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Waugh, Jr. et al.

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[45] **June 28, 1974**

[54] **SLICE PRE-ALIGNER**

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[52] **U.S. Cl.** ..... **198/33 AB,** 214/1 R

[51] **Int. Cl.** **B65g 47/24**

[58] **Field of Search** ..... 214/1 R, 1 Q; 198/33 R, 198/33 AB

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Primary Examiner—Frank E. Werner

Attorney, Agent, or Firm—Harold Levine; James T. Comfort; James O. Dixon

[57] **ABSTRACT**

A pre-aligning device for slices of hard material such as silicon or germanium having flats on their peripheries comprising a laterally slidable block having a flat surface which is biased toward the slice periphery, and on which the flat of a slice is adapted to seat. The slide block has at least one elongated slot extending parallel with its said surface into which a rigidly supported pin extends to limit the extent of lateral sliding of the block which is engaged by the periphery of the slice and which occurs when the slice supported as by a rotatable vacuum chuck is rotated. When the flat of said slice engages the flat surface of the slide block, it is detected as by photo-cells and means to stop driven rotation of the chuck and slice is activated. The flat of the slice however overshoots the surface of the block before complete stoppage of chuck rotation occurs. At such time, the bias of the slide block towards said slice effects a limited counter rotation of the slice and full seating of its flat on said flat slide block surface. The slide block is slidably carried on a support having a surface which has a low coefficient of friction on which the slide block rests.

