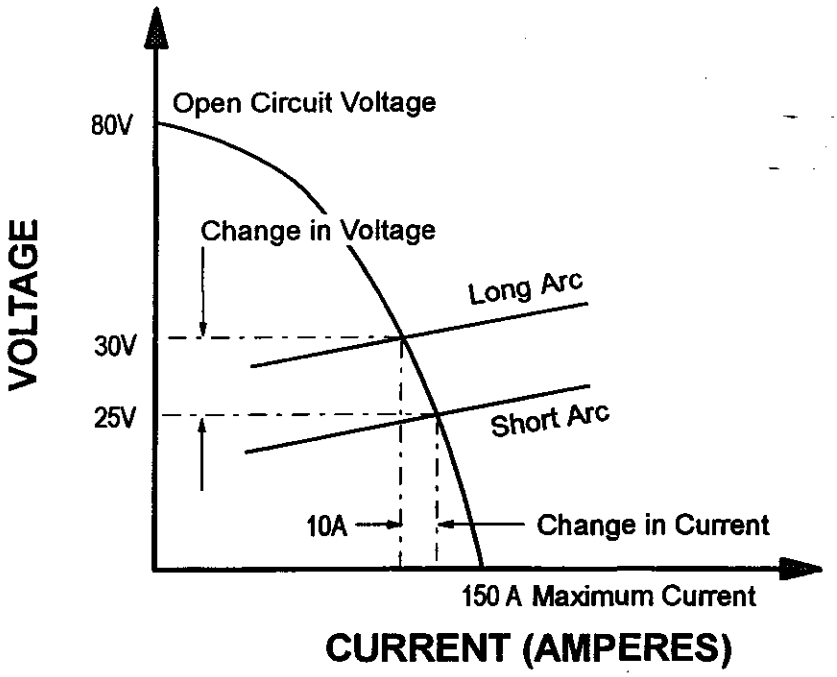
Welding Processes

Welding Power Supplies & Controls

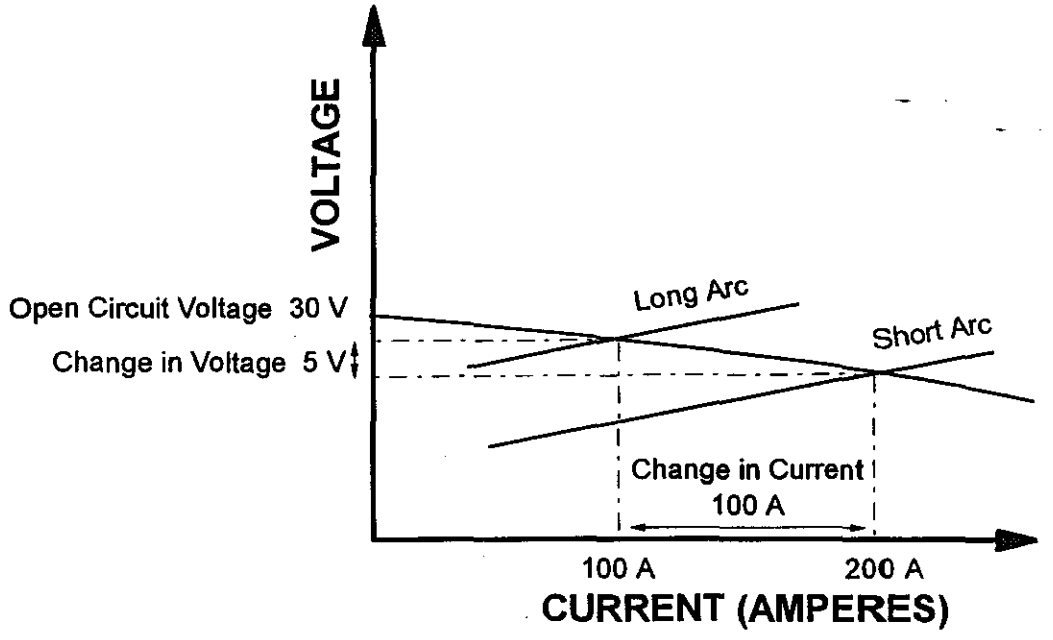
Lecture Scope

- Power Supply Output Characteristics
- Relationship to Welding Processes
- Main Types of Power Supply
  - Transformer
  - Solid state
  - Alternator
- Process Controls

