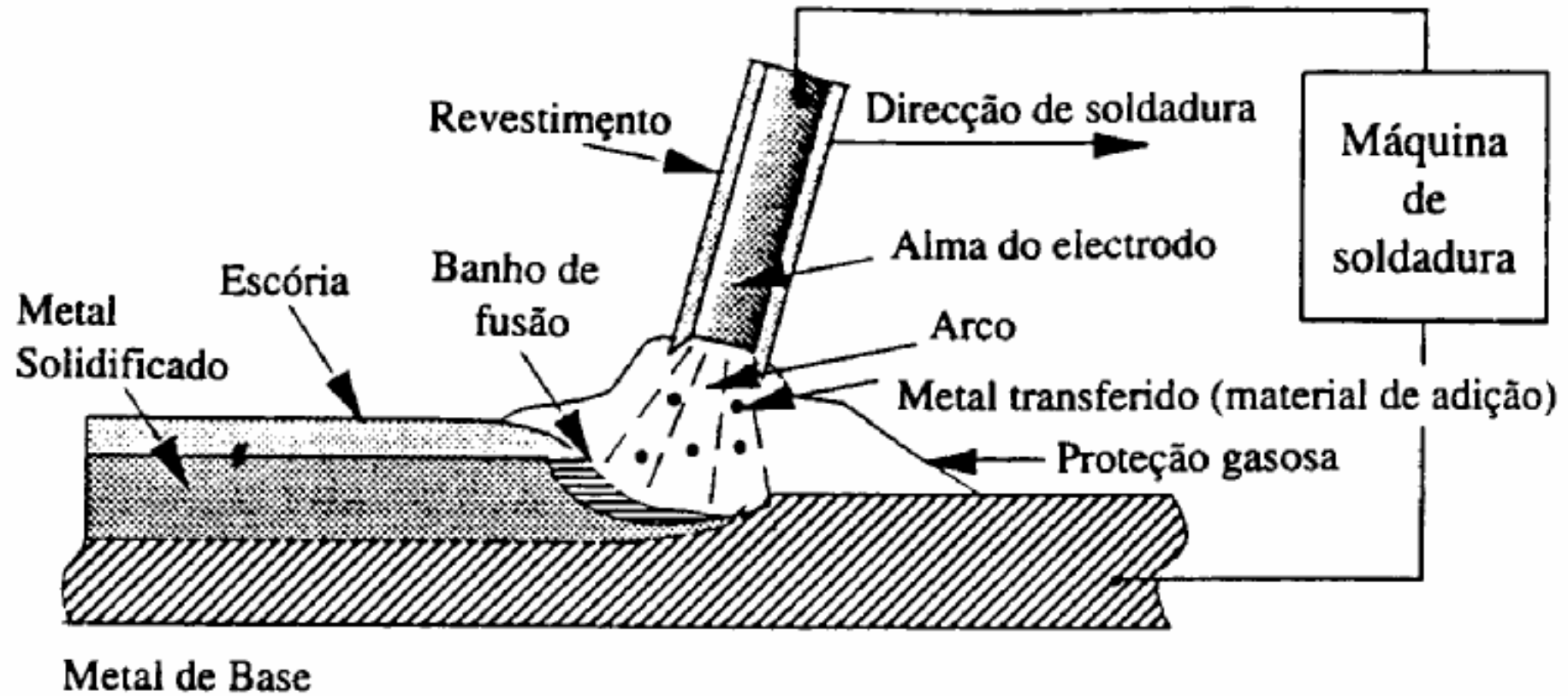


# Construção Naval Soldada

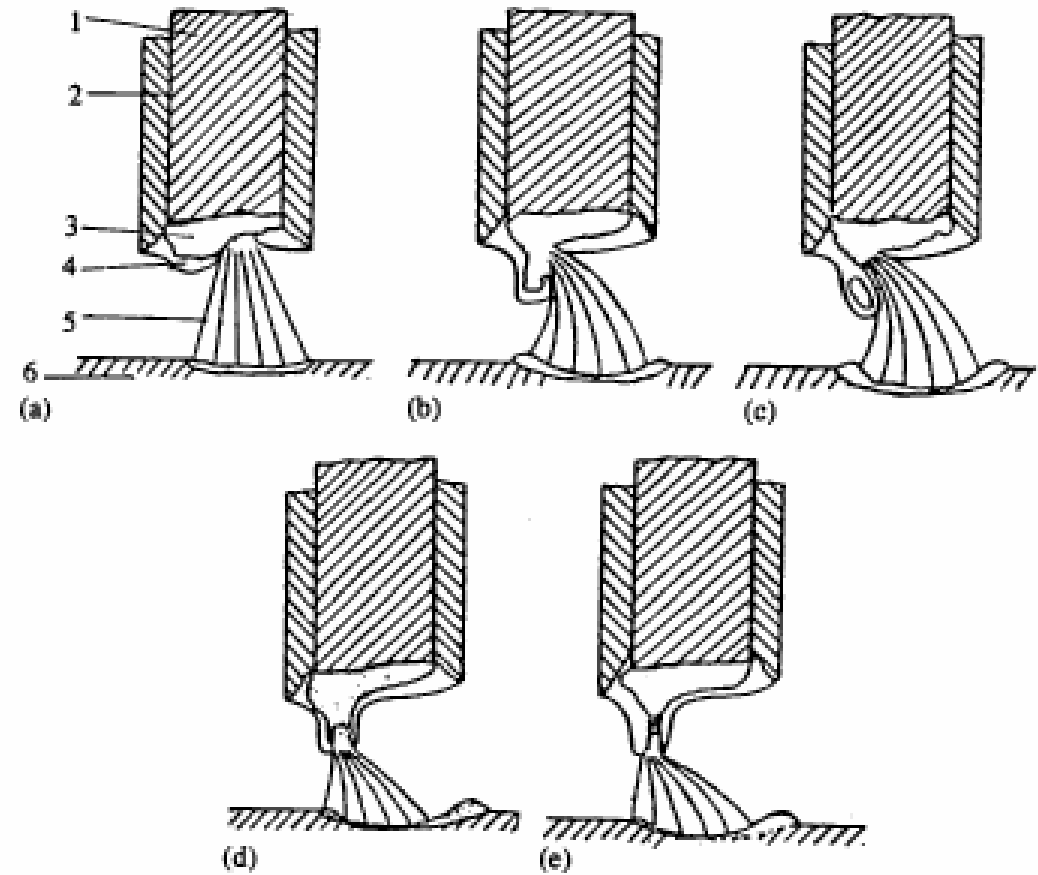
# Welded Shipbuilding

Welding Techniques

# Manual Arc Welding



# Manual Arc Welding - Transfer



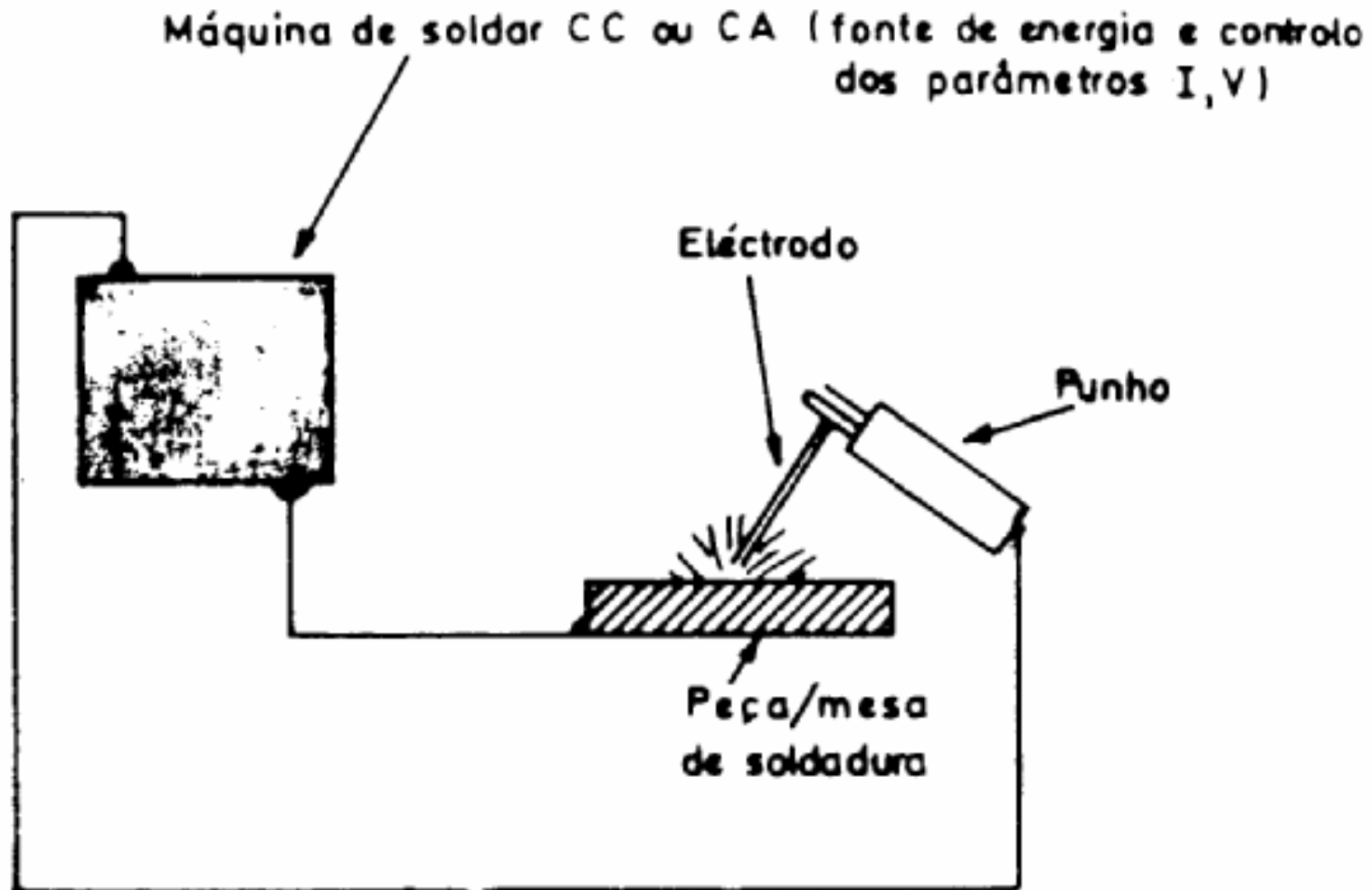
Modos de transferência de eléctrodos revestidos:

a) Fase inicial, b) Deformação do metal líquido devido a pressão na raiz do arco, c) separação da gota devido a tensão superficial, d) Alternativamente: o arco move-se para a parte líquida do eléctrodo, e) a gota separa-se por acção da força electromagnética (ref. 7)

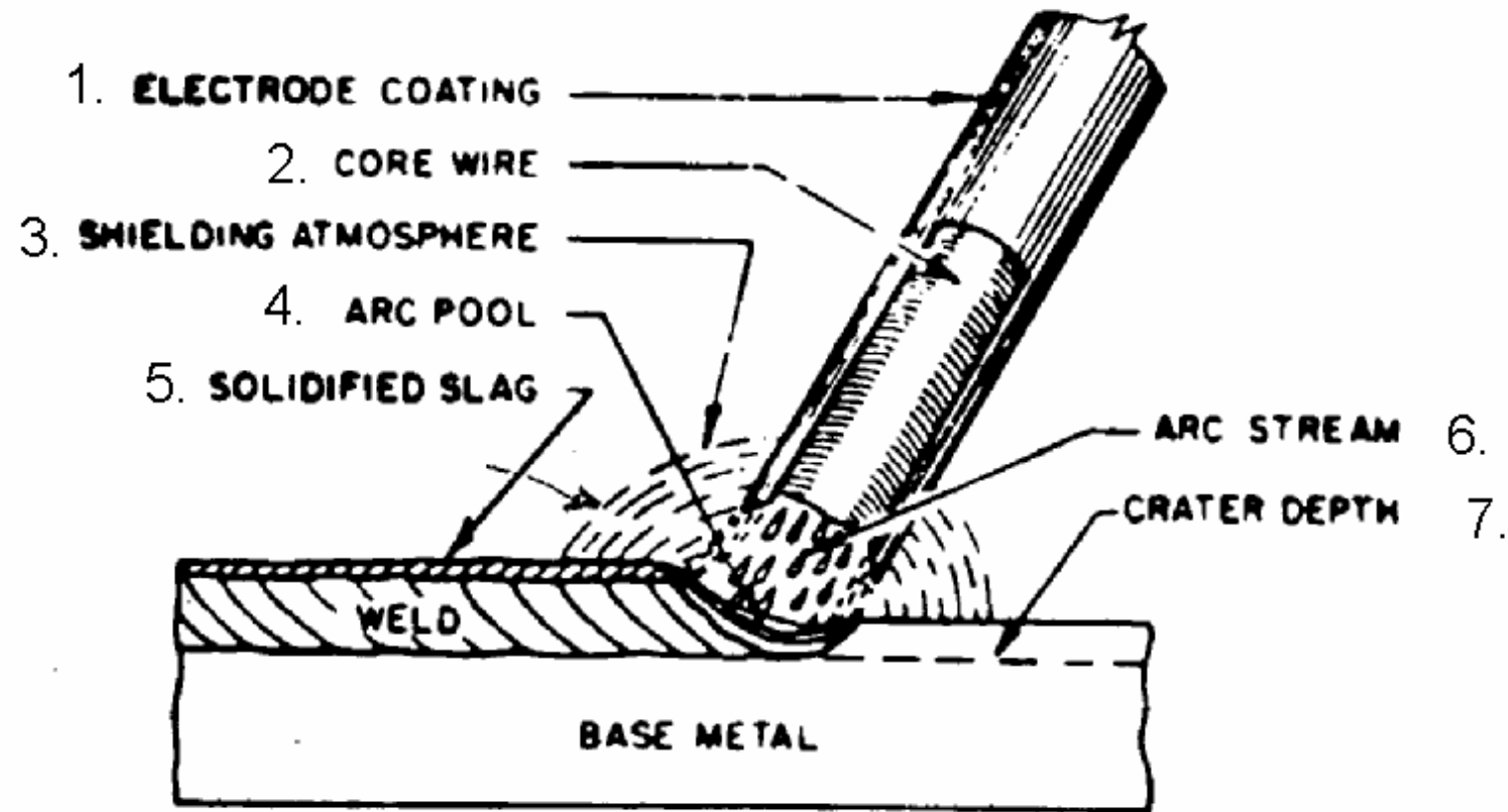
1 - alma do eléctrodo  
2 - revestimento  
3 - ponta do eléctrodo

