MEAM 150
Fundamentals of Mechanical Prototyping

Stirling Fundamentals
Workholding

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Dr. Robert Stirling

Patent 1816

Closed-cycle regenerative hot air engine

Theoretical full Carnot efficiency

Any heat source

Semi-reversible
THERMODYNAMICS OF THE STIRLING ENGINE

Diagram showing the thermodynamic cycle of a Stirling engine with labels for each process:
- \( \text{1} \rightarrow \text{2} \): Isothermal compression (heat rejection)
- \( \text{2} \rightarrow \text{3} \): Isochoric heating
- \( \text{3} \rightarrow \text{4} \): Isothermal expansion (heat absorption)
- \( \text{4} \rightarrow \text{1} \): Isochoric cooling

Diagram of the Stirling engine components:
- Expansion space
- Expansion piston
- Heater
- Working gas (air)
- Regenerator
- Compression space
- Cooler
- Compression piston
- Balance mass
THE JOY OF FIXTURES
GENERAL GUIDELINES

KEEP YOUR PART FROM MOVING

VISE
SCREWS
BOLTS
CLAMPS
ETC.

LOCATE YOUR PART/BLANK

PINS
SHOULDER SCREWS
ETC.
STRAIGHT CLAMPS

- FLANGED NUT
- WASHER

STEP BLOCKS

- STUD
- STRAP
- T-NUT

**Stepped Strap**

- Strap not stepped

Needs 2nd step block to distribute load.
CUSTOM STRAP CLAMPS
CUSTOM FIXTURES
SOFT JAWS

ODD SIZES/SHAPES
MACHINABLE
CUSTOM FIXTURE ELEMENTS

MATERIAL: STEEL VS. ALUMINUM

LOCATING ELEMENTS: ARE SCREWS GOOD ENOUGH?

MACHINE SCREWS  DOWEL PINS  SHOULDER BOLTS