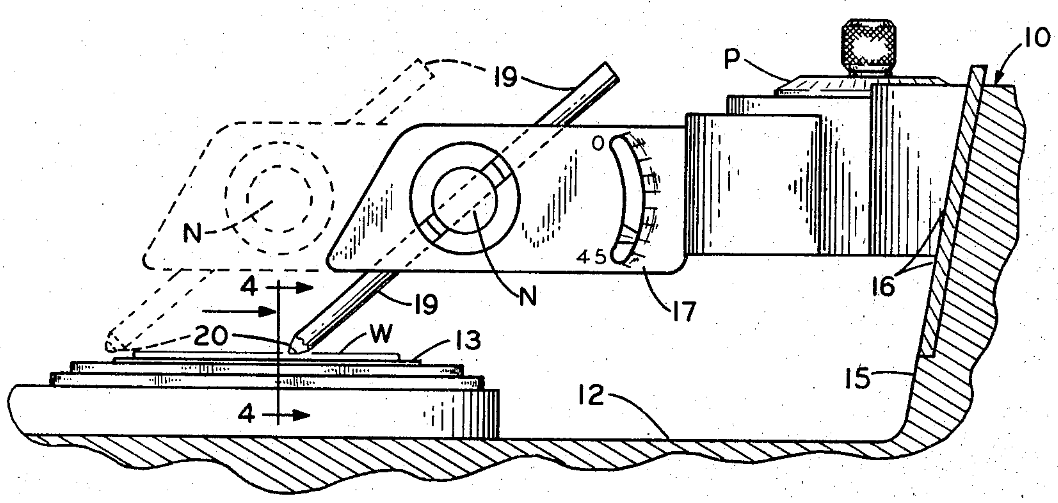


Fig.2

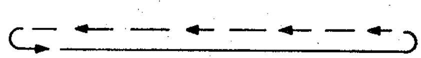


Fig. 2A.

INVENTOR.
Karl O. Reichert

BY Leslie M. Hansen
His Attorney

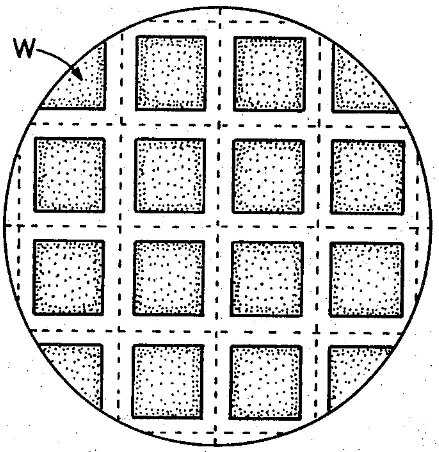
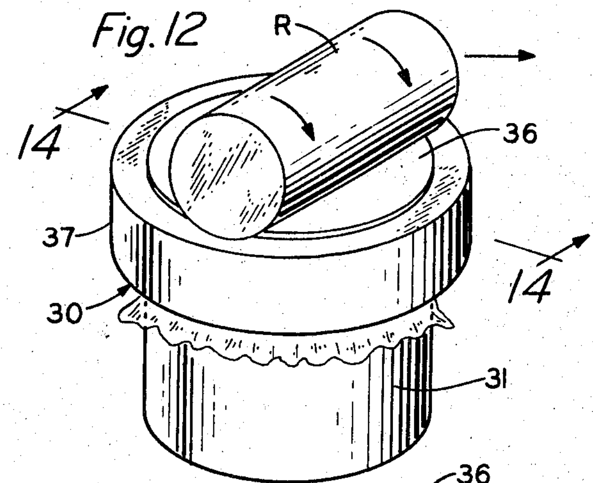


Fig.3

Fig.12



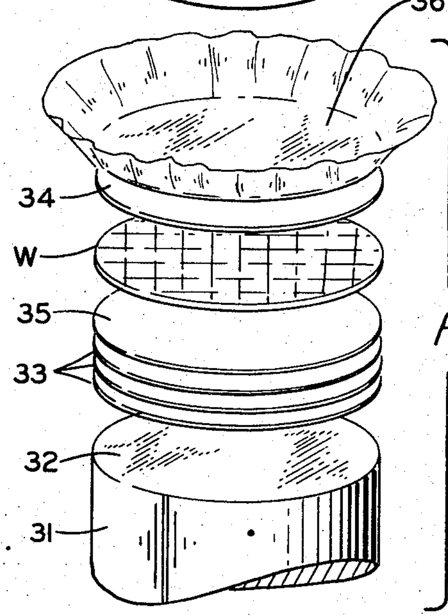


Fig.13

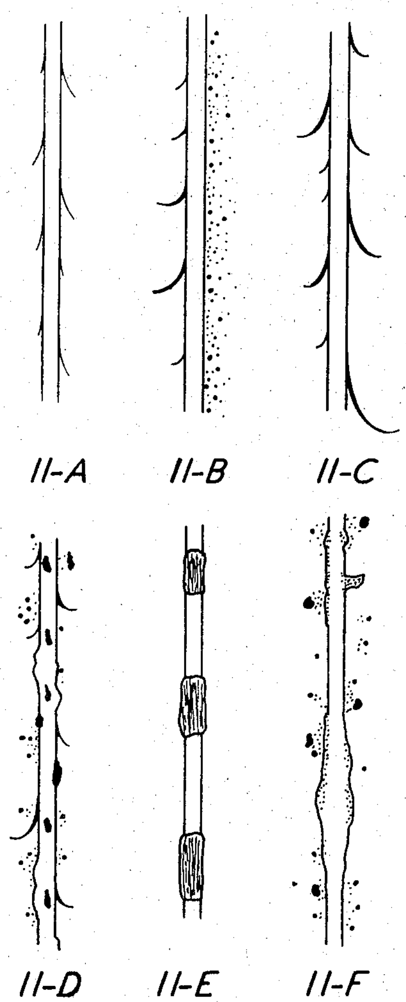


Fig.11.

