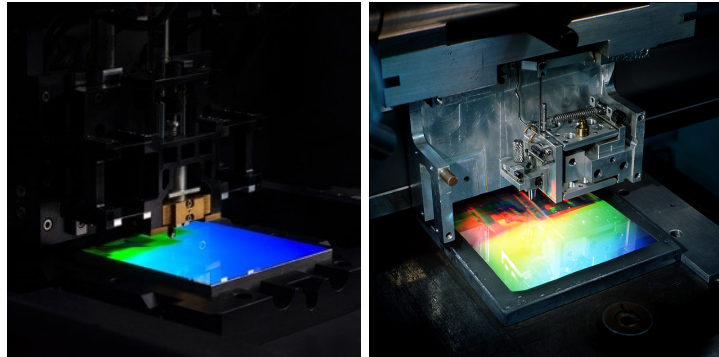


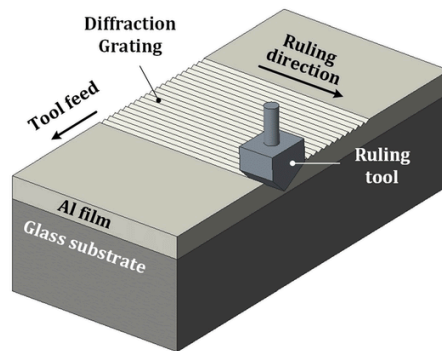
Ruling Machine Planning

Inspiration Images

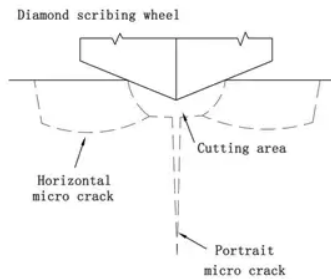
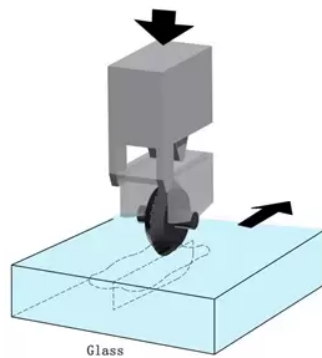
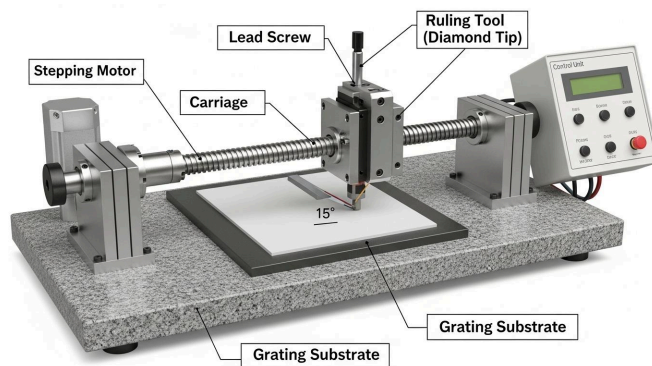
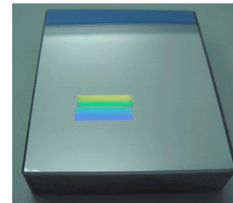


(a)

(b)



(c)



Ruling Engine Components

- A carriage which holds the sample (often a grating blank)
 - CAD then 3D print or CNC mill OR laser cut out of acrylic(?)
- A very sharp tool (typically a diamond point) held in place for altering the sample surface; nano scribe
 - CAD then 3D print or CNC mill

How to make it work

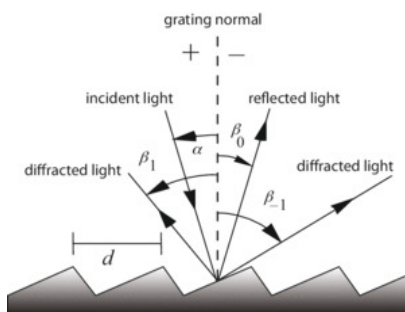
- After each groove is ruled, the carriage moves across by one grating period to rule the next one.
 - Motor control (with code) for 2-axis motion and associated electronics (layout?)
 - Decouple substrate motion from ruling tool (on a wheel)
 - Laser cutting acrylic(?) container
 - Closed-loop positioning using input device (sensors: interferometer, position sensor, limit switch, etc.)
 - Input device to tell it what parameters of what to make (grating size and spacing for instance)

Concerns

- Initial alignment with my interferometer or commercial one
- Quantifying precision of motion system
- Vibration isolation
- Prolonged tool wear due to long travel distances (and sourcing suitable diamond tips)
- Validate using my Michelson interferometer (observe and quantify errors in the ruling motion, plus look at finished workpiece)

What to rule

- Substrate? (aluminum-coated glass?)
- Plane ruled blazed diffraction grating

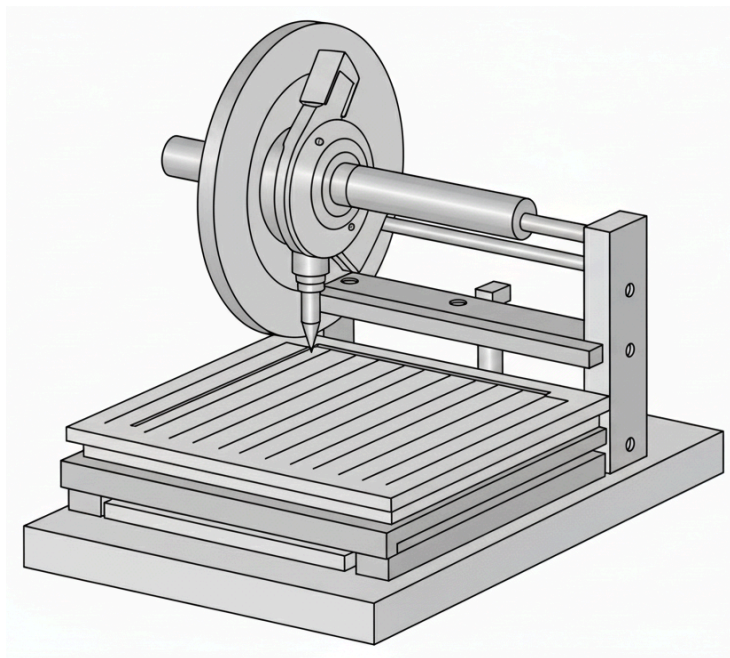


- “Michelson engine is unusual in that it covers the widest range of groove frequencies of any ruling engine: it can rule gratings as coarse as 32 grooves per millimeter (g/mm) and as fine as 5,400 g/mm” [[Newport 1](#)]
- Choose a ruled grating over a holographic one when: low groove density, e.g., **less than 600 grooves/mm** since ghosts and subsequent stray light intensity are proportional to the square of order and groove density [[Horiba](#)]
- What is the MVP in terms of performance/accuracy/etc?

Sources

- [Newport on Ruled Diffraction Gratings](#)
- [Newport Determination of the Blaze Wavelength](#)
- [Horiba on Diffraction Gratings Ruled and Holographic](#) (math)
- [Grating manufacturing techniques for replication including casting](#)
- [Experimental Investigation and Numerical Analysis of Mechanical Ruling for an Aluminum Coated Diffraction Grating](#)

Takeaways from Meeting with Quentin



- Diamond scribe on a wheel
- Single axis flexure motion perpendicular to lines (piezo stage perhaps)
 - Refer to [Zach's diffraction grating](#)
- Aim to make very small but functional grating