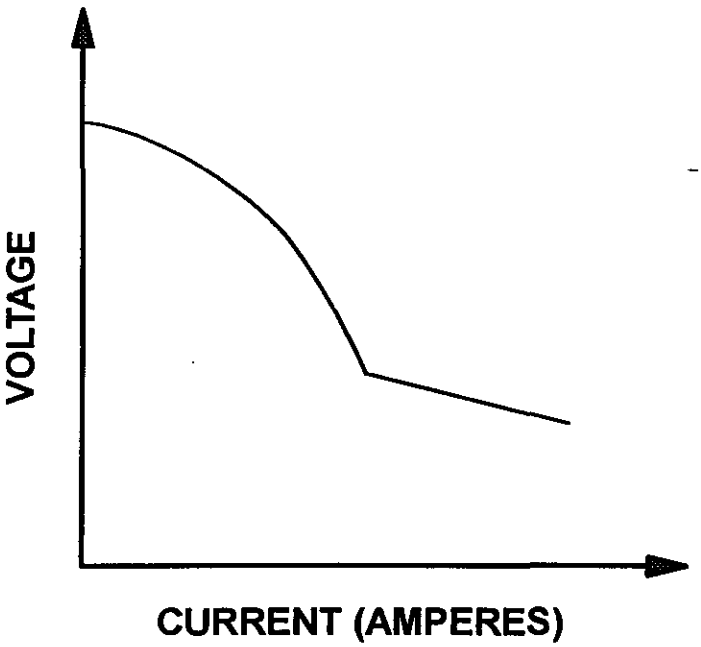
"Drooping" Output Characteristic



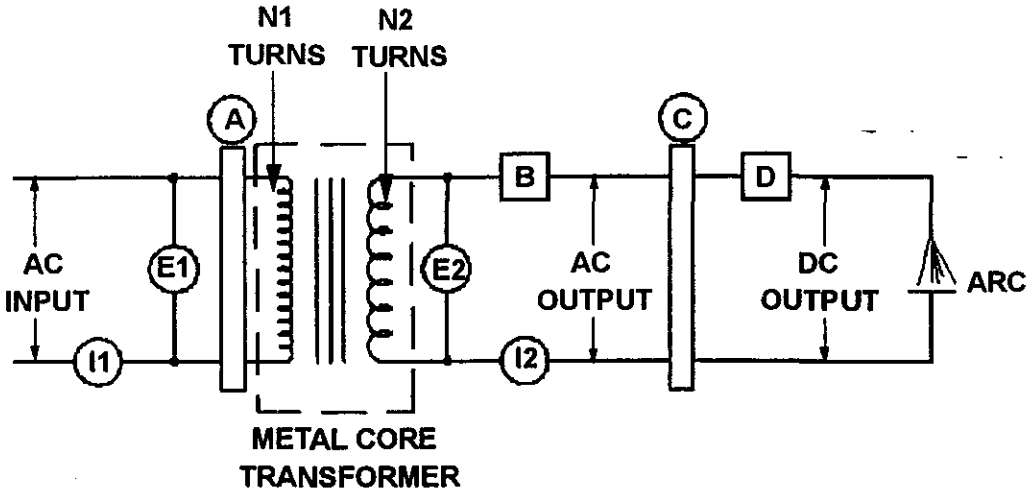
"Flat" Output Characteristic



Combination Volt-Amp Curve



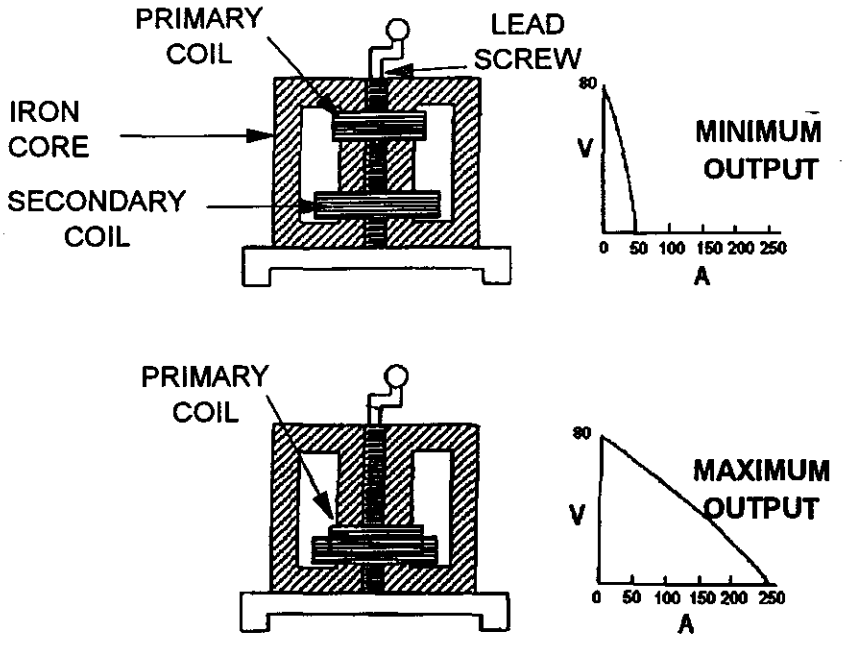
Principal Elements of Transformer Power Supply