15 Claims, 11 Drawing Figures

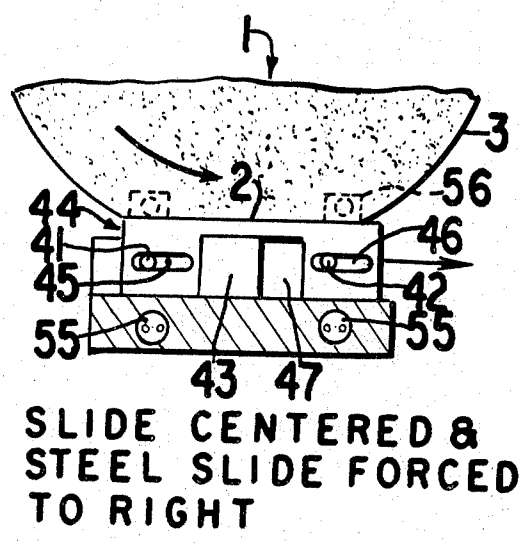


FIG. 1

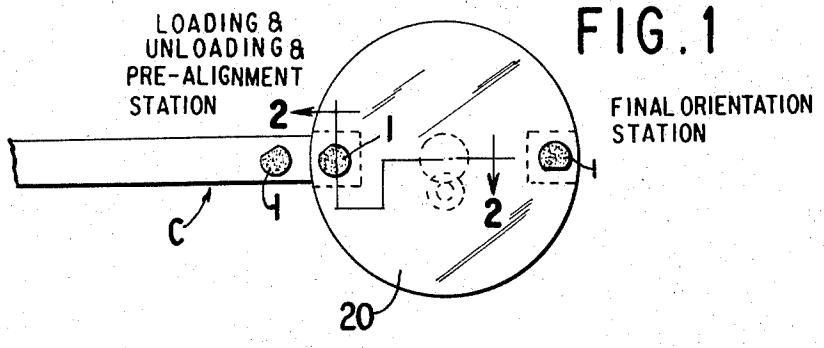


FIG. 2

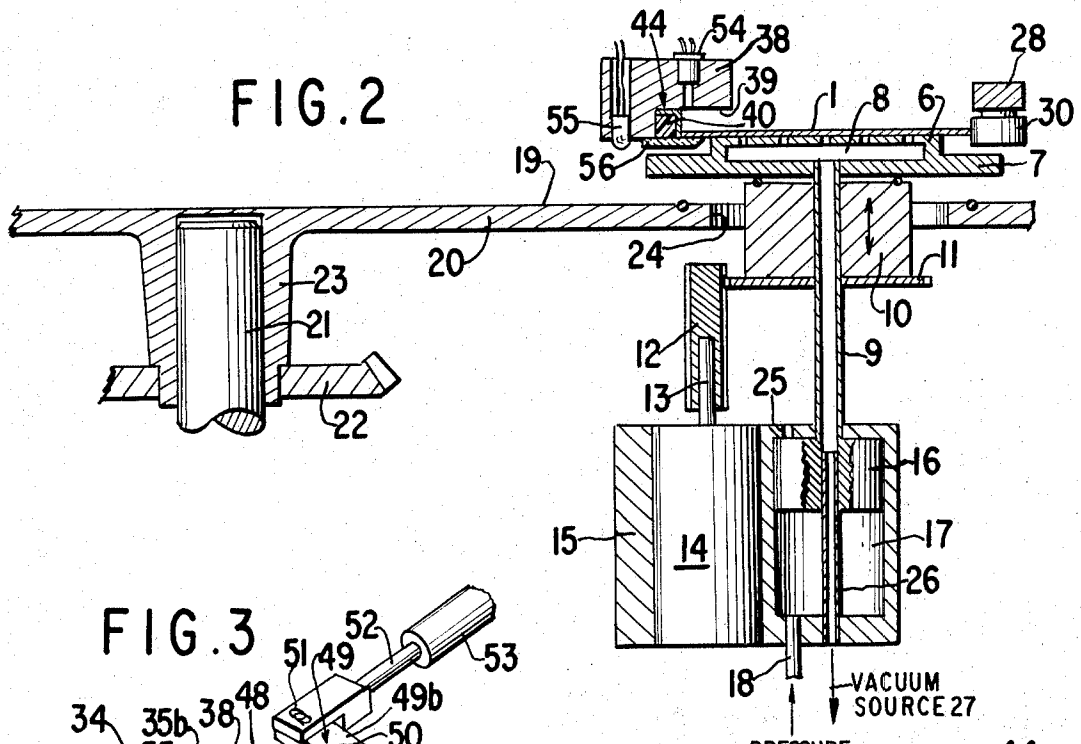
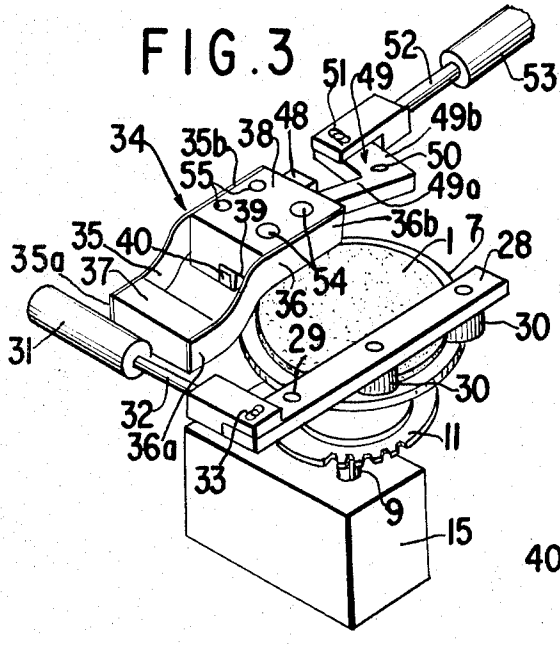


FIG. 3



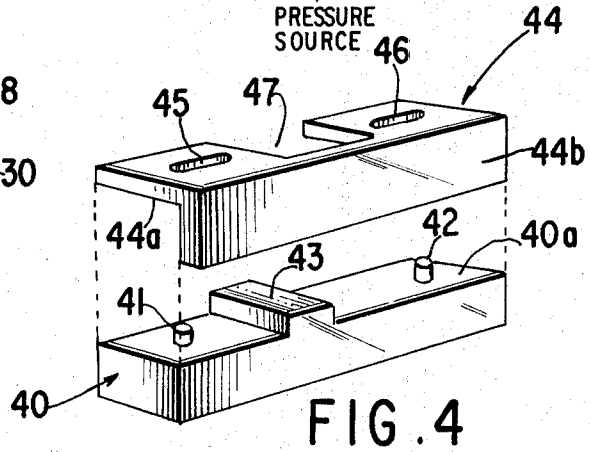
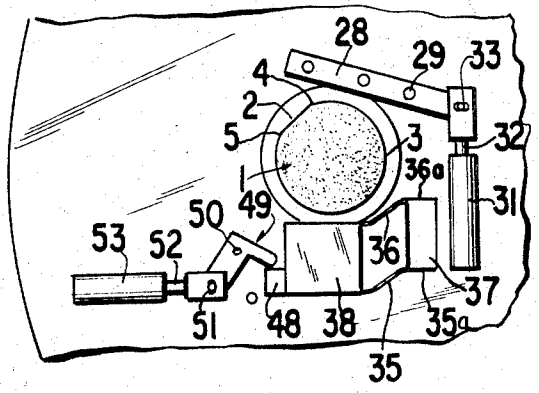