4 - escória líquida  
5 - arco  
6 - peça

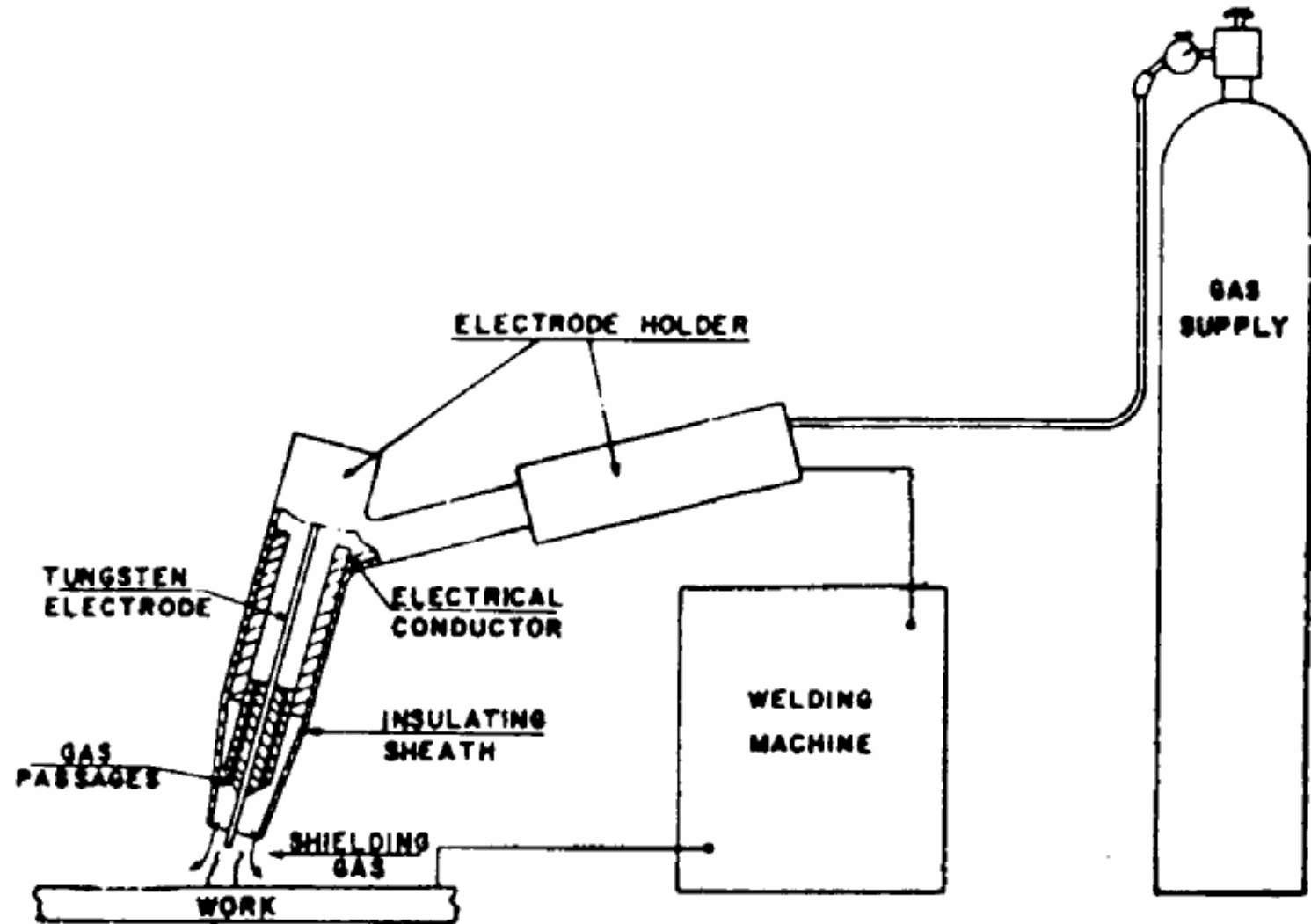
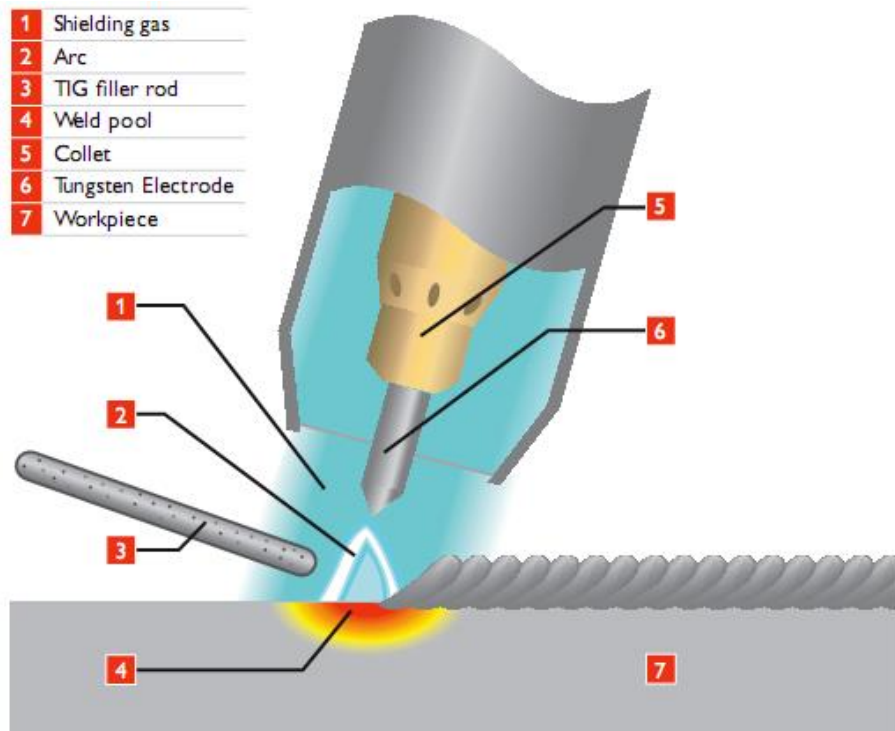
# Manual Arc Welding - Circuit