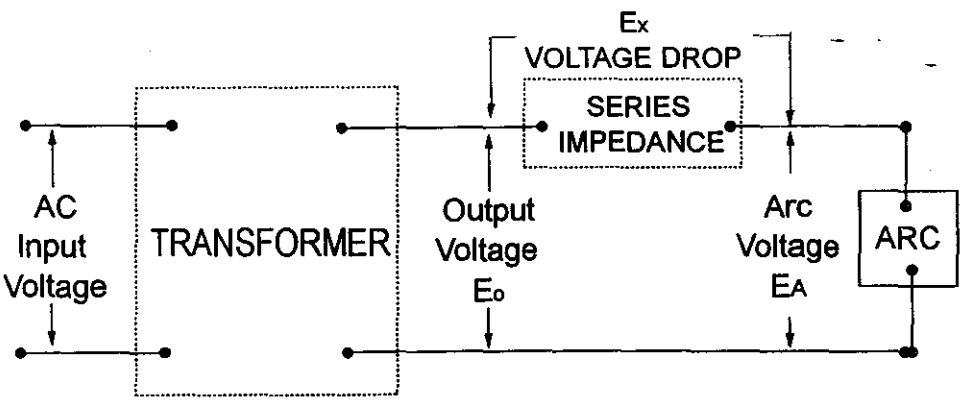
A: Primary solid state inverter if used
B: Series output control if used (AC/DC)
C: Rectifier or SCR control for DC output
D: Secondary switch for chopper type control of DC output