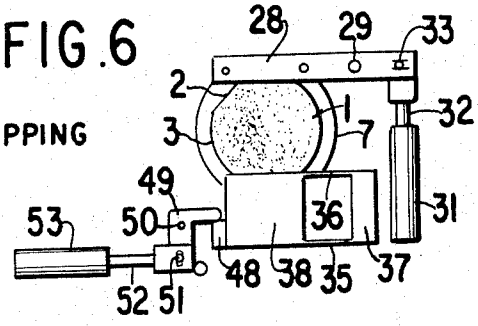
FIG. 4

FIG.5



LOADING

FIG.6



GRIPPING

FIG.7

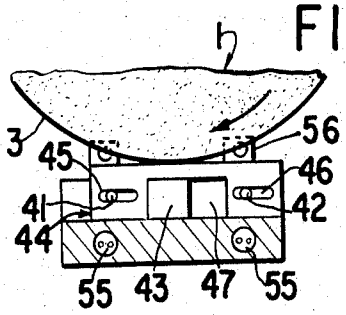
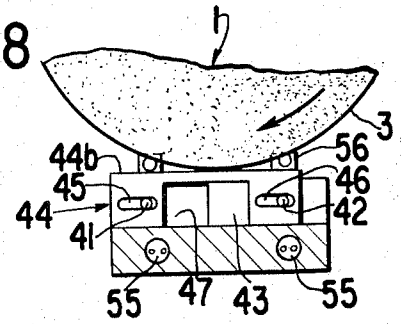
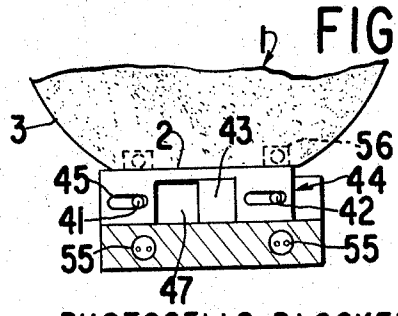


FIG.8



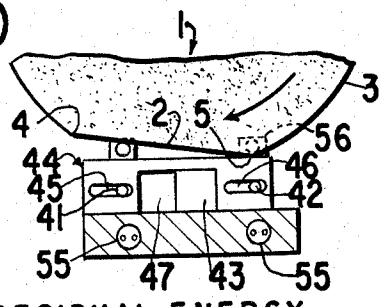
ROTATION

FIG.9



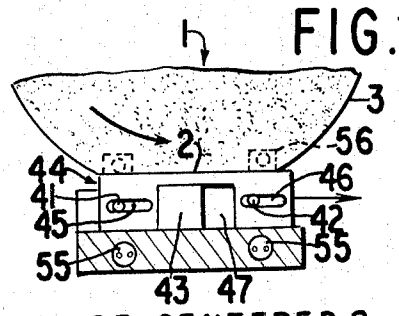
PHOTOCELLS BLOCKED.
ROTATION STOPPED

FIG.10



RESIDUAL ENERGY
OVER SHOOT

FIG.11



SLIDE CENTERED &
STEEL SLIDE FORCED
TO RIGHT

SLICE PRE-ALIGNER

BRIEF SUMMARY OF INVENTION

This invention relates to a device for use in conjunction with an automatic slice aligner and exposure machine to pre-align slices of materials such as silicon or germanium so that several photographic exposures will all be aligned, i.e. in registration with each other to such a degree that automatic alignment means can take over and make corrections to align the slice precisely to the mask.

Pre-alignment of slices heretofore has usually been done by sensing a "flat" on the slice and holding the position with some form of vacuum chuck. A motor is used to rotate the slice or chuck and either photocells or pneumatic sensors are used to stop the motor when the slice flat is "found." All of the known devices are operated by means of solenoid valves and motors which in turn are controlled either by cam timers or hard-wired logic. These control arrangements are very time-consuming to change in order to make changes or modify the operation of the pre-aligner.