# Manual Arc Welding - Nomenclature

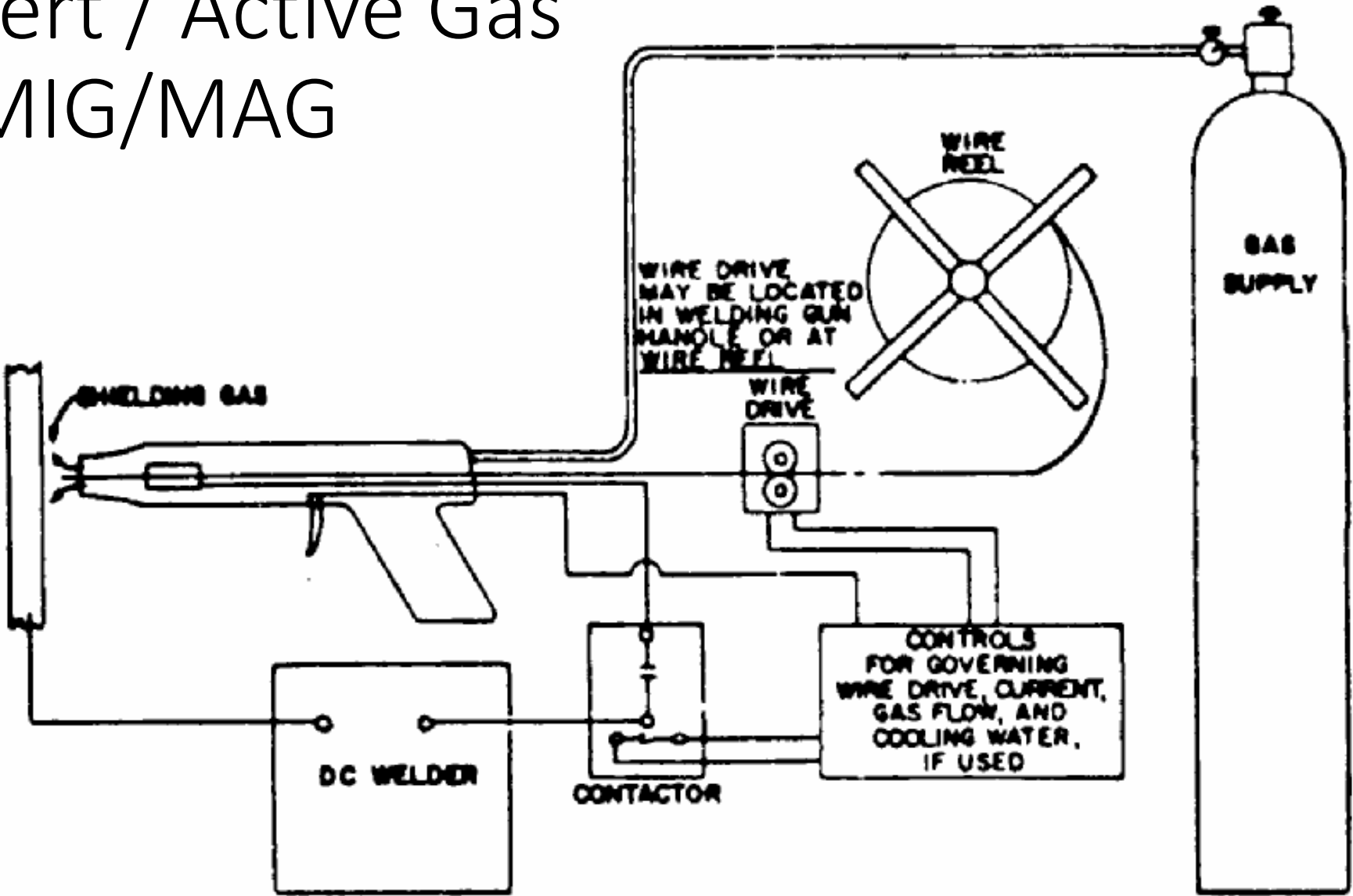


# Tungsten Inert Gas Welding - TIG

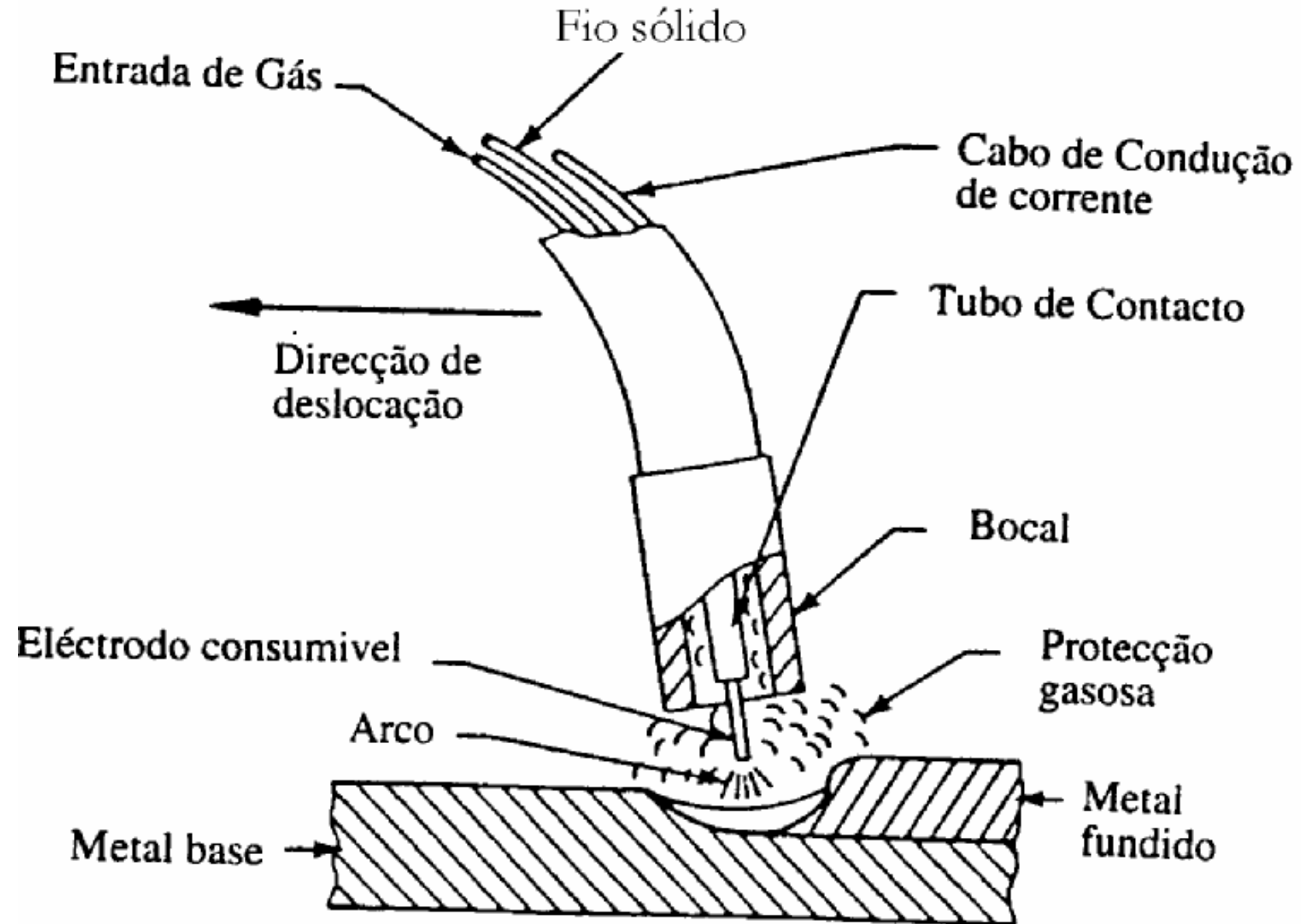


[https://www.youtube.com/watch?v=WSnj8AASuFs&ebc=ANyPxKq4BCYdnjTPwmETDeFl\\_1jHw6U0r55K\\_0VbMH4QJjZiUH7CmbBENCYfKn6PSLDT-NIGcyBGjXixw9rJdhgiCd2GrEiH5A](https