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Wafer Cutting Machine

Description

The present invention relates to a wafer cutting machine according to the preamble of the main claim.

In detail, the invention relates to a wafer cutting machine comprising two rotatable work spindles arranged in coaxial fashion relative to each other, each carrying on its end a separating disk supported on a hub, and each being movable relative to a work table adapted to be equipped with a wafer.

Such wafer cutting machines are known from the prior art with very different designs. They serve to separate the individual wafer-mounted chips during their manufacturing process, or also other electronic components.

The individual chips or chip blanks, which are most of the time square, are first cut out of the wafer in the form of strips. Each strip has the width of the chip or chip blank to be produced. After the separating disks have cut a plurality of parallel webs out of the wafer, the work table is rotated together with the wafer by 90° to carry out the second arrangement of separating cuts.

The prior art shows two spindle type wafer cutting machines comprising two work spindles, each having supported thereon a separating disk. The work time can be reduced by half due to the use of two separating disks, as compared with wafer



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cutting machines having only one separating disk. It is also known that a V-shaped cut is performed by means of one of the separating disks while the separating process proper is carried out by means of a second separating disk. Both separating disks can be mounted in combined fashion on a single work spindle to produce a corresponding beveled cut.

It has turned out to be a disadvantage of the known wafer cutting machines that, due to the incorporation and construction of the work spindles and the separating disk, it is not possible to perform very small parallel cuts because the separating disks cannot approach one another in an appropriate way. This makes the wafer cutting machine less powerful and efficient.

It is the object of the present invention to provide a wafer cutting machine of the above-mentioned type which, while being of a simple construction and adapted to be handled in an easy and reliable way, permits an efficient production of parallel cuts that are positioned very close to one another.

According to the invention this object is achieved by the features of the main claim; the subclaims show further advantageous designs of the invention.

The wafer cutting machine according to the invention is characterized by a number of considerable advantages.

It is intended according to the invention that the two separating disks are arranged to face one another on the work spindles, the hub of each separating disk being positioned on the back side of the separating disk and arranged on the work spindle. Thus the two separating disks can approach one another leaving a very small distance thereinbetween, which results in precise and very thin cutting distances of the two parallel-working separating disks. Thus, it is possible by using the wafer cutting machine according to the invention to operate with two

separating disks at the same time for cutting small strips of chips, chip blanks, or the like, out of a wafer, or for separating the same from the wafer, or for producing corresponding separating notches.

It is intended in a particularly advantageous development of the invention that the work spindles are each movable in axial direction. A feed movement of the separating disks is thereby possible in an accurate way.

It goes without saying that the separating disks of the invention can be designed in the form of flat disks or flat rings. However, it is also possible to configure these in any desired way with respect to their cross section, e.g. in order to perform a separating cut by means of a flat, disk-like portion while an adjoining portion is made conical or beveled to work the edges of the chip strips, chip blank strips or IC strips accordingly.

According to the invention the two separating disks are adapted to approach one another at least up to the working width of an IC strip or chip strip to be worked in the wafer. Hence, it is also possible to produce a very small strip.

Within the scope of the present invention it is further of advantage when each of the separating disks is firmly connected to the hub, and the hub itself is detachably supported on the work spindle. It is thereby possible to exchange the separating disks in a particularly simple way with corresponding accuracy.

The invention will now be described with reference to an embodiment taken in conjunction with the drawing, in which:

Fig. 1 is a perspective simplified view of an embodiment of a wafer cutting machine according to the invention;

Fig. 2 is a schematic side view of the two work spindles with separating disks and hubs;

Fig. 3 is a simplified top view on a work table with a wafer and on two working positions of the pairs of separating disks according to the invention, which are shown by analogy with the illustration of Fig. 2;

Fig. 4 is an exploded view of the end portion of a work spindle with an associated hub and separating disk; and

Fig. 5 is a configuration by analogy with Fig. 4 in the fully mounted state.

Fig. 1 is a perspective view of the wafer cutting machine according to the invention. Said machine comprises a frame 10 which has secured thereto a guide means 11 holding a carriage 12 thereon in a longitudinally displaceable manner. The carriage 12 is e.g. movable by means of a ball type spindle 13. The carriage 12 carries a work table 8 which is rotatable about a vertical axis by means of a drive (not shown).

The frame 10 has secured thereto a console 14 which comprises horizontal guide means 15, 16 parallel to one another, on which carriages 17, 18 are supported in a horizontally movable direction. The movement is carried out via ball spindles 19, 20, or similar means, which are movable in the known way by means of a drive 21.

Each of the two carriages 17 and 18 has mounted thereon a motor 22 and 23, the motors serving to vertically shift carrier slides 24, 25 via a drive system (not shown).

