Submerged arc welding(SAW)

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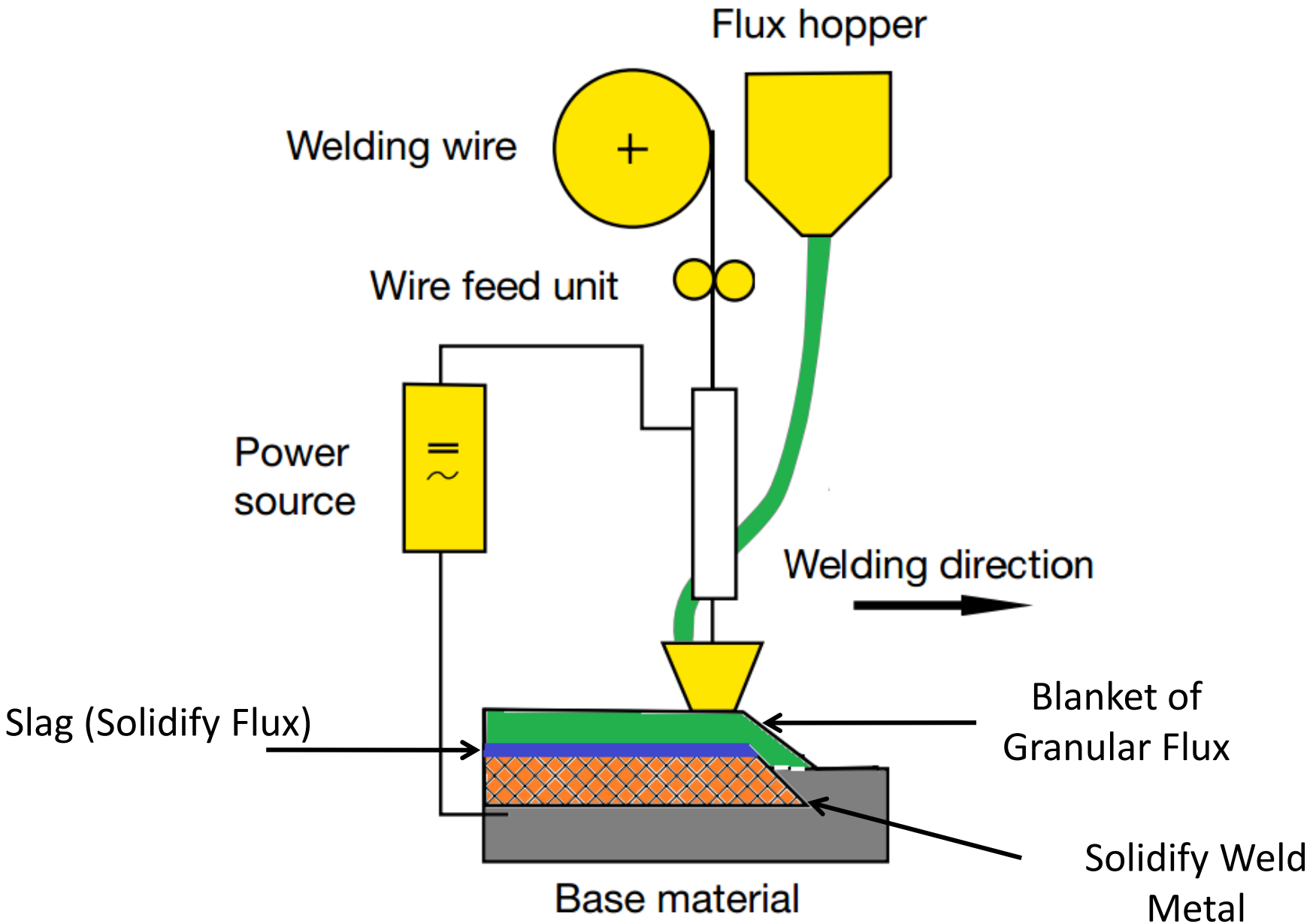
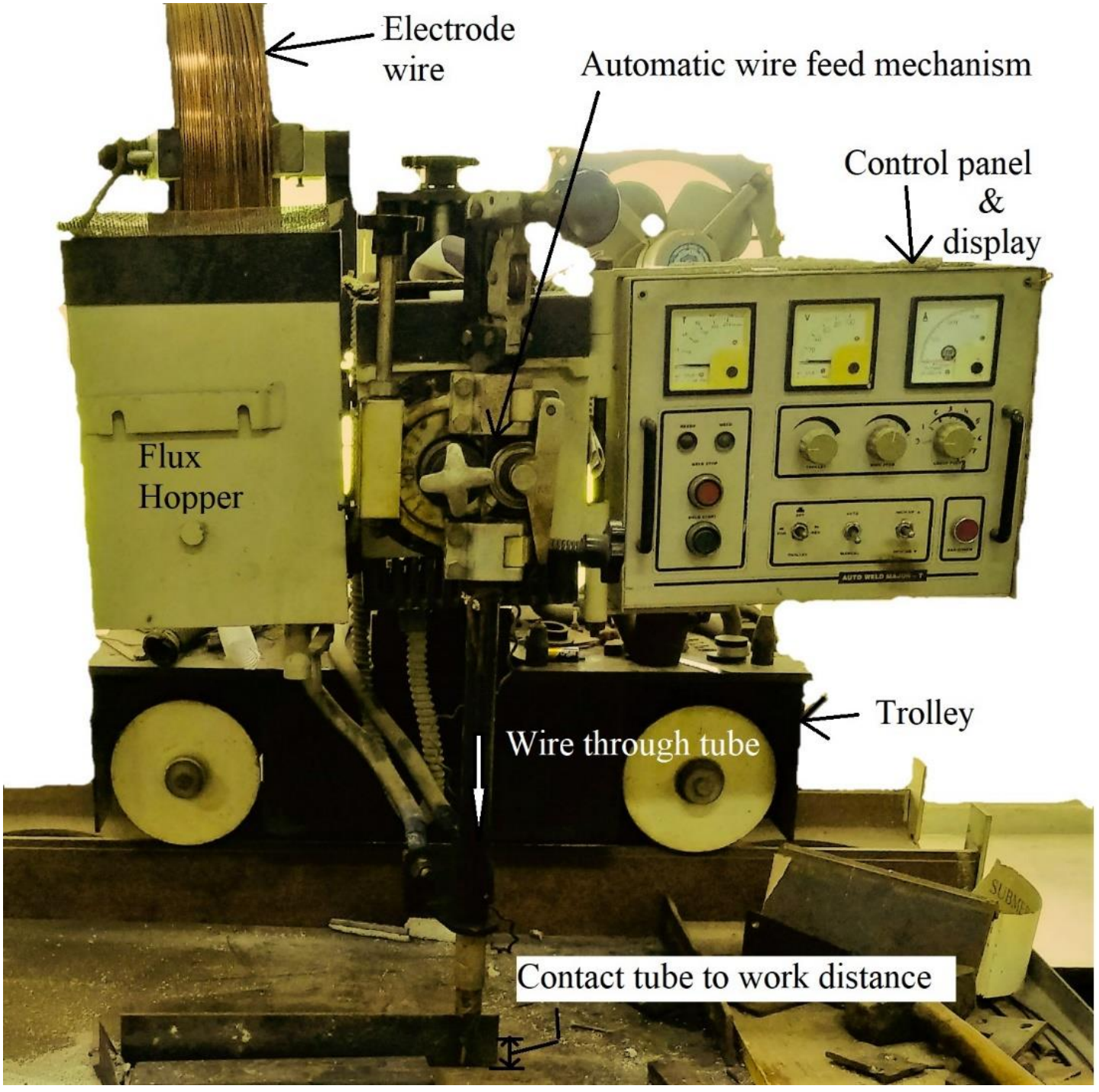
- Submerged arc welding(SAW) is an arc-welding process that uses a continuous, consumable bare wire electrode, and arc shielding is provided by a cover of ***granular flux***.
- ***No shielding gas*** is used in the submerged arc welding (SAW) process.
- The arc is maintained beneath the blanket of flux therefore ***no arc is visible*** (only a few small flames being visible sometimes).