://www.youtube.com/watch?v=WSnj8AASuFs&ebc=ANyPxKq4BCYdnjTPwmETDeFl_1jHw6U0r55K_0VbMH4QJjZiUH7CmbBENCYfKn6PSLDT-NIGcyBGjXixw9rJdhgiCd2GrEiH5A)

# Tungsten Inert / Active Gas Welding – MIG/MAG



# MIG / MAG





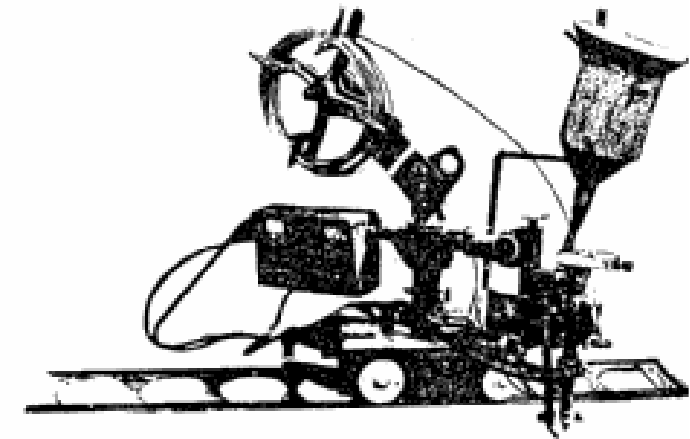
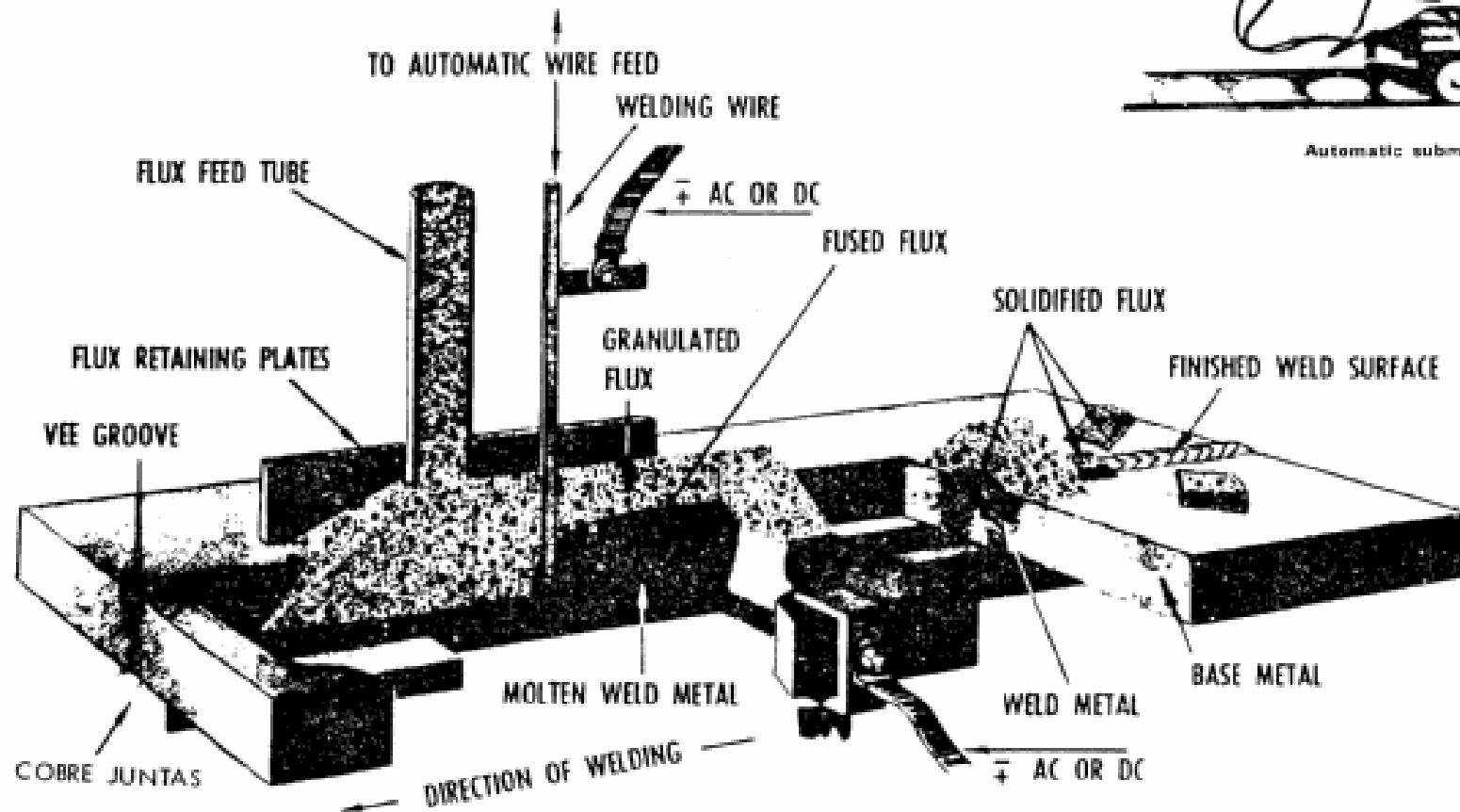
# MIG/MAG examples



