

Working On Glass

Machine grinding, polishing and
figuring of large thin telescope
mirrors

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Doing is better than being paralyzed by design fear problems

Grinding and polishing machine

- Built a versatile, modular, multi-mode grinding and polishing machine for working on large thin mirrors
- Machine built to allow modifications, adaptations and experimentation
- Very little sensible information available in the literature or on the web, especially that dealing with machine figuring - typical manual strokes do not always work as desired
- Machine provided opportunity to research some of these issues, especially the use of various sub-diameter laps and in controlling the outer edge of mirror

Machine construction

- Central module containing rotating table (old washing machine remnants) – golfcart motor
- Two removable side modules – welded frame holding vertical spindle, crank, adjustable crank-pin, variable speed DC motor and gearbox
- Modules can be mounted either adjacent to each other or opposite each other making different modes and motions possible
- Crocodile with adjustable offsets and four cylindrical buffers to restrain mirror and allow automatic rotation of mirror with MOT to combat astigmatism during grinding and polishing
- Side arm to control lateral motion
- Other arms and frames developed over time to extend capability with sub-diameter tools

Grinding and polishing modes

- Zeiss mode with arms at right angles – crocodile frame for MOT or simple slotted wooden arm or frame to hold TOT for sub-diameter polishing laps
- Hindle mode with frames opposite
- Draper/Ritchie modes with frames opposite – TOT using sub-diameter polishing laps held by telescopic wooden arm
- Mirror-O-Matic type fixed over-arm hypocycloidal mode using Zeiss or telescopic Draper arm with mirror table spinning at higher speed, allowing sub-diameter polishing lap to auto-rotate
- Central spindle and table can rotate continuously or be pulsed at controllable intervals and durations

A modular multi-mode grinding and polishing machine for large thin mirrors

Zeiss mode with 20" grinding tool in position waiting for mirror and frame to be placed on top

Telescopic arm being used either in Mirror-O-Matic type hypocycloidal polishing mode or Draper mode



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Hypocycloidal mode using 10" sub-diameter polishing tool held by telescopic Draper arm – mirror spinning face up



Crocodile frame in position on mirror face down on grinding tool, ready for cross arm to be attached – Zeiss mode



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Telescopic arm in Draper mode
– 3.5" sub-diameter Al/pitch tool

Zeiss mode – MOT full size tool – either
grinding or polishing - mirror held by crocodile
frame to allow auto-rotation of mirror



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Wooden adjustable slotted arm in Zeiss mode – 13" sub-diameter tool doing a W-stroke



Wooden frame holding sub-diameter tool between four rollers in Zeiss mode



20" tile tool for grinding

Just after casting – porcelain tiles cast in Hydrastone

Ground to fit mirror



Never waste a piece of glass by using it as a grinding tool!

20" pitch lap for polishing

Full size pitch polishing lap before pressing – Hydrastone base

Full size polishing lap with mirror on top – polishing with Cerium Oxide



20" pitch laps

20" pitch lap cut to 5-star shape
for initial parabolising



Re-doing a 20" pitch lap because of lousy
pitch – messy job!



Sub-diameter laps for figuring

10" scalloped pitch lap cast using a silicone rubber mould

8" pitch lap with hexagonal facets cast using a 20" silicone rubber mould



Moulds for casting pitch laps

Making silicone rubber moulds – routed mould in treated plywood ready for pouring silicone rubber mix



Silicone rubber mould ready for casting laps or loose pitch blocks



Moulds for casting pitch laps

Large 20" rubber mould made using a hexagonal tile mould

10" mould for an experimental spiral lap for hypocycloidal polishing motions