p 6

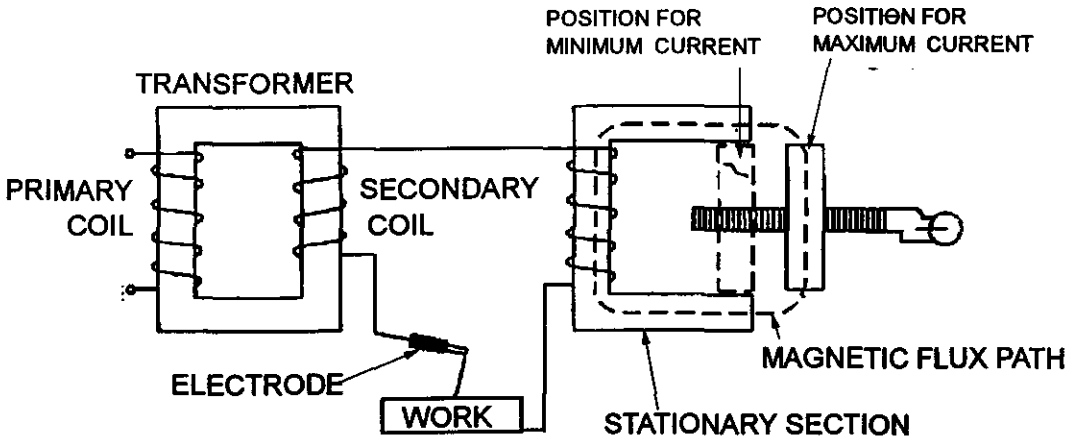
Moveable-Coil AC Power Source



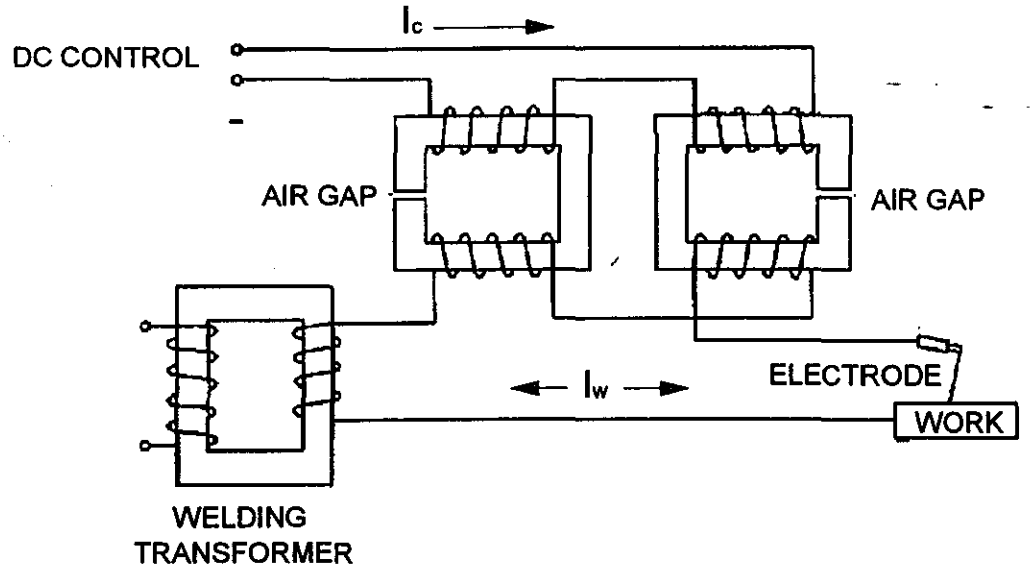
Typical Series Impedance Control