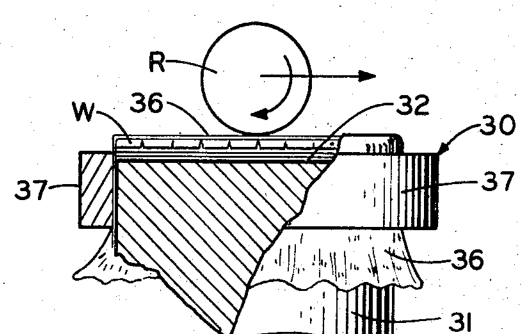


Fig.14.

INVENTOR.
Karl O. Reichert
BY
Leslie M. Hansen
His Attorney

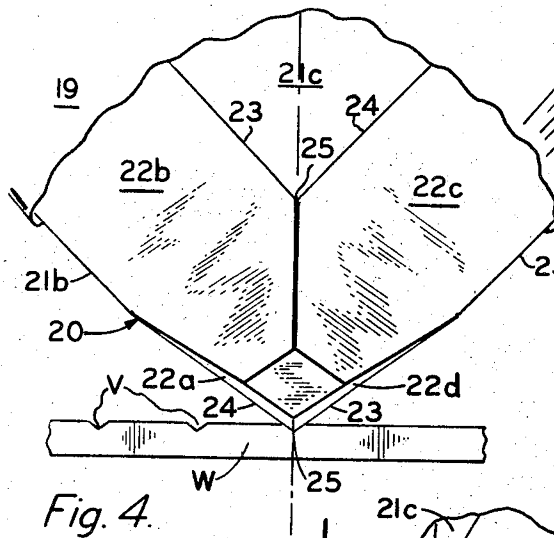


Fig. 4.