Flux hopper
Welding wire
+
Wire feed unit
Power source
Welding direction
Slag (Solidify Flux)
Blanket of Granular Flux
Solidify Weld Metal
Base material


Electrode wire
Automatic wire feed mechanism
Control panel & display
Flux Hopper
Trolley
Wire through tube
Contact tube to work distance

Submerged arc welding(SAW)

- The portion of the flux closest to the arc is melted, mixing with the molten weld metal to remove impurities and then solidifying on top of the weld joint to form a ***glass-like slag***.
- The slag and unfused flux granules on top provide good ***protection from the atmosphere*** and good ***thermal insulation*** for the weld area, resulting in relatively slow cooling and a ***high-quality weld joint***, noted for ***toughness and ductility.***

Submerged arc welding(SAW)

- The unfused flux remaining after welding can be recovered and ***reused***.
- The solid slag covering the weld must be chipped away, usually by manual means.

APPLICATIONS

- Submerged arc welding is widely used in steel fabrication for structural shapes (e.g., welded I-beams); longitudinal and circumferential seams for
  - ***large diameter pipes,***
  - ***tanks,***
  - ***pressure vessels,***
  - ***welded components for heavy machinery,***
  - ***thick sheets for shipbuilding etc.***

Shipbuilding often requires long welded seams for joining **thick plates**, and process like Submerged Arc Welding is the preferred choice for this task

Image source: https://www.motorship.com/news101/ships-and-shipyards/system-solutions-for-economical-welding

Video Link

https://www.youtube.com/watch?v=H6QGLGJ-BOE

APPLICATIONS

- In these kinds of applications, steel plates of ***25-mm thickness and heavier*** are routinely welded by this process.
- The process is ***not recommended*** for high-carbon steels, tool steels, aluminum, magnesium, titanium, lead, or zinc.
- Low-carbon, low-alloy, and stainless steels can be readily welded by SAW.
- The process is ***not recommended*** for high-carbon steels, tool steels, aluminum, magnesium, titanium, lead, or zinc.

Characteristics/ Advantages

- ***High welding speeds***,
- ***high deposition rates***,
- ***deep penetration***, and
- ***high cleanliness*** (due to the flux action) are all characteristic of submerged arc welding.

- Because the arc is totally submerged, ***high welding currents can be used*** (600 to 2000 A) (5 to 10 times higher than MMAW).
- A welding speed of 0.75 m/min in 2.5-cm-thick steel plate is typical.

Characteristics/ Advantages

- Single-pass welds can be made with penetrations up to 25 mm, and greater thicknesses can be joined by multiple passes.
- Because the metal is deposited in fewer passes than with alternative processes, there is ***less possibility of entrapped slag*** or voids, and weld quality is further enhanced.
- For even higher deposition rates, multiple electrode wires can be employed.

LIMITATIONS

- Limitations to the process include the
  - ***need for extensive flux handling***,
  - ***possible contamination of the flux by moisture*** (leading to porosity in the weld),
  - ***the large volume of slag that must be removed***, and
  - ***shrinkage problems due to the large weld pool.***
- The high heat inputs can produce large grain size structures, and the slow cooling rate may enable segregation and possible hydrogen or hot cracking.
- Welding is restricted to the horizontal position, since the flux and slag are held in place by gravity.