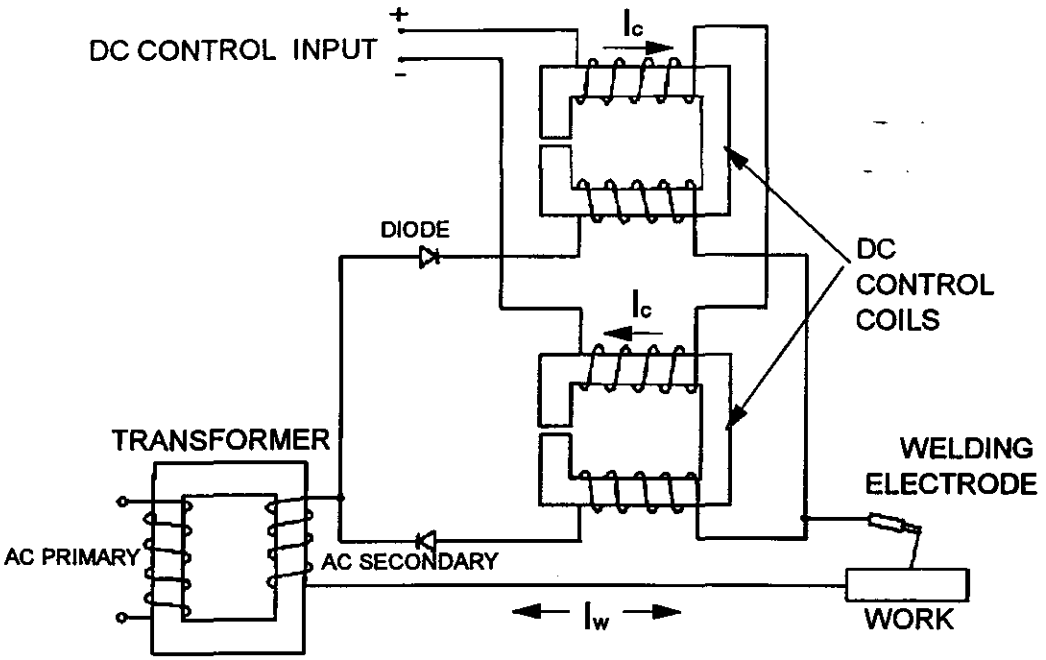
Moveable-Core Reactor AC Power Source



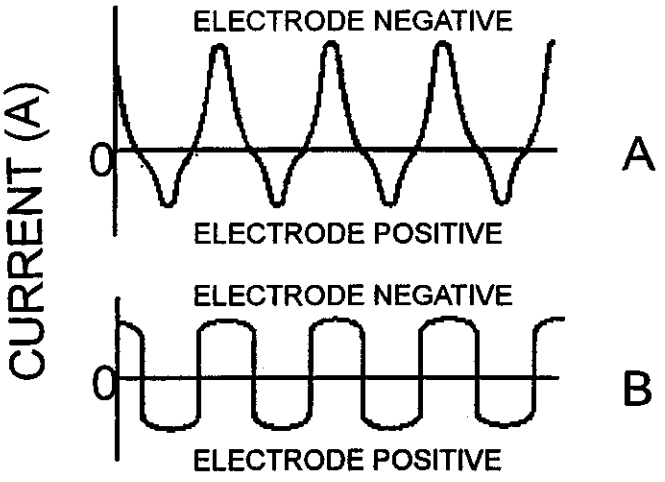
Saturable Reactor AC Welding Power Source