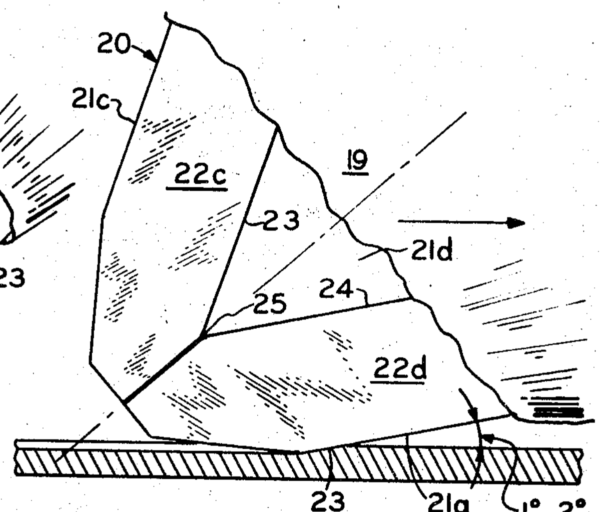


Fig. 5

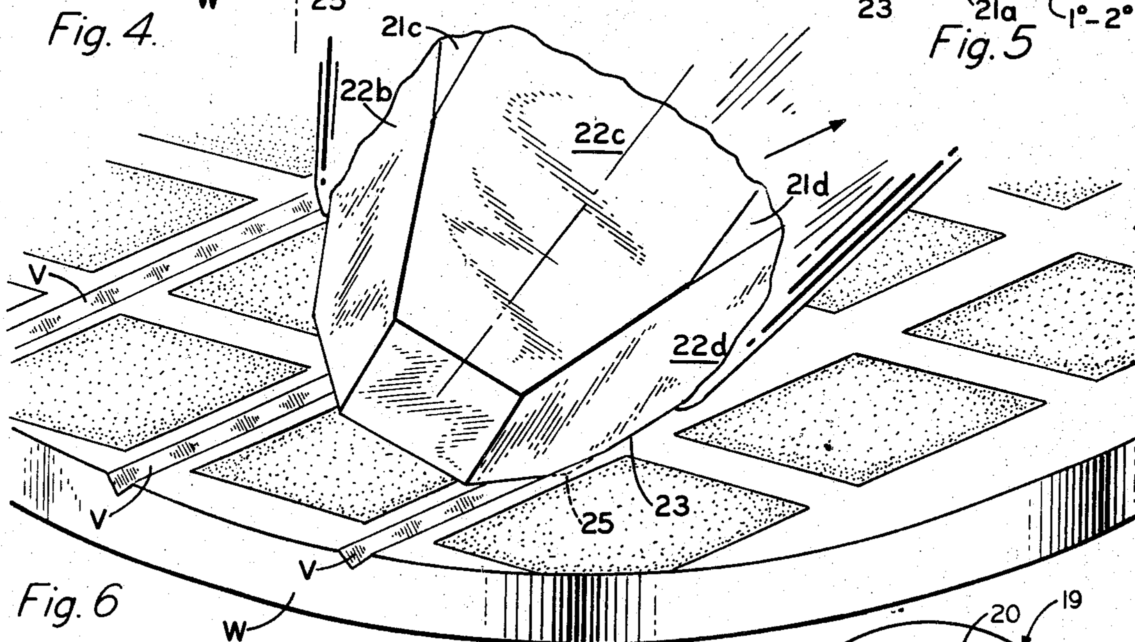
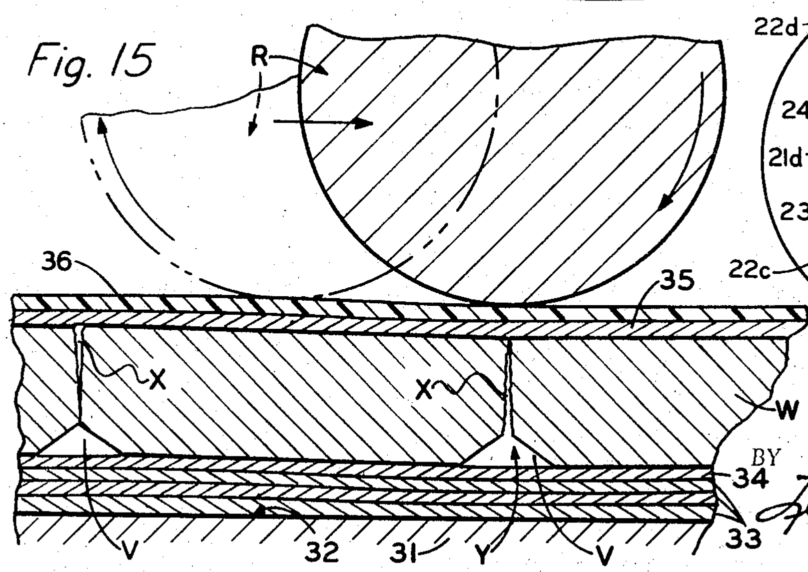


Fig. 6

Fig. 15



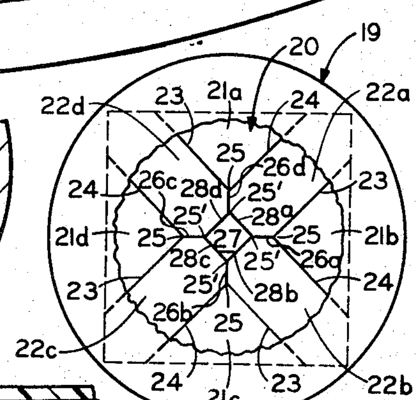


Fig. 16

INVENTOR.
Karl O. Reichert

BY
Leslie M. Hansen
His Attorney

Fig. 7

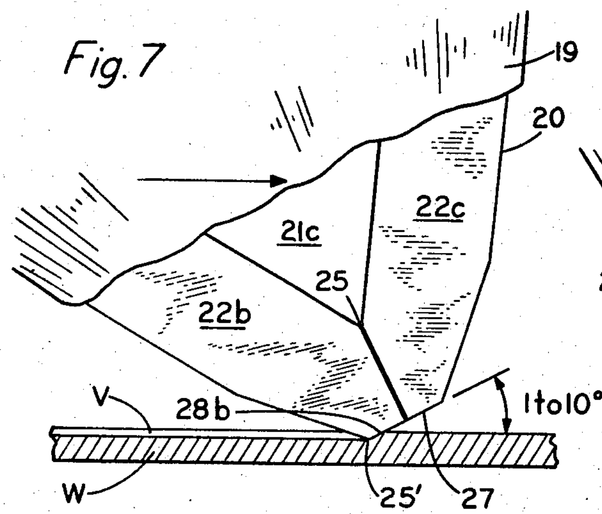
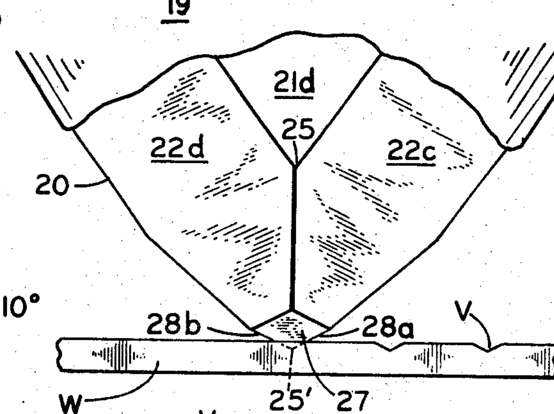


Fig. 8.