Another fault of known pre-aligner systems that causes trouble is the flat surface that the slice flat rests on when the flat is found. This flat surface is semi-rigid and the corners of the said slice flat often hang on this surface. The flat surface heretofore used was the face of a rigidly held block. The delay between the time when the flat was sensed and when slice rotation is stopped caused the flat to overshoot the surface. Mechanical biasing pressure usually caused the flat to slip back into place on the flat surface of the block. However, after a number of actuations the corners of the flats of the slices would wear a pit into the surface of the rigidly held flat block preventing the slice flat from seating properly on the said surface. Even a sapphire surface or tungsten steel surface on the flat rigid block have been found to be subject to such wear. A hypothesis as to why such wear by softer silicon occurs is believed to be that the crystal structure of the silicon in the slice is oriented so that the plane of the slice is abnormally rigid. Regardless of the truth of this hypothesis, the fact remains that such wear has been found to occur in actual practice.

Objects and features of the present invention are the provision of a pre-alignment device that eliminates the hereinabove described faults in a simple and effective manner.

In practicing the invention, a laterally slidable block having the requisite flat surface is utilized in lieu of the non-slidable block. This slidable block is of a very hard material such as tungsten carbide whose upper flat surface serves for detecting the slice "flats." This block is provided with elongated guide slots through which rigidly held guide rods extend so that the block may slide laterally back and forth within limits defined by the slots on a slide surface of a non-slidably positioned member of material having a low coefficient of friction such as Teflon.

When this sliding block is substituted for the non-slidable flat detecting block, the chuck-held slice is rotated clockwise, for example, until the flat is sensed. During this rotation the slide block is displaced laterally to the limits permitted by the pins in the slots of the slide block. The sensing of the flat initiates stopping of rotation of the motor. However, the flat of the slice

overshoots the flat surface of the slide block because of inertia. At this time of overshoot, the lagging corner of the flat rests on the flat surface of the laterally displaced block. Then, since rotation of the motor has been stopped, the slice rotates counterclockwise because of biasing pressure of the slide block and shifts the previously laterally shifted block reversely with effective seating of the entire flat of the slice on the surface of reversely shifted laterally slidable block.

The slide block is supported on a sliding surface, for example, of Teflon or other surface having a low coefficient of friction. Thus, little or no wear occurs between the engaging surface of the laterally slidable block and the "Teflon" surface of its support. Hence, for the slice flat to seat properly on the slide block, it is only necessary for the latter to slip on the low friction surface of the "Teflon" support instead of requiring a sharp silicon corner of a slice to slip on the surface of the block were the latter non-slidable. Since the metal to Teflon friction factor is very low, the lateral slippage of the slide block insures positive alignment of the flat on the surface of the sliding block without wear on the surface of the latter during seating on the flat surface of the sliding block by a sharp hard corner of a flat being aligned. Even if some wear occurs the alignment inaccuracies resulting from wear on the flat surface of a non-sliding block do not occur when a laterally slidable block is used.

Other objects and features of the invention will become apparent from the following detailed description and the accompanying drawings, wherein:

FIG. **1** is a diagrammatic plan view of a pre-aligning arrangement embodying the invention;

FIG. **2** is a sectional view taken along lines **2—2** of FIG. **1** and viewed in the direction of the arrows;

FIG. **3** is a perspective view of a pre-aligning device embodying the invention;

FIG. **4** is an exploded perspective view of the slide block and its support; and

FIGS. **5–11** inclusive are diagrammatic illustrations of successive steps of operation of the pre-aligning device of this invention.

DETAILED DESCRIPTION

Referring now to the drawings, the reference character **1** denotes a slice of silicon or germanium of other desired material required to be aligned with other or like slices for fashioning integrated circuits or the like. Each such slice has a flat **2** in its periphery **3** defined by sharp corners **4** and **5** respectively at junctions of the flat **2** with the remainder of the periphery **3** of the slice **1.**

Each slice **1** that is to be pre-aligned is fed by hand or in any suitable mechanical way as by a belt conveyor system onto the upper perforate face plate **6** of a rotational chuck **7.** The chuck **7** has an internal chamber **8** with which all the perforations of face plate **6** communicate. The chuck **7** is supported by a tubular shaft **9** that is movable both vertically and rotatively. This tubular shaft **9** is rotatively supported on a guide block **10** which is reciprocally movable vertically. A driven gear **11** is secured to shaft **9.** This gear **11** in turn meshes with an axially elongated gear **12** and is slidable along its length. This gear **12** in turn is secured on the drive shaft **13** of the motor **14** within a casing **15.** The length of gear **12** permits permits the shaft **9** to be rotated by motor **14** during limited axial displacement of shaft **9.**