<http://pt.slideshare.net/MohamadHakimeeRoslan/gmaw-14831019>

# Submerged Arc Welding

Figura - Soldadura por arco submerso



Automatic submerged arc welding machine

# Submerged Arc Welding - SAW

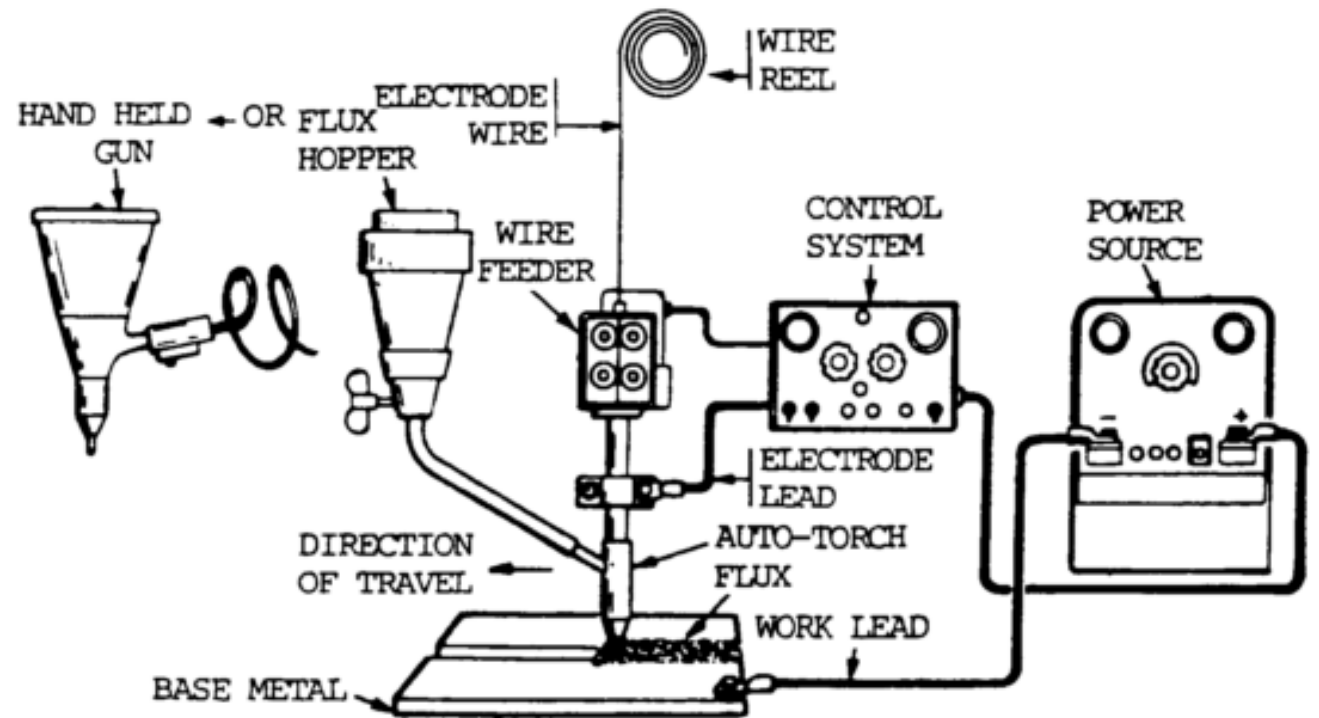
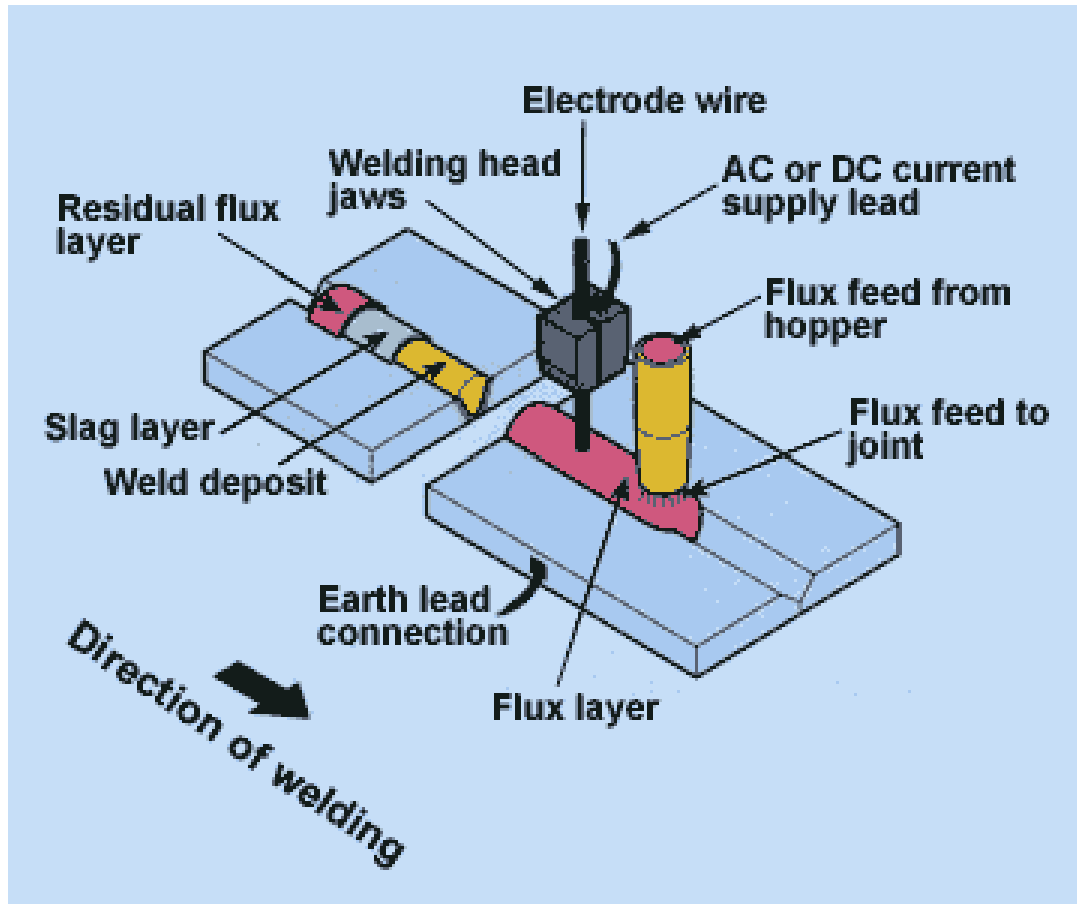
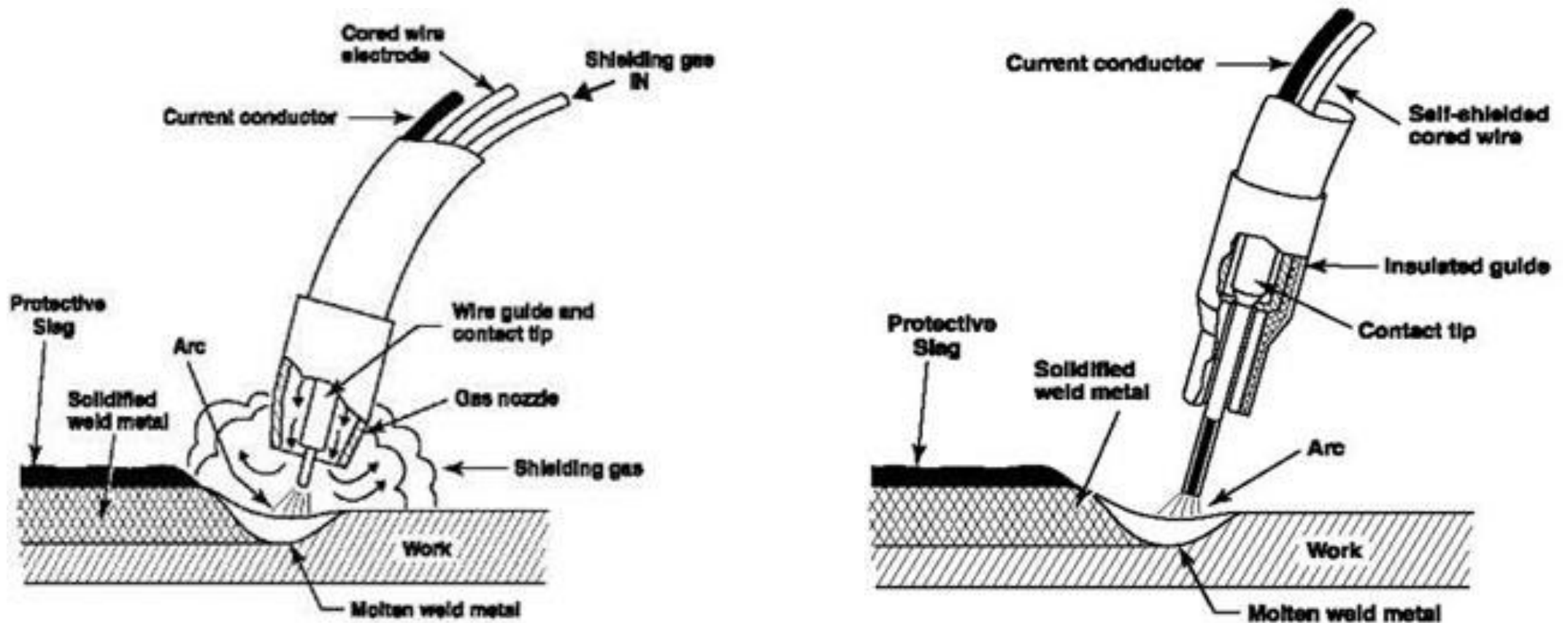