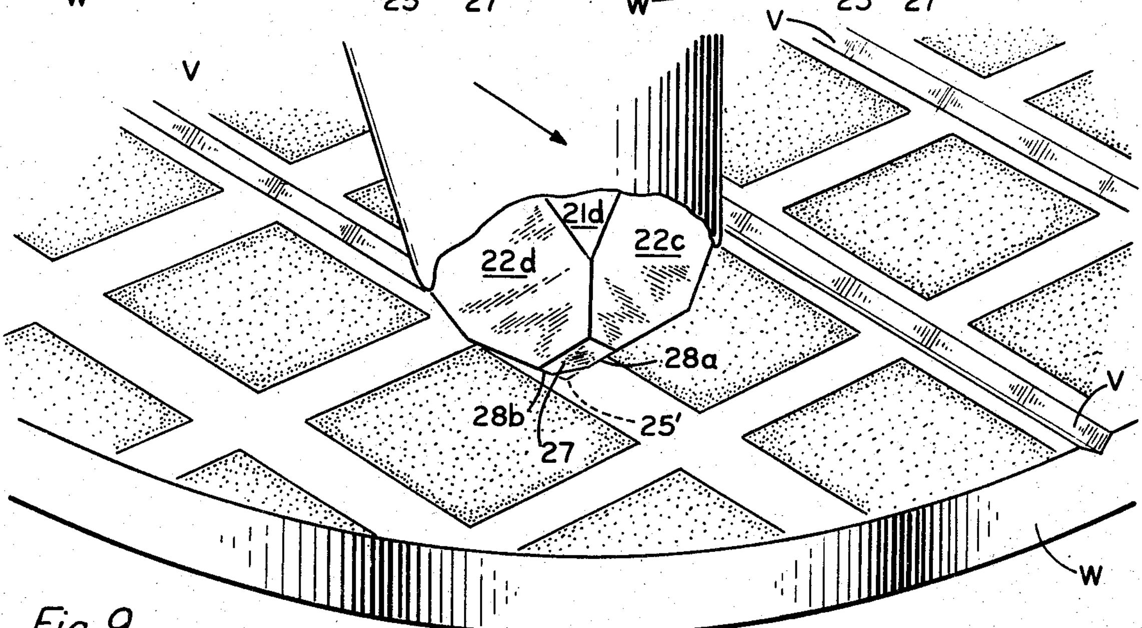


Fig. 9.

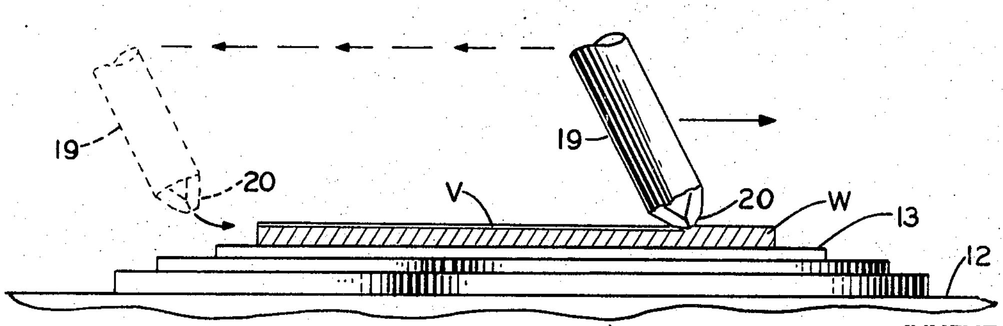


Fig. 10.

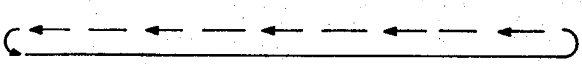


Fig. 10 A

INVENTOR.
Karl O. Reichert

BY Leslie M. Hansen
His Attorney

METHOD OF GROOVING SEMICONDUCTOR WAFER FOR THE DIVIDING THEREOF

BACKGROUND

The present invention relates to a new for novel method of grooving silicon wafers and the dividing thereof into separate dies.

The art of manufacturing semiconductors in the form of tiny pieces of silicon or similar material, commonly called a "die," is already highly developed. The process consists of producing man-made silicon bodies in the form of 1½ to 2 inch diameter bars which are sliced into wafers about 9 mils thick. Upon these wafers a plurality of tiny printed circuits are impressed by photographic process. The printed circuits on the face of such wafers are divided into a desired number of square areas ultimately to become the dies. These printed square areas are separated by transverse unprinted zones at micrometric distances along which the wafer is to be scribed and broken to produce the individual dies.

Heretofore it has been the practice to scratch or scribe the wafers along the unprinted zones after which the wafers, resting on a resilient bed, are subjected to pressure so as to cause them to break along the scribed lines in the hope of obtaining a reasonable number of good, usable semiconductors out of the entire quantity that were printed on the wafer.

In the year 1962 there was developed by the Tempress Research Company of Sunnyvale, California an automatic scribing machine later to be explained in the disclosure of the present application. In conjunction with this machine a diamond scriber was developed forming the subject of U. S. Letters Pat. No. 3,138,875 issued on June 30, 1964 to Frank L. Christensen and assigned to Tempress Research Corporation.

According to the teachings of this Christensen patent and the procedure recommended in the manual of operation of the automatic scribing machine, the scribing of each wafer is accomplished by forcing a knife edge of the diamond scriber against the wafer at a predetermined pressure as the scriber is moved unidirectionally and automatically along each unprinted zone in uniform strokes of about 30 to the minute. After each scribing operation in transverse directions the wafers, held between sheets of suitable tissue, are rolled in both directions so as to break the wafer along all scribed lines into the individual dies or semiconductors printed thereon.

Many of these semiconductors are used in spacecraft such as are produced under the command of NASA. It is therefore imperative that each semiconductor be perfect. After the breaking operation only about 20 percent of the total number of the dies may be acceptable.