The shaft 9 in turn is joined to a piston 16 which is movable reciprocally in a chamber 17 as by pressurized air or gas delivered at 18 to chamber 17 from a controlled source (not shown). Such pressure when introduced into chamber 17 acting upwardly on piston 16 elevates the chuck 7 to the level shown in FIG. 2 at which time the block 10 maintains the chuck 7 upwardly spaced from the surface 19 of a horizontal turntable 20. This turntable is supported on a shaft 21 and is adapted to be rotated in either direction as required by a drive gear (not shown) meshing with gear 22 secured to the hub 23 of the turntable. This turntable 20 has one or more openings 24 each of larger diameter than block 10 so that a lowering of the chuck 17 onto surface 19 of turntable 20 may be effected when the piston 16 moves downwardly in chamber 17 upon cut-off of pressure delivered at 18 to said cylinder. Inlet or vent 25 leading from chamber 17 above piston 16 to atmosphere permits a downward stroke of piston 16 in chamber 17 upon cessation of and release of pressure delivered via 18 to chamber 17 below piston 16. The upper end of tubular shaft 9 opens into space 8 of chuck 7. A tube 26 within chamber 17 and coaxial with tubular shaft 9 is slidable with respect to piston and with the inner tubular surface of shaft 9. This tube 26 is connected alternatively to a vacuum source 27 or to a pressure source as required during operation of the pre-aligning arrangement as will be described.

A bar 28 (FIGS. 2, 3, 5 and 6) is supported pivotally and horizontally at 29. This bar has a pair of spaced rollers 30 which are mounted to extend axially and are engageable with the periphery 3 of slice 1 or movable upon a swing of arm 28 into a clearance site away from said periphery during loading and unloading of chuck 7 with a slice 1. The swing of arm 29 is provided by a controlled air operated cylinder 31. The piston rod 32 of the air cylinder is connected by pin and slot arrangement at 33 to said bar 28. In this way bar 28 may be swung toward a slice engaging position by appropriate operation of the cylinder 31 on said chuck or away therefrom into the release position shown in FIGS. 6 and 5 respectively.

At a substantially diametrically opposite location a biasing arrangement denoted generally by reference character 34 serves as will be described to provide biasing pressure against the periphery of said slice 1 during slice pre-aligning.

This biasing arrangement 34 comprises a pair of spaced-apart parallelly extending spring arms 35, 36 corresponding end portions 35*a*, 36*a* of which are secured to a fixed support 37. The portions 35*b*, 36*b* of said arms are secured to opposite sides of a block 38 which is spaced from support 37. Block 38 has a cut away recess 39 of substantially L-shaped section in a lower corner thereof whose depth is greater than the thickness of slices to be pre-aligned.

A block member 40 is secured to the vertical wall of recess 39, and preferably is of material having a low coefficient of friction, being for example of a synthetic plastic such as Teflon. On the alternative the outer surfaces of said block member 40 may be coated with a layer of such material. A pair of guide pins 41 and 42 are symmetrically mounted fixedly to block 40 and extend outwardly from its outer surface 40*a*. A protrusion 43 extending outwardly of surface 40*a* of said block is equispaced from the two guide pins 41 and 42.

A slide member 44 which in the embodiment shown has a L-shaped section is mounted and supported slidably on the support block 40. This slide member is preferably of extremely hard material such as tungsten carbide, or at least its outermost surfaces have a layer of such material thereon. Elongated guide slots 45 and 46 are provided in the horizontal arm 44*a* of slide member 44 to receive the respective guide pins 41 and 42. Additionally, an elongated recess 47 is provided in the same arm 44*a*. This recess has greater length that the width of projection 43 into which the latter extends. The guide pins 41 and 42 in slots 45 and 46 and projection 43 in recess 47 permit limited lateral to and fro slidable movement of slide member 44 with respect to support block 40.

The outer face of the vertical arm 44b of slide member 44 is a flat plane that extends vertically with respect to the periphery of the slice 1. The spring carried block 38 is positioned by support 37 so that the spring arms 35, 36 bias the flat plane surface 44*b* of slide member 44 toward the periphery 3 of a slice 1 positioned on the perforate surface 6 of chuck 7.