Figure 10-59. Block diagram - SAW.

# SAW examples



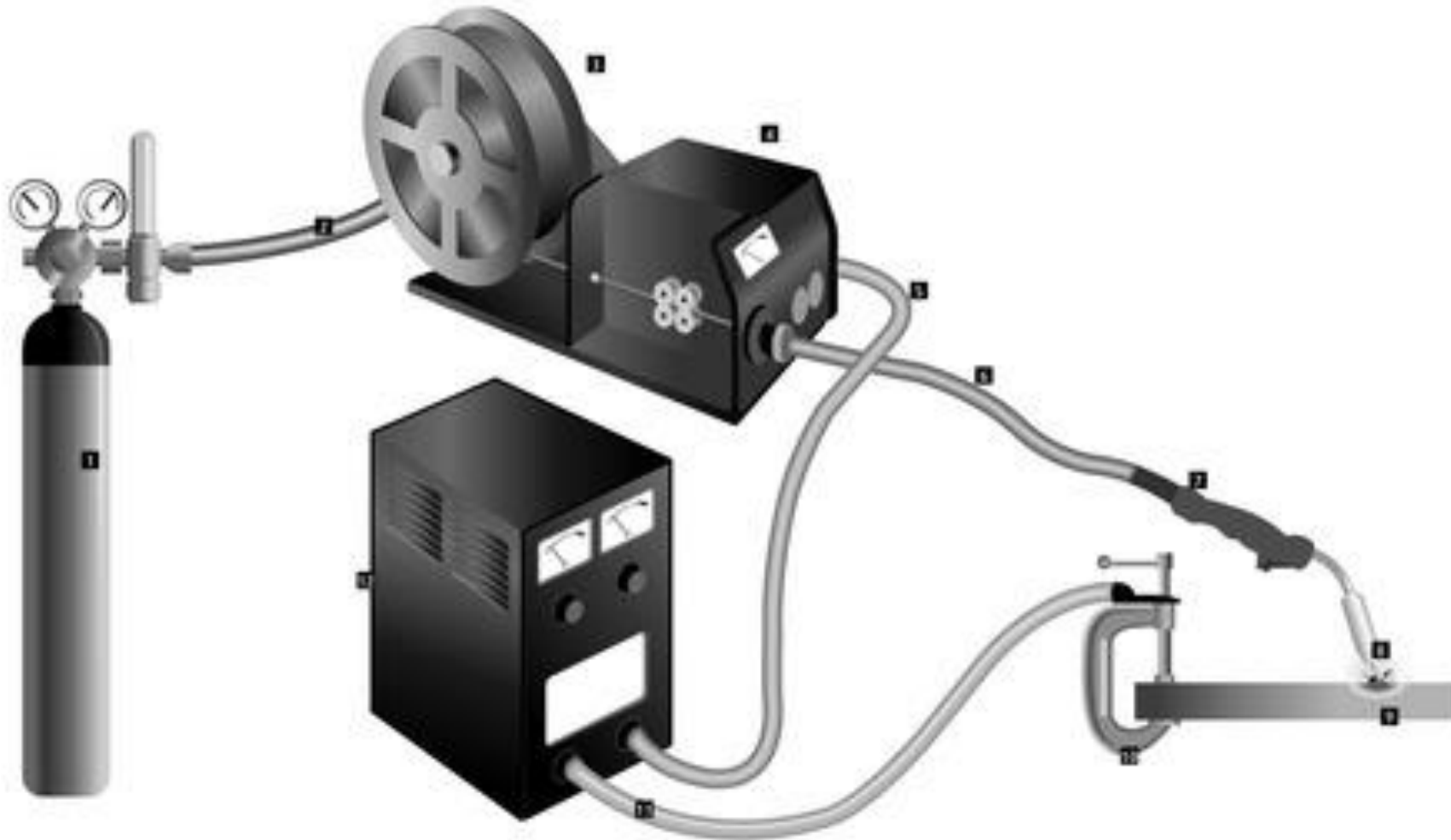
# Flux Cored Arc Welding - FCAW



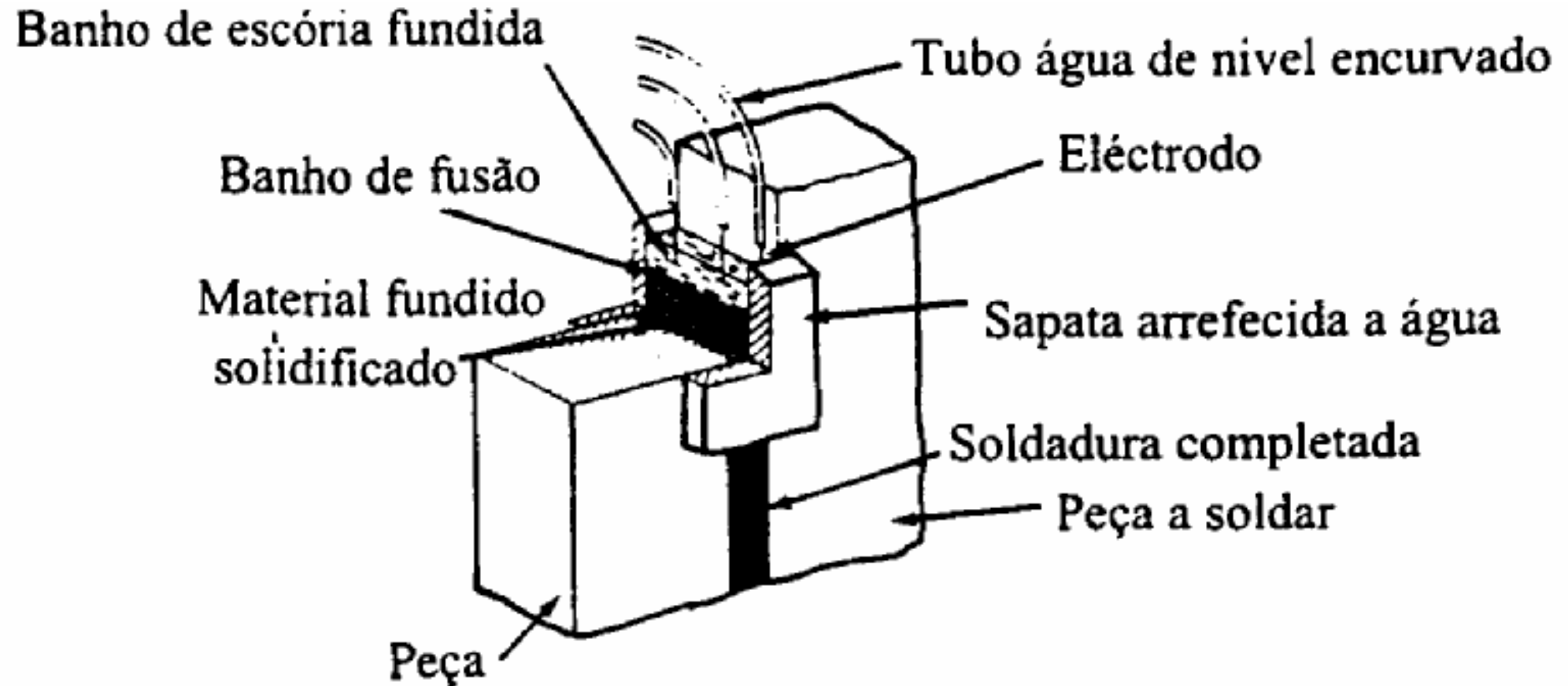
# FCAW - Equipment

Process schematic diagram for MIG/MAG, FCAW and MCAW