Although a preliminary inspection is made under great magnification, the human eye may not detect slight flaws, fissures or fractures that are present. Consequently, although passing preliminary inspection certain of the semiconductors may become defective in handling or by flow of current under test a fracture may show up. Therefore, despite the appearance of a clear, good looking die it may have hidden unobvious fissures which may fracture later and possibly result in a failure. Consequently, upon closer inspection of the individual semiconductors of the acceptable number of dies under

a **400** power microscope, it is not uncommon to find 70 percent to 80 percent of them unacceptable due to chips, flaws or fissures extending into the printed zones of the semiconductor. As a result, such semiconductors may have a value of from 20 to 30 dollars each and many may be worth as much as $400.00 apiece. Regardless of the monetary value of each die any possible failure thereof could result in the aborting or failure of the entire entity of which any such semiconductor die may be a component. It is therefore imperative that each die be cut and broken as neatly as possible to avoid later breakdown of the die or the semiconductor thereon. **4**

STATEMENT OF INVENTION

In the study of the art of scribing and breaking wafers I have made several important discoveries leading to what might be considered a very unorthodox method in the light of the foregoing knowledge. First of all I have noted that the silicon bars from which each wafer is sliced is built up of a series of annular structural rings on the order of the grain of wood. I have discovered that in scribing such material it is most important to determine the molecular structure of the grain of each wafer in order that it may be positioned on the scribing machine in a manner to be scribed with the grain and not against the grain. Next I discovered that the scribing as heretofore recommended, consisting of forcing a knife edge of the diamond cutter along the surface of a wafer, is like driving a wedge into the surface. A better analogy would be to liken the action to that of a plow in which the knife edge of the cutter is forced into the upper surface of the wafer causing the silicon to chip and/or to be spread outwardly from the knife edge. Another example would be like the bow of a boat cutting through water, the bow spreading the water to each side of the bow as the latter travels along ahead of the boat. Such action of a single sharp cutting edge of a diamond scriber has a tendency to dig in or gouge the silicon and to crumble the same and spread silicon chips outwardly from the knife edge as the latter is forced under pressure against the silicon surface. This causes ragged edges to develop along the scribed line and feather-like fissures to extend outwardly from each side of the scribed line. It also is the cause of undetectable fissures or fractures branching out from the scribed line and into the zones of the printed circuits on the various die or dies, i.e., beyond the unprinted zones thereof.

To overcome these difficulties I have discovered that best results are obtained by shaving or scraping each side of a -V-groove in a wafer rather than merely scratching or forcing a knife edge, wedge-like, into the surface of the wafer.

OBJECTS OF INVENTION

Accordingly it is an object of the present invention to provide a method of actually shaving side walls of a V shaped groove in the unprinted zones of the silicon material between the printed circuits on a wafer.

The method proposed in this invention contemplates the setting of the diamond tool as a cutting or shaving head relative to the wafer such that two diverging edges of the cutting head between one flat face thereof are disposed to scrape or shave silicon particles equally on the opposite two faces of the V shaped groove being formed. Moreover, the apex or point of convergence of the two diverging cutting edges is disposed in a lowermost and trailing disposition in relation to the direction of movement of the diamond cutting head over the wafer. In other words the flat face or facet between the two diverging cutting edges lies in a plane comparable to but at an acute angle relative to the upper surface of the wafer so as to glide over the same like a surfboard or sled. This causes a first cutting of the wafer at transversely opposite sides of the outer margin of the V shaped groove and any shaving or chipping to occur within the groove while the trailing apex at the convergence of the two cutting edges disposed lowermost in the base of the groove makes a final clean scraping action within the groove thus formed.

These and other objects and advantages of the present method will become apparent from a reading of the following detailed description in the light of the four sheets of accompanying drawings in which:

FIG. **1** is a fragmentary perspective view of a wafer scribing machine.

FIG. **2** is a side elevational view of FIG. **1** showing the diamond cutting head set in accordance with the method of the present invention.

FIG. **2A** is a diagram of the path of movement of the cutting head of FIG. **2**.

FIG. **3** is a magnified plan view of a portion of a printed wafer prior to grooving.

FIG. **4** is an enlarged fragmentary detail illustration of the cutting head and wafer of FIG. **2** and as seen from line **4—4** therein.

FIG. **5** is a side elevational view of FIG. **4**, the wafer of which is shown in section;

FIG. **6** is a perspective illustration of FIGS. **4** and **5**.

FIG. **7** is an enlarged perspective view of the cutting head and wafer similar to that of FIG. **5** but with a different set of cutting edges of the cutting tool forming the groove in the wafer.

FIG. **8** is a view of the cutting head and wafer of FIG. **7** as seen from the righthand side of the latter.

FIG. **9** is a perspective illustration of FIGS. **7** and **8**.

FIG. **10** is a view similar to that of FIG. **2** showing the disposition of the cutting head relative to the wafer in accordance with the procedure of FIGS. **7**, **8** and **9**.

FIG. **10A** is a diagram of the direction of movement of the cutting head of FIG. **10**.

FIG. **11** includes a series of examples of scribings magnified by about 400 times to illustrate various results of scribing in wafers as compared with the grooving thereof in accordance with the method of the present invention;

FIG. **12** is a perspective view of a tool for breaking wafers in accordance with the present invention.