Magnetic Amplifier Control

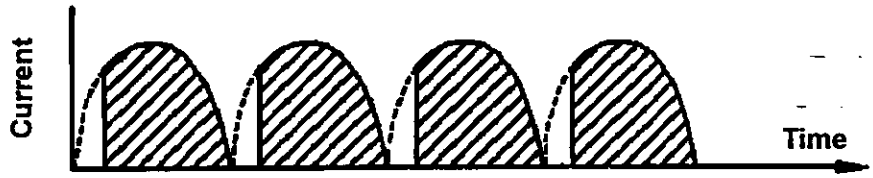


AC Current Waveforms

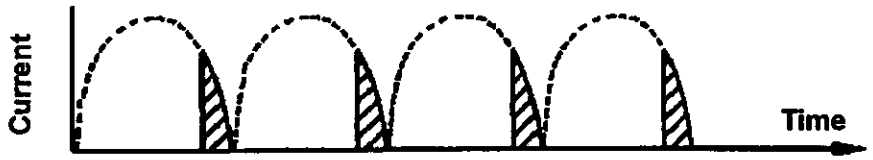


A-Magnetic Amplifier
B-Square Wave

Phase Control Using an SCR Bridge

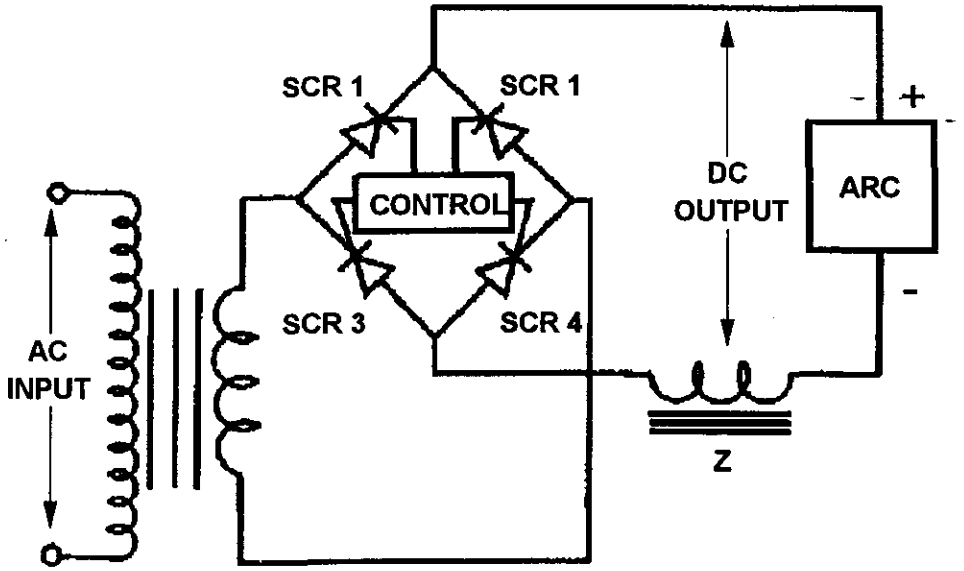


High-power SCRs conducting early in the half-cycle

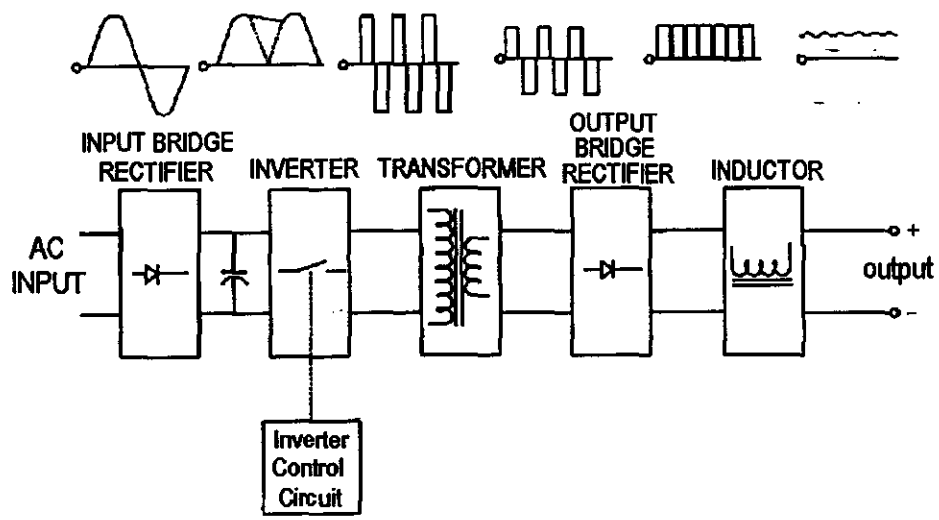


Lower power SCRs conducting late in the half-cycle

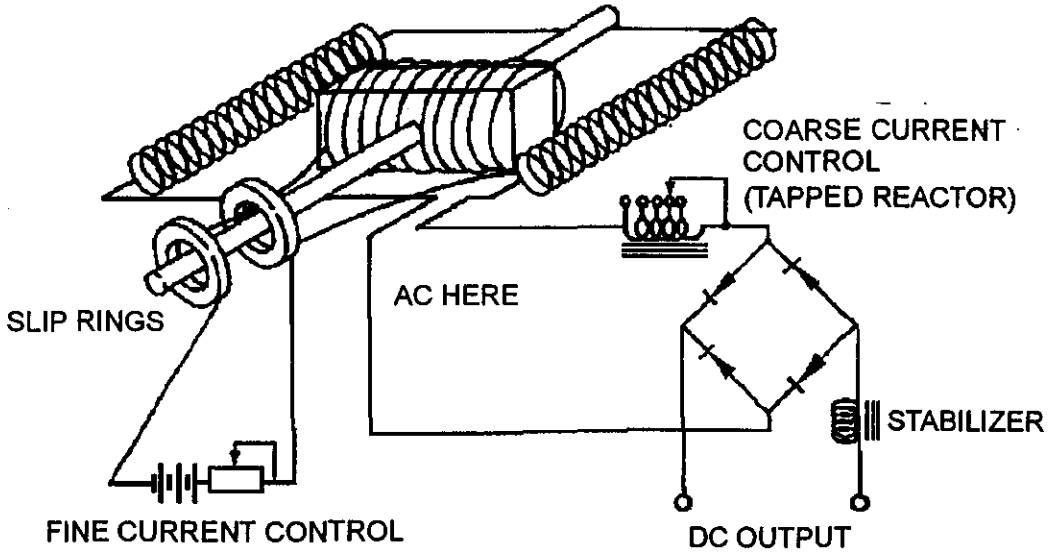
SCR-Controlled DC Power Source



Inverter Power Source