Each of the carrier slides 24, 25 has arranged thereon a bearing pedestal 26, 27, each carrying a work spindle 1, 2. It goes without saying that a corresponding drive is provided for the work spindles 1, 2, but is not shown in detail.

Furthermore, Fig. 1 shows that the guide means 11 is used for a displacement in X-direction so as to move the work table 8 and a wafer 7 secured thereto (see Fig. 3) in X-direction. A movement in Y-direction is possible with the help of the guide means 15, 16 in order to move the work spindles 1, 2 in said direction. A movement in Z-direction takes place through a vertical displacement of the carrier slides 24, 25 on carriages 17, 18.

Fig. 2 is a schematic side view showing the respective end portion of the two work spindles 1, 2, on which hubs 5, 6 are supported that carry a separating disk 3 and 4, respectively, on their face. It becomes apparent from Fig. 2 that the two separating disks 3, 4 can be arranged very close to each other to realize a working width 1.

Fig. 3 shows the assignment during different working operations. In a top view, the work table 8 is shown with a wafer 7 secured to or held on said table. A multitude of individual chips, chip blanks or ICs are formed on the wafer 7 and are to be isolated by means of separation cuts to be performed by the separating disks 3, 4.

Being assigned to the IC strips 9 formed by the individual ICs 28, each of the separating disks 3, 4, is shown in an extreme marginal position of its range of movement. It follows from the illustration that a complete row or a complete IC strip 9 can be worked by means of one single cut. After separation or treatment of the individual IC strips 9, the work table 8 is rotated about a vertical axis by 90° so as to work or separate individual ICs, chips or chip blanks in a finishing way.

Figs. 4 and 5 show the construction of the end portion of the work spindles 1 and 2, respectively. Each of the work spindles 1 and 2 comprises a shaft 29 having an attachment 30 or shoulder integrally formed thereon. The attachment 30 is followed by a threaded step 31 which can be inserted into a recess 32 of a hub 5 and 6, respectively. The recess 32 passes into an enlarged portion 33 into which a nut 34 can be inserted. The nut 34 can be screwed onto the threaded step 31 to secure the separating disk 3 and 4, respectively, to spindle 1 and 2, respectively, in the end figure 5. The nut 34 is fully accommodated through the depth of the enlarged portion 33, resulting in a planar flat working surface of the separating disks 3, 4.

As has already been mentioned, the separating disk need not be designed in the form of a flat disk or a flat ring. Rather, a contoured cross-sectional design is also possible. The separating disk may be designed in the usual way, e.g. it may be covered with diamond grinding bodies, or the like.

The present invention is not limited to the illustrated embodiment. Rather, many modifications and alterations are possible within the scope of the present invention.

List of Reference Numerals

1	work spindle	26	bearing pedestal
2	work spindle	27	bearing pedestal
3	separating disk	28	IC
4	separating disk	29	shaft
5	hub	30	attachment
6	hub	31	threaded step
7	wafer	32	recess
8	work table	33	enlarged portion
9	IC strip	34	nut
10	frame		
11	guide means		
12	carriage		
13	ball spindle		
14	console		
15	guide means		
16	guide means		
17	carriage		
18	carriage		
19	ball spindle		
20	ball spindle		
21	drive		
22	motor		
23	motor		
24	carrier slide		
25	carrier slide		

Claims

1. A wafer cutting machine (1) comprising two rotatable work spindles (1, 2) arranged in coaxial fashion relative to each other, each carrying on the end thereof a separating disk (3, 4) supported on a hub (5, 6), and each being movable relative to a work table (8) adapted to be equipped with a wafer (7), characterized in that the two separating disks (3, 4) are each arranged to face one another, each of the hubs (5, 6) being positioned on the back side of the separating disk (3, 4) and arranged on the work spindle (1, 2).
2. The wafer cutting machine according to claim 1, characterized in that the work spindles (1, 2) are movable in axial direction.
3. The wafer cutting machine according to claim 2, characterized in that the two separating disks (3, 4) are adapted to approach each other at least up to the working width (1) of an IC strip (9) to be worked in the wafer (7).
4. The wafer cutting machine according to any one of claims 1 to 3, characterized in that the separating disks (3, 4) are designed in the form of flat disks.
5. The wafer cutting machine according to any one of claims 1 to 3, characterized in that the separating disks (3, 4) are designed in the form of flat rings.
6. The wafer cutting machine according to any one of the preceding claims 1 to 5, characterized in that a respective separating disk (3, 4) is firmly connected to the hub (5, 6), and that the hub (5, 6) is detachably supported on the work spindle (1, 2).