FIG. **13** is an exploded perspective view of part of the tool of FIG. **12**;

FIG. **14** is a section through FIG. **12** taken along line **14—14** therein;

FIG. **15** is an enlarged detail sectional view of a portion of FIG. **14** to illustrate the breaking operation thereof; and

FIG. **16** is a tip end view of a diamond cutting tool illustrative of the type shown in FIGS. **4** through **9** inclusive.

GENERAL DESCRIPTION

FIGS. **1**, **2**, and **10** of the drawings show the principal parts of an automatic scribing machine **10** sufficient to an understanding of the method of the present invention. Briefly the machine **10** comprises a chassis **11** having a fore table **12** upon which a vacuum type wafer supporting platform **13** is mounted and adapted for rotary adjustment by means of handle tabs **14**. At the back of the table **12** an upstanding wall **15** supports a laterally shiftable carriage **16** from which a reciprocating ram **17** extends forwardly over the platform **13**. This ram **17** carries a tool holder **18** at its fore end through which a stylus-like shank **19** of a scribing tool **20** extends through an angle clamping nut N whereby the cutting end of the tool can be adjusted angularly for scribing action relative to a wafer W resting on the vacuum platform **13**. The ram **17** also has a pressure adjusting micrometer P and a depth reference micrometer D for setting the scribing tool **20** at a desired pressure and depth of cut relative to a wafer supported on the vacuum platform **13**.

The wafer W is placed, printed side up, upon the vacuum pad of platform **13** and held thereon by suction. The wafer W is thus disposed under a suitable optical viewing means (not shown) having the usual focusable microscope and illuminating means by which the wafer can be seen under magnification. By this arrangement the wafer W may be adjusted by manipulation of the handles **14** of platform **13** to align the unprinted zones thereon with the reciprocating strokes of the ram **17** and the cutting end of the tool **20** carried thereby. The laterally shiftable carriage **16** for the ram **17** is then conditioned by suitable control means (not shown) for spacing each stroke of the ram according to the micrometric distance between unprinted zones on the wafer. As illustrated in FIGS. **2A** and **10A** the ram **17** reciprocates fore to aft above the table **12** and is raised on the forward stroke as the carriage **16** shifts laterally and then is lowered to adjust the cutting end of the diamond point of the scribing tool **20** to the proper depth before it is drawn rearwardly across the wafer.

The scribing tool may be any one of several well known diamond scribers such, for example, as the one disclosed and described in the aforementioned U.S. Pat. No. 3,138,875. Although the Christensen Patent is specifically directed to a diamond point having a truncated tip it should here be understood that any form of diamond point having the necessary triangular facets may be employed in the practice of the method of the present invention. For example, as best illustrated in FIG. **16**, the cutting end of the tool **20** has four main faces **21***a*, **21***b*, **21***c* and **21***d* ground to form a pyramid. The ridge between these several faces is ground away to form four diagonally disposed facets **22***a*, **22***b*, **22***c* and **22***d* resulting in an octahedron shape. The octahedron thus formed provides a pair of diverging cutting edges **23 24** on each triangular side **21***a*, **21***b*, **21***c* and **21***d* of the basic pyramidal form. These diverging cutting edges converge at an apex angle **25** on the cutting tool **20** there being a separate such apex **25** on each of the triangular facets of the diamond head **20**.

From the four apexes **25**, four knife-like edges **26***a*, **26***b* **26***c* and **26***d* extend pyramid form toward a point of convergence which, in the present disclosure is truncated providing a flat face **27** perpendicular to the axis of the diamond head cutting tool **20**. The flat face **27** is in the form of a square the sides of which provide angularly disposed cutting edges **28***a*, **28***b*, **28***c* and **28***d* at the terminal ends of the diagonally disposed facets **22***a*, **22***b*, **22***c* and **22***d*, respectively. Any two contiguous pair of these cutting edges **28***a*, **28***b*, **28***c* and **28***d* provide the necessary apex **25'** and diverging cutting edges similar to those **23–24** previously mentioned for carrying out the method of the present invention.

DETAILED DESCRIPTION

One method of cutting a groove into the surface of a wafer in accordance with the present invention is best seen in FIGS. **4**, **5** and **6** wherein the apex **25** of one pair of diverging cutting edges **23–24** is shown set at a depth of approximately **2** mils below the surface of the wafer. The triangular side **21***a* between such cutting edges, **23–24** is then set in an aft leaning position (FIGS. **1**, **2** and **2**A) at an acute angle of from 1° to 2° relative to the surface of the wafer W. With the apex **25** and the cutting edges **23–24** thus set, the shank **19** of the cutting tool **20** is secured by the clamping nut N in the reciprocating ram **17**. A test cut is then made in a blank wafer from the same bar as the printed wafer to be cut. By optically observing the cutting action during reciprocation of the ram it can be determined whether the cut is being made with the grain of the silicon wafer. Once the grain structure of the printed wafer is determined it can be placed upon the vacuum platform **13** and the latter adjusted by handles **14** to align the unprinted zones on the wafer with the stroke of the ram **17**. The automatic scribing machine **16** is then set into operation and the cutting head **20**, thus set, allowed to perform its cutting operation. The diamond cutter will thus continue to effect a shaving action simultaneously at each side of a V shaped groove thus formed. By observation through the optical system the V groove thus formed will reflect a solid beam of light back from both freshly cut sides of the V groove indicating a clean and perfect groove. Such a clean cut V groove is illustrated at 11A in FIG. **11**. Any deviation from such clear cut groove might be evidenced by any one of the other illustrations 11B, 11C, 11D, 11E or 11F in FIG. **11** in which:

11B shows a V groove resulting from a misorientation of the triangular side **21***a* relative to the surface of the wafer, i.e., the side **21***a* may be tilted relative to the top surface of the wafer resulting in fissures on one side and powdering on the other side of the V groove;

11C shows a V groove in which the fissures extend more than double the width of the V groove such that a chip may ultimately extend into the printed zone of a die at the time of breaking of the wafer or during extreme heat or cold or the high g application which develops in space flight;

11D shows a very ragged, chippy line and contamination which will result from the wedge-like action caused by the forcing of any knife edge of the cutting head into the surface of a wafer;

11E shows the gouging or chipping which results from too much pressure being applied to the cutting head; and

11F shows a ragged line chipped out at the sides of the desired V groove including the contamination from the chipping.

From the foregoing it will be appreciated that clean cut V grooves can only be made by having the two diverging cutting edges **23–24** applied under uniform pressure at transversely opposed sides of the groove when the flat triangular face **21***a* between such cutting edges is disposed at an acute angle relative to the surface of the wafer and the apex **25** at the point of convergence of the cutting edges in a trailing position at the base of the groove being cut. By this procedure as the cutting head **20** advances across the wafer at proper depth and pressure, sharp clean outer edges are first formed as the inwardly slanting cutting edges **23–24** gradually shave silicon material inwardly of the groove right down to the base thereof where the trailing apex **25** and the cutting edges **23–24** scrapes out all the carbon shavings leaving a clean groove with shiny side faces on either side of the V groove.

Another manner of grooving a wafer in accordance with the method of the present invention is illustrated in FIGS. **7**, **8**, **9** and **10** in which a different facet of the diamond cutting head **20** is disposed in the necessary and particular relation with the surface of the wafer to accomplish a good clean groove. This procedure entails the use of a pair of angularly disposed contiguous cutting edges **28***a*, **28***b*, **28***c* and/or **28***d* and the apex **25'** between them. In this procedure the flat face **27** formed at the end of a truncated cutting head **20** must be disposed at an acute angle relative to the surface of the wafer to be cut (See FIGS. **7**). For this reason the shank **19** of the cutting tool **20** has its tip extending rearwardly of the machine **10** in the direction of movement of the depressed tool during the cutting action (FIGS. **10** and **10**A). The shank **19** must therefore be adjusted with its axis tilted in a rearwardly slanting position relative to the ram **17** and secured by the clamping nut N with its cutting head in a leading direction relative to the cutting stroke of the ram In this position the truncated tip or face **27** on the cutting head is facing in the direction of movement of the tool **20** when in its depressed condition for cutting a groove into the wafer.

As explained above it is important that the two diverging cutting edges be equally angularly disposed relative to the sides of the groove to be cut. Consequently, a test cut should be tried in a plain blank wafer of the same stock as the printed one to be cut.

Two of the cutting edges, for example, **28***a* and **28***b* (FIGS. **8** and **9**) are disposed to shave silicon material from the wafer to simultaneously form opposite side walls of a groove therein. The apex **25'** at the point of convergence of these two cutting edges **28***a* and **28***b* is set at the proper depth of cut and in a trailing position during the cutting action. In this manner the two diverging, cutting edges **28***a* and **28***b* gradually shave the silicon material to form side walls of a groove in the wafer. Moreover, the flat face **27** between the cutting edges, being at an acute angle relative to the surface of the wafer, the slicing or shaving action of the cutting edges first cuts a clean marginal edge at each side of the groove and directs the shavings of silicon inwardly of the groove where the trailing apex **25'** effects a scraping out of the shavings in the direction of movement of the cutting head to assure a clean V groove with clear, shiny side walls.

By constant vigilance, i.e., periodic microscopic inspection of the cuts being made or during the optical inspection following the breaking of a wafer, it will become apparent whether the V groove being cut is chipped, has objectionable fissures or fractures resulting from a dull cutting tool or one that is not ground properly to provide the necessary sharp diverging cutting edges aligned symmetrically relative to the trailing apex of the facet on which they are formed. Any deviation from a clean clear reflective image of the V grooves on optical inspection will warrant changing the facet to assure uniformity in cutting according to the method of the present invention.

The same uniform shape and form of groove can be cut time after time by setting any one of the comparable facets on any diamond cutter in the position defined herein. For example, should the diverging cutting edges **23–24** or apex **25** of any facet become dull or break down, any fresh-unused set thereof, when placed for cutting action relative to a wafer in accordance with the present method will result in a similar albeit, identical V groove cut regardless of the change of facets or even the change of the cutting head on which such facets are formed.

After each wafer W has been grooved in both directions in accordance with the foregoing method a good clean breaking of the wafer into the numerous dies afforded should result. Much care should be taken in this phase of the procedure, however. Too much resiliency on the pad beneath each cut wafer can cause too great a tilting or angular shifting of the breaking dies relative to each other. Moreover, if too large or too small a roller R is used in relation to the micrometric distance between V grooves cut into the wafer, chipping at the edges of the dies can and does occur resulting in unnecessary loss of dies (semiconductors) which would otherwise be acceptable.