Alternator Type Power Supply

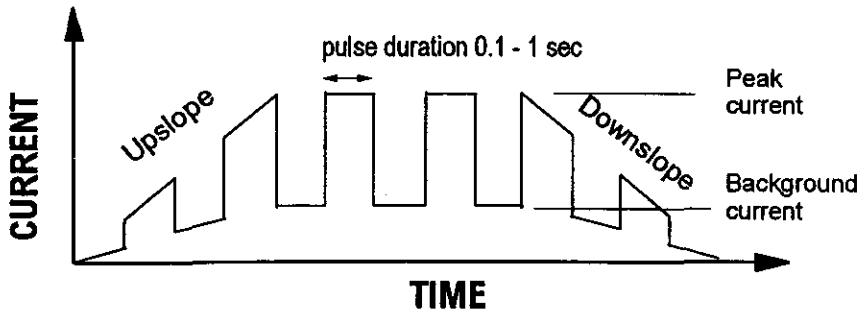


Process Controls

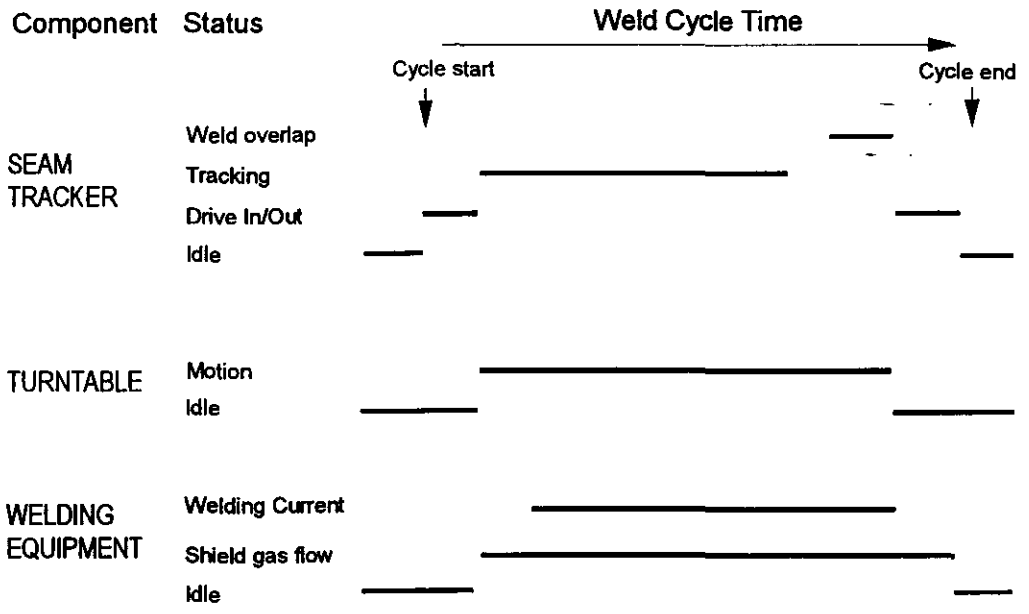
- Welding Current Programming
  - upslope, downslope, crater fill
- Process cycle control
  - co-ordinate operation of welding power, wire feed, weld head motion, shielding gas flow, etc
  - Open loop logic
- Adaptive or feedback control
  - seam tracking
    - arc voltage control, electro-mechanical & optical methods
  - process control