The block 38 and with it plane surface 44b of slide member 44 is adapted to be swung laterally away from engagement of surface 44*b* with said periphery 3 of said slice 1 for slice mounting on said chuck and removal therefrom. To this end block 38 has a protuberance or nose 48. A lever 49, pivotally mounted at 50 has one of its arms 49*a* located to engage the nose 48. The other arm 49*b* is coupled by pin and slot connection 51 to a piston rod 52 of an air operated cylinder 53 which is similar to cylinder 31. In the retracted position of piston rod 52 as shown in FIG. 5 the lever arm 49*a* bearing on nose 48 displaces block 38 and with it surface 44 of slide member 44 against the action of springs 35 and 36 away from contact with the periphery 3 of a slice 1 namely to a loading position as seen in FIG. 5. At the same time, the piston rod 32 of cylinder 31 is retracted to swing arm 28 away from an engaging position with a slice 1 on the chuck 7, also as seen in FIG. 5. The two cylinders 31 and 53 may be activated concurrently or sequentially to bring the respective piston rods 32 and 52 and with them respective levers 28 and 49 to the position of FIG. 5 which is alternatively a loading position and unloading position for successive slices 1 that are to be pre-aligned.

Similarly the two cylinders 31 and 53 may be activated to move respective piston rods 32 and 52 reversely to the gripping position shown in FIG. 6 at which time the rollers 30 of lever 28 engage the periphery 3 of a slice 1 that has been mounted on chuck 7 and at the same time the flat surface 44b of slide member 44 is biased by springs 35 and 36 against the periphery 3 of the mounted slice.

A pair of spaced apart photoelectric cells 54 are mounted in block 38 which respectively are adapted to be activated by light from lamps 55 also mounted in block 38 via optical prisms 56 of glass or other suitable optical material. These cells 54 are so located with respect to the flat surface 44*b* of slide member 44 that while the latter engages the curved periphery 3 of a slide, lights from lamps 55 are projected freely via the prisms 56 to the respective photoelectric cells maintaining them in activated state. However, when the flat 2 of a slice becomes fully seated on the flat surface 44*a* of the slide member 44 as will be presently described, the body of slice 1 projects into the paths of light from

lamps **55** and blocks transmission of light from the latter to said cells **54** deactivating them. This deactivation of said cells is utilized to sense detection of the flat on the slice via suitable circuits and stop rotation of the chuck bearing such slice when said flat becomes seated on the flat surface **44**b of slide member **44.**

OPERATION

Operation of the slice pre-aligner as hereinabove described is as follows.

The bar or arm **28** and the block **38** with the flat surface **44***b* of slide member **44** are manipulated by the respective cylinders **31** and **53** to the loading and unloading position of FIG. **5.** At this time a slice **1** is applied onto the perforate surface **6** of vacuum chuck **7** and vacuum effected from source **27** to chamber **8** of chuck **7** and perforations in surface **6** to hold the slice **1** securely on said surface. This application of slice **1** may be effected manually or by feeding it on a reversible conveyor C to the loading station of FIG. **1** at which time the loading or unloading condition of FIG. **5** is present. When the conveyor C is utilized, transfer of the slice from the conveyor C to said chuck may be effected by a suitably directed air blast directed obliquely to the upper surface of the slice on the conveyor to blow it onto the surface **6** of the chuck **7.** During such blowing of the slice onto the surface **6** of the chuck air is blown into the chamber **8** via tube **9** to provide a support film via perforations in chuck surface **6** for the slice being blown into said surface. A photoelectric cell (not shown) may be utilized to cut off the oblique air blast and create suction in chuck **7** from source **27** when the slice is properly oriented on the chuck surface. This same cell may serve to initiate subsequent operations of the pre-aligner or if a slice is manually located on the chuck, subsequent operations may be initiated manually.

After a slice has been properly positioned on the chuck **7,** either manually or automatically from conveyor C, the air cylinders **31** and **53** are activated to establish the gripping position of FIG. **6,** at which time the rollers **30** of bar **38** engage the curved periphery **3** of the chuck mounted slice and the flat surface **44***b* of slide member **44** is biased against the same curved periphery of the mounted slice. Then the motor **14** is activated to rotate the chuck **7** via intermeshing gears **12** and **11,** for example, in the clockwise direction. At the commencement of such rotation, the slide block **44** is in the position shown in FIG. **7** with the protuberance **43** at the right end of recess **47** and the pins **41** and **42** near or at the left ends of slots **45** and **46.** The surface **44**b of said slide block is biased against the curved periphery **3** of slice **1** and frictionally engaged therewith. As soon as clockwise rotation of chuck **7** and slice **1** begins, the slide block moves laterally leftward to the position shown in FIG. **8.** In both positions the curvature of the periphery **3** of slice **1** permits transmission of light from the lamps via prisms **57** to the photoelectric cells **56.** As clockwise rotation continues, the flat **2** of slice **1** moves onto and is seated on the flat surface **44**b of the slide member **44** as seen in FIG. **9** at which time the body of slice **1** interrupts the paths of light via the prisms **57** to the photoelectric cells **56,** deactivating them. This deactivation through appropriate computer and electric circuits deactivates the motor **14** which has been rotating the chuck **7** and the slice carried thereon. However, residual inertial energy of the chuck causes the slice and chuck to continue some residual clockwise rotation so that the flat **2** overshoots the flat surface **44**b of slide member **44** and comes to a rest position at which time the lagging edge **5** of the slice flat **2** bears against the flat surface **44**b of slide member **44** as seen in FIG. **10** while its leading edge **4** is free of said surface.

