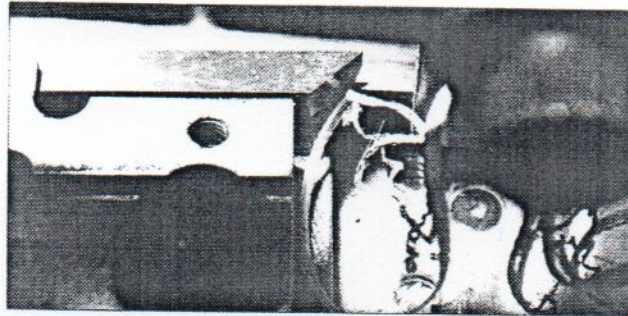


BEVELING AND EDGE POLISHING



1. THE PROCESS

A roller or drive belt transport mechanism, pushes the sides (edges) of sheared or cut to size panels past skiving cutter blade assemblies; a Fiberglas/copper chip is generated resulting in panels with smooth and polished edges.

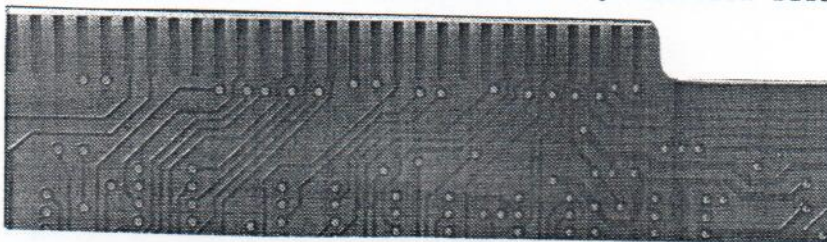


2. EQUIPMENT'S CAPABILITIES

A) BEVELING

1/ The strip/contact edges of printed circuit boards are beveled to facilitate the "plugging in" of these contact strips into the edge connectors. Most commonly used angles are: 20°, 50°, 60° and 90°. Both sides are beveled at the same time. The bevel depth can be changed by adjusting the fence position. Also uneven bevel depths per side are possible. The scrap gold on the gold finger shavings, can be reclaimed.

2/ Rounding of the board edges improves sliding inside the guide rails during assembly or disassembly of the PC boards. Finished panel size corrections with increments of .004" (0.1 mm) can be realized on a production basis.



B) EDGE POLISHING

Do these problems sound familiar?

1/ Unclean edges and angles creating "nodules" (copper build up) during plating, causing damage to the film or the photoresist layer.

2/ Edge burs created during shearing or cutting, preventing tight stacking. The resulting space between the panels allows burs on the edges of drilled holes to form; in addition, resulting increase in tension between the panels is causing drills to break.

3/ From the panel edge protruding and consequently fractured epoxy particles sticking to film and panels, obstructing correct exposure; necessitating re-touch and rework to prevent bridging or line interruption on the final product.

4/ Chips contaminating paint during silk-screening, causing etch and plating errors.

5/ Glass and epoxy particles from the sheared and cut edges ending up in the plating tanks, forcing frequent cleaning and premature replacement of the expensive chemicals.

This process eliminates the following problems:

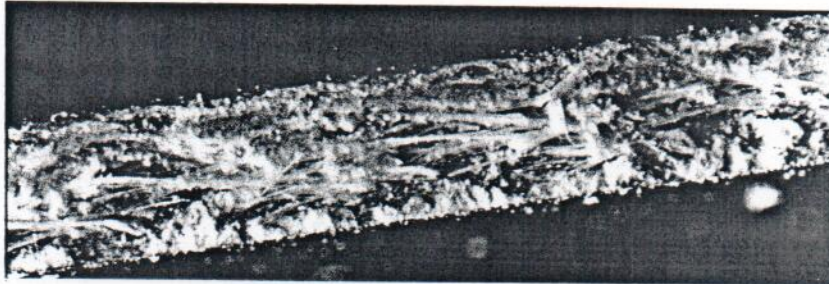
- Scratching of panels
- Edge copper build-up
- Fiber particles in plating tanks
- Spaces between panels during stacking
- Exclusion during photoresist lamination
- Inaccurate edge positioning during automatic processing

Therefore:

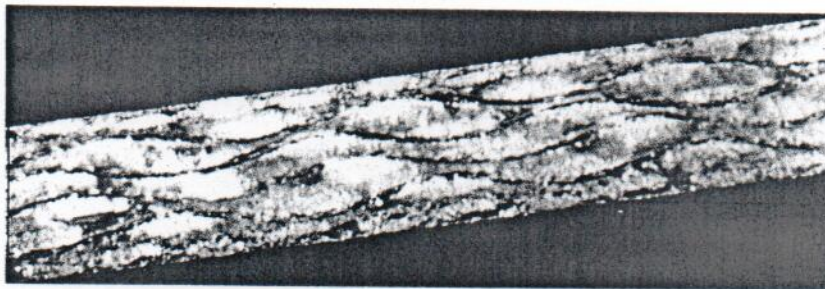
Edge polishing after shearing or cutting!

— AN ECONOMICALLY SOUND INVESTMENT —

Fiberglass and epoxy particles are the cause of many production problems.



The smooth, polished edges are clearly visible.



3. REFERENCES

To date, there are over 2000 machines using the skiving principle:

- over 1700 BEVELMASTERS
- over 300 BEVELMATE
- over 300 EDGEMATE

WORLD WIDE!

An extensive customer list is available on request.

4. THE EQUIPMENT AND ITS APPLICATIONS

For technical details, see product information sheets.