Current Programming

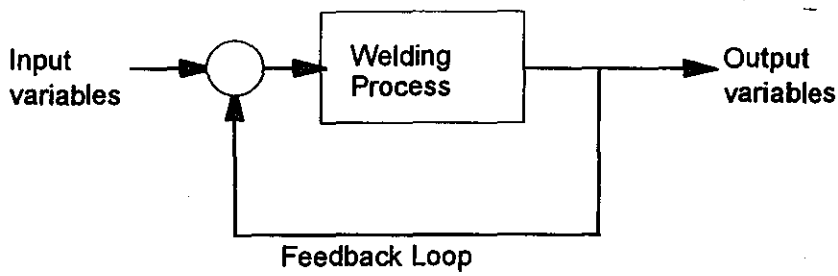
Pulsed GTAW



Process Control

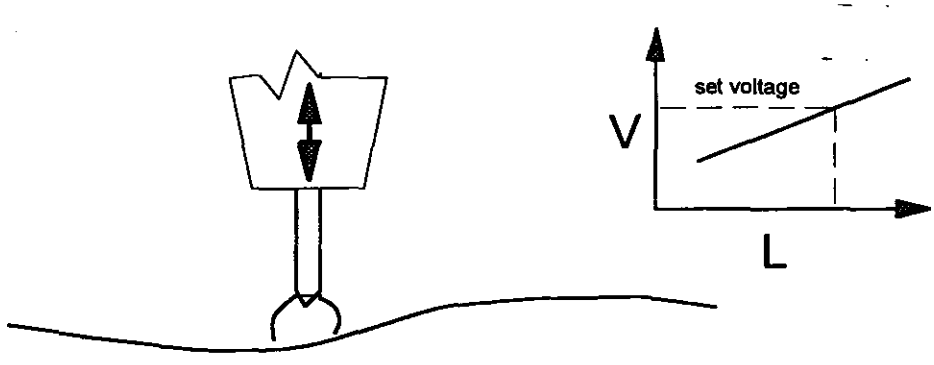


Adaptive Control



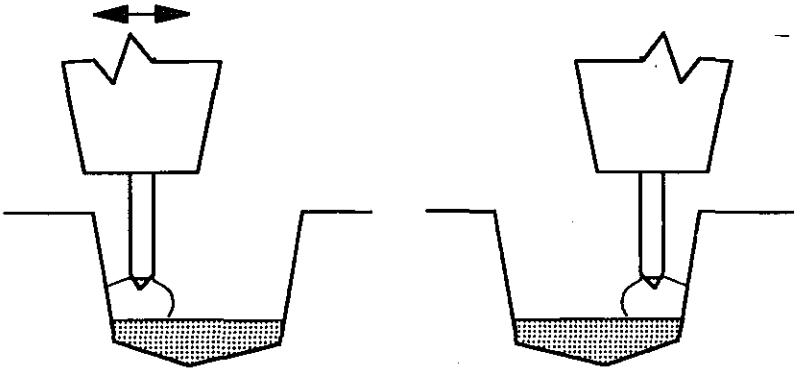
Adaptive control

Arc length control based on arc voltage



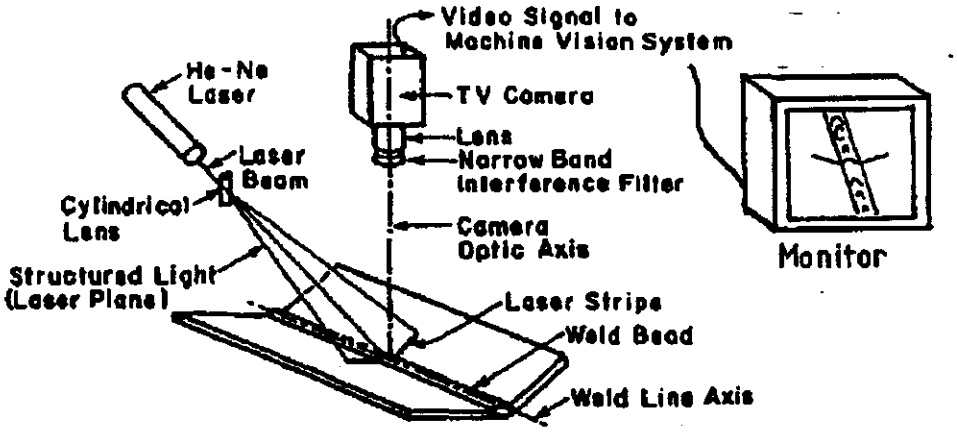
Adaptive Control

Joint tracking using arc voltage sensing



Adaptive control

Optical joint tracking method



Adaptive control

Feedback control of GTAW weld penetration based on photodiodes