At this time the biasing forces are exerted by springs **35** and **36** and are transmitted via block **38** to slide member **44.** These forces are of sufficient magnitude to effect a slight counterclockwise rotation of slice **1** as seen in FIG. **11** with concurrent rightward displacement of slide member **44** which causes the flat **2** to reseat itself on the flat surface **44***b* of said slide member so that pre-alignment of the said slice **1** with respect to its flat **2** is completed.

Subsequent to completion of this pre-alignment of the slice, fluid or air pressure in cylinder **17** from a source via inlet **18** is removed and piston **16** moves downwardly in cylinder **17** carrying with it the tubular shaft **9** of chuck **7** together with block **10,** so that the chuck **7** seats on the turntable **19** above opening **24** while shaft **9** and bearing block **10** pass downwardly through said opening to clear the underface of said turntable **20.** The turntable **20** bearing the chuck **7** seated thereon and containing the pre-aligned slice **1** is then rotated to a final orientation station as seen in FIG. **1** where final exact alignment of the pre-aligned slice may be effected manually as by using a microscope and a masked pattern by suitable automatic means. During rotation of turntable from the pre-alignment station to the final exact alignment station vacuum is maintained in chuck chamber **8** and via the preforations in its surface **6** on the pre-aligned slice through a secondary source (not shown) which becomes activated at the same time the vacuum from source **27** has been cut off.

Upon completion of the final alignment of the pre-aligned slice, the turntable is rotated in reverse direction to return the chuck **7** now bearing the finally aligned slice to the original loading and unloading station of FIG. **1** at which pre-alignment had previously been effected. The chamber **17** below piston **16** is then supplied with air or fluid under pressure to elevate piston **16** to its original position shown in FIG. **2** at which time also the shaft **9** and bearing block **10** are elevated through opening **24** of said turntable to the original position shown in said FIG. **6.** Then the pistons of cylinders **31** and **53** are activated to retract their respective piston rods **32** and **52** and to pivot bar **28** and also swing block **38** against the biasing action of its support springs **35** and **36** away from the periphery of the aligned slice **1.** Vacuum in chamber **8** via shaft **9** is cut off and the slice manually removed. Optionally air pressure may be introduced into chuck chamber **8** which via perforate surface **6** elevates the now fully aligned slice relative to surface **6.** Then an air blast (not shown) may be directed obliquely against the upper surface of fully aligned slice to direct it onto the conveyor belt C whose direction of movement is then reversed to carry the slice away from the pre-aligning station.

The same sequence of operations is effected for the respective succeeding slices that are first desired to be pre-aligned by use of their flats as described above and finally aligned after such pre-alignment.

The provision in the pre-aligning device of the slide block with limited lateral slidability during pre-aligning

rotation of the chuck held slice provides a solution for the wear problem occurring in known pre-alignment devices wherein the flat sensing surface is provided on a rigidly positioned member instead of on a laterally sliding member. When a rigidly positioned member is utilized the overshoot of the flat on the slice and the engagement of the edges of the slice flat, and particularly the lagging edge on the rigid block surface has a wearing effect on the rigid surface which ultimately wears a pit into such surface which prevents counterclockwise reseating action of the flats of succeeding slices and destroys the accuracy of pre-alignment of such succeeding slices. This problem with rigid flat surfaces has been found to occur regardless of how hard the flat surfaces are. Even sapphire surfaces on rigid members have been pit-worn with consequent destruction of the desired pre-alignment of slices. In contrast, when the sliding member is used instead of the rigid member, the problem of wear becomes immaterial and to all practical purposes is eliminated. This is so because during clockwise rotation the slide member is shifted laterally and during counterclockwise rotation and final seating of the flat on the flat surface of said slide member, the slide member is reversely shifted laterally, so that substantially no wear by the edge of the slice on the flat surface of said slide member occurs. Moreover, even occurrence of some wear has no effect on the alignment because the flat of the slice seats itself on portions of the flat surface of the slide where no wear can or does occur during the pre-alignment operations.