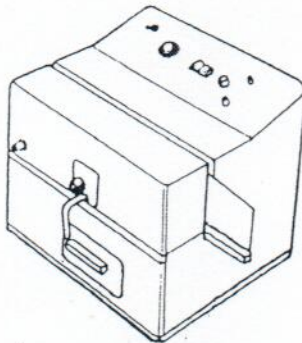
The common characteristics of these machines, are:

* Environment friendly, i.e. no noisy spindles and a minimum of airborne particles * Both sides or edges, are machined in a single pass, without the need for special adjustments * Variations in material thickness does not require machine adjustments * Excellent repeatability of the bevel heights * Polished edges, with or without radii * Minimum amount of maintenance is required *

This is economically only possible, because of this applied technology. Our equipment manufacturer has already recognized this, for well over 10 years. Machine reliability has been proven a thousand fold since then.

The somewhat higher investment, when compared to a simple de-burring machine, is richly compensated for by the increased productivity of 60 feet (18 m) per minute through put, the long tool life, the low tooling costs, plus all the advantages mentioned above.

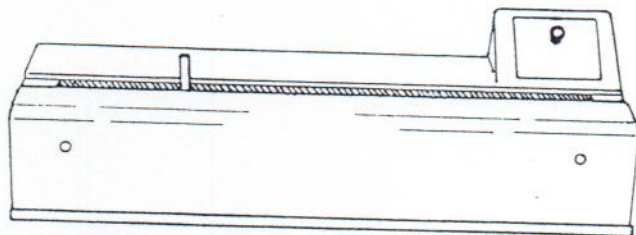
BEVELMASTER



This model offers universal application possibilities, beveling as well as edge polishing.

The panels are transported by a belt system. Tool holders, complete with different cutter blocks, allow for quick angle change over. Bevel height is adjusted by turning a knob. Collection tray for gold scrap is built-in. Accessories for attaching a central vacuum system to handle small or medium size shavings are available. Standard machine can handle panels as short as 3 1/2" (90 mm); 2" (50 mm) with a small board accessory.

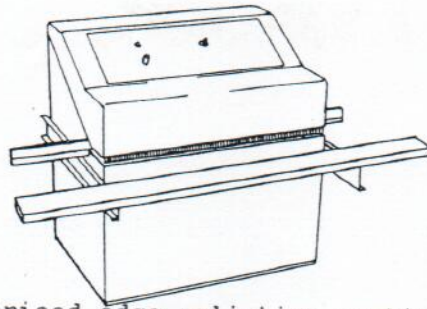
BEVELMATE



This machine has been designed especially, for difficult beveling and edge polishing applications.

The panels are clamped individually and pushed pneumatically across the skiving cutter blade. The BEVELMATE is ideal for jobs, which because of the shape or panel construction are otherwise impossible. Examples are: recessed contact strips, very small PC boards or boards with unfavorable length/width ratios and stuffed boards.

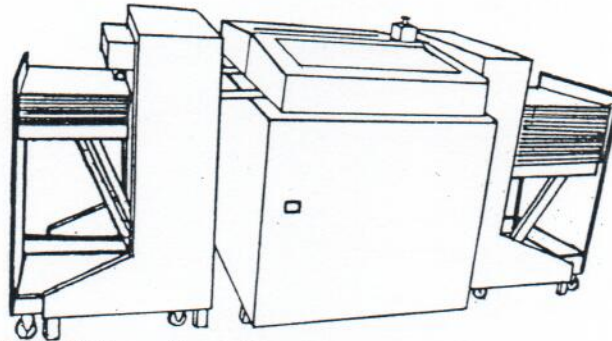
EDGEMATE



A sturdy and economically priced edge polishing machine, for 10" (250 mm) long panels and up.

Powerful panel transport mechanism with urethane coated wheels and an excellent exhaust scoop for even the most tenacious shavings. Capable of handling thick boards, such as multilayer boards which need to be polished after laminating and cutting to size; and thin Fiberglas reenforced panels as thin as .016" (0.4mm), without changing the original set up. Even slightly warped boards cause no problems.

EDGEMATE 2 + 4



By combining several EDGEMATE units, 2 or 4 sides can be polished in one pass. Adjustment for panel width is simple. The distance between the opposite heads can be increased with a positioning motor, until the panel fits in between; and be brought together until a switch automatically stops the inward travel, after making contact with the edge of the panel. Panel variations of up to .08" (2.0 mm) have no effect on the results.

The equipment can be fitted with automatic loading and unloading robots, including transport carts.

5. CUTTING TOOLS AND TOOL LIFE

Minimal tooling costs:

BEVELMASTER - Tool life per sharpening: 10,000 linear feet (3 km). Up to 50 re-sharpenings are possible; i. e. 500,000 feet (150 km) for 200.- DM.

BEVELMATE - In spite of the intricate cutter shape, aprox. 10 re-sharpenings are possible.

EDGEMATE - Approximately as many as 100 re-sharpenings with .012" (0.3 mm) are possible. Only +/- 2 minutes per tool are needed, with our special designed re-sharpening machine.

EDGEMATE 2 - Based on 5,000 to 7,000 panels (10" x 16" or 260 mm x 400 mm) per day; in one year, all 4 sides can be polished with a total of 40 cuttes (investment of 8,000.- DM). Comparable calculations for rotating diamond cutters are at least 10 times higher, i. e. cost savings on cutters alone, will amortize the total investment for an EDGEMATE.

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