In accordance with the method of the present invention I have further discovered a method and means for assuring clean and safe breaking of dies from a wafer to a semiconductor size. This method and means is disclosed in FIGS. **12** through **15** in the accompanying drawing.

Referring to FIGS. **12**, **13** and **14** the means **30** employed consists of a solid bar **31** of metal such as steel having one end **32** milled to a perfectly flat surface perpendicular to the axis of the bar **31**. Upon this surface **32** is laid a plurality of discs of tissue, preferably about **20** sheets, to form a resilient pad **33**. The cut wafer W, safely held between two such discs of tissue **34–35** is placed upon the pad **34**. The tissue discs **33**, **34** and **35** are of substantially the same diameter as the end **32** of the bar **31**, preferably no larger.

A disc or sheet of plyofilm, cellophane or plastic cover **36** of greater diameter or size than the bar **31** is then laid over the several discs **33**, **34** and **35** and forced down over the same by a ring **37** which stretches the plastic cover **36** tightly over the pad, tissues and wafer to secure the latter in a firm flat condition on the pad **33**.

As best seen in FIGS. **14** and **15** the wafer W is disposed with its V grooved, printed surface, down upon the pad **33**. The transverse direction of the several V grooves in the wafer must be noted so as to assure accurate direction of the roller R relative to the disposition of the V grooves, the breaking occuring in a plane wherein the axis of the roller R passes over a groove aligned therewith.

In accordance with the present invention the size of the roller R to be used on a particular wafer is dependent upon the micrometric distance between groove lines in each wafer.

For example, in the case of printed circuits on dies of a size from 10 to 20 mils a roller R having a diameter under 1 inch should be used. For larger dies having a dimension of from 40 to 50 mills a roller of from 1½ inch to 2 inches in diameter is best. Larger dies such as from 60 to 120 mils in size require a roller or ring having a diameter of 3 inches to 4 inches in diameter.

By having a relatively firm yet resilient pad, such as the plural tissue discs **33** suggested, the rolling action of the proper sized roller over the plastic cover **36** merely causes the silicon material to spread at the base of the V groove slightly but sufficiently to cause a clean break X (FIG. **15**) in a plane radially of the center of the roller R as is passes over the grooved zone of a wafer. In this manner there is less likelihood of any surface abrasion between the broken edges of adjacent dies during the breaking operation and a minimum of crumbling of the silicon material marginally of each die. The clean cut V grooves in accordance with the method of the present invention and the slight spreading of adjacent dies (Y FIG. **15**) assures against any unnecesary crumbling, chipping or cracking of the dies thus broken during the breaking operation. This is attributed to the minimal movement of the adjacent dies by reason of the relatively firm yet resilient pad **33** as well as the proper size or diameter of the selected roller R in accordance with the method of the present invention.

Having thus described my method of grooving silicon wafers and the means of dividing the same into individual dies in specific detail, it will be appreciated by those skilled in the art that variations of procedure and substitution of materials may be possible without departing from the spirit or scope of my invention herein defined. I therefore desire to avail myself of any steps or procedure as well as means for accomplishing the same within the purview of the appended claims.

What I claim as new and desire to protect by Letters Patent is:

1. In the scribing of silicon and like wafers having electronic semiconductors printed thereon in metrometric areas between unprinted zones for dividing such areas into independent dies by the use of a polyhedron tipped diamond scriber having a plurality of exposed triangular facets each bordered by cutting edges diverging outwardly from the apex of each of such facets and means for reciprocating the same over the unprinted zones of such wafer; the method of shaving V grooves in such wafer consisting in:

setting such polyhedron tipped diamond scriber with one of such triangular facets thereof in a plane facing the upper surface of such wafer and disposed at an acute angle from its apex radially relative to the upper surface of such wafer and setting the apex at the point of convergence of the diverging cutting edges of such triangular facet below the upper surface of the wafer and in a trailing position relative to the direction of movement of the diamond scriber therealong and then moving the triangular facet with its forwardly leaning diverging cutting edges thus disposed and simultaneously shaving opposite side walls of a V groove into the upper surface of the wafer.

2. The method in accordance with that of claim 1 in which said one triangular facet is set at an angle of from 1° to 10° relative to the surface of such wafer and in advance of the trailing apex of said triangular facet.

3. The method in accordance with that of claim 2 in which the trailing apex of said facet is set at a depth of 2 mils below the surface of such wafer to form the center of the V groove shaved therein.

4. The method in accordance with that of claim 3 including: setting the outwardly diverging cutting edges on said facet equally disposed relative to the trailing apex thereof whereby said cutting edges simultaneously form initial marginal ridges transversely opposite each other and substantially equidistant from the center of said groove.

5. The method in accordance with that of claim 4, in which said outwardly diverging cutting edges on said facet gradually shave silicon material from the side walls of the V shaped groove being formed and direct such shavings toward the center of the groove.

6. The method in accordance with that of claim 5 in which the trailing apex of said facet scrapes the silicon material shaved from the side walls of said V shaped groove on out of the latter.

* * * * *