While a specific embodiment of the invention has been described, variations in structure within the scope of the appended claims are possible and are contemplated. There is no intention of limitation to the exact disclosure herein presented.

What is claimed is:

1. In a device for pre-aligning a slice of material having a flat on its periphery with leading and lagging corners defining said flat with respect to said periphery, and wherein said slice is held in a drivable rotatable chuck means for rotating said chucks and means for stopping driven rotation of said chuck and said slice when a flat of said slice is sensed, that improvement comprising a laterally slidable member having a flat surface engageable with said periphery and flat, a support for said slide member, having a low coefficient of friction on which said laterally slidable member is mounted for limited lateral slide thereon in two opposite directions, means for limiting the extent of said slide on said support, biasing means for said flat surface of said slide member for biasing it toward engagement with the periphery and flat of a slice held by said chuck, said member being slid laterally in one of its two directions upon rotation of said slice held by said chuck until said flat is sensed by seating on said slidable member at which time driven rotation of said slice and chuck ceases, residual inertia at cessation of driven rotation permitting an overshoot in undriven like rotation of the slice and chuck at said cessation until the lagging corner of said flat engages said flat surface, said biasing means then exerting a reversely directed rotational force on the slice carried by the chuck to an extent sufficient to reseat said flat on said flat surface of said laterally slidable member and simultaneously shift said laterally slidable member in the second of its two directions.

2. In a device according to claim **1** photoelectric sensing means for detecting the seating of said flat on said flat surface.

3. In a device according to claim **1** said biasing means comprising spring members, a block carrying both said support and said laterally slidable member.

4. In a device according to claim **1,** said slidable member having a recess and at least one elongated slot, and a protuberance and pin means carried by said support for permitting said limited slide of said sliding member.

5. In a device according to claim **1,** said chuck being of suction type to hold a slice during pre-alignment thereof.

6. In a device according to claim **1** a movable arm movable to and away from the periphery of a slice mounted on said chuck cooperating with said biasing means, and means for applying suction via a chamber in said chuck to said slice so as to maintain said slice securely in position on said chuck during pre-alignment of said slice.

7. In a device according to claim **1,** means for transferring a slice after pre-alignment to a final alignment position.

8. In a device according to claim **7,** said means for transferring a slice after pre-alignment comprising a rotatable turntable and means for moving and depositing a pre-aligned slice together with said chuck onto said turntable.

9. In a device according to claim **8** wherein said last-named means includes a drive shaft for rotating said chuck, and pressure operated piston means for moving said shaft and chuck selectively into and out of deposit onto said turntable.

10. In a device according to claim **1,** means for sensing seating of said flat on said flat surface comprising photoelectric cells, means for directing light to said cells, said cells being positioned with respect to said slice that light to said cells is interrupted when said flat is seated on said flat surface.

11. In a device according to claim **1,** means for positioning said slice on said chuck including a pivoted bar, roller means on said bar engageable with said periphery, means for pivoting said bar toward and away from said periphery and means for selectively countering said biasing means to permit loading of said slice on to said chuck.

12. In a device according to claim **1,** said support having a surface of Teflon with a low friction coefficient, on which surface said laterally slidable member may slide, said member having elongated slots parallel to said support surface, and rigidly mounted stop pins in said slots to limit the extent of slide of said member.

13. A device for pre-aligning a slice having a flat on its periphery comprising means for rotating said slice, a slide member having a plane surface engageable with said periphery, said slide member being movable laterally during engagement with said periphery during rotation of said slice, means for biasing said flat surface toward said periphery, means for sensing seating of said flat of said slice on said plane surface and stopping rotation of said slice, said slice however inertially overshooting rotation of said slice and its flat beyond the sensed seating on said flat on said surface, and said biasing means then forcing said flat surface of said slide member to effect reverse rotation of said slice suffi-

ciently to reseat the flat of said slice on said flat surface.

14. A device according to claim **13** including a support of material having a low coefficient of friction for said slide member and means for limiting the extent of slide of said slide member relative to said support, and the flat surface of said slide member being of hard wear resistant material.

15. A device according to claim **14** wherein said last named means include slots on said slide members and pins extending from said support and engaged in said slots.

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