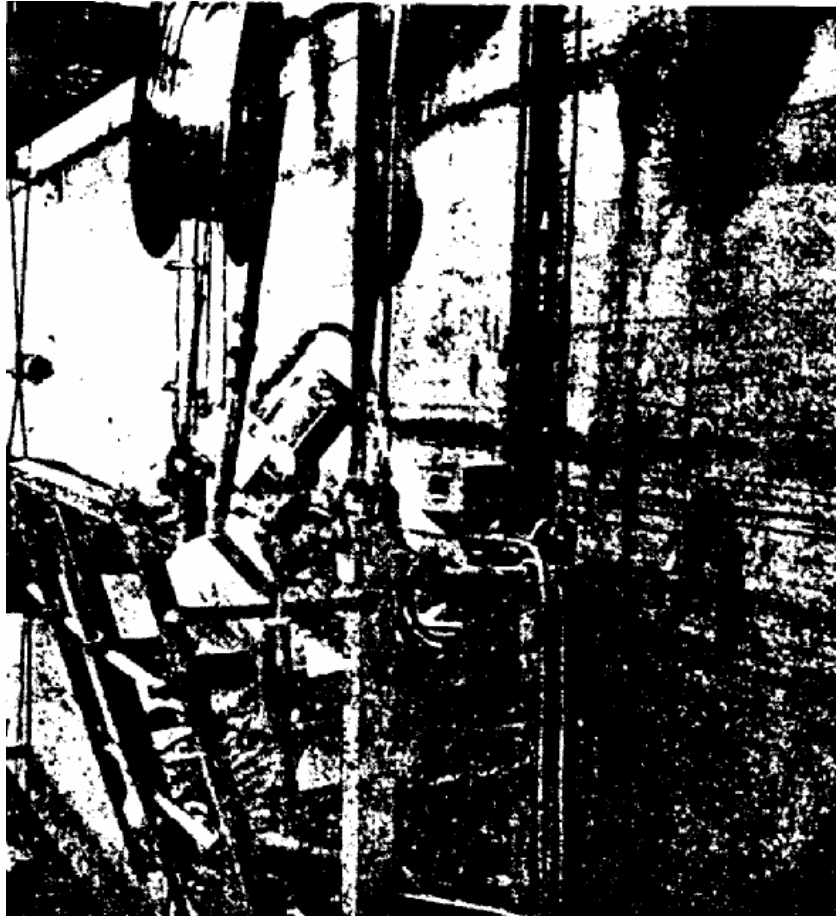
1 Gas cylinder, 2 Gas hose, 3 Continuous wire, 4 Wire feed unit, 5 Power cable, 6 Torch conduit, 7 Welding torch, 8 Arc, 9 Workpiece, 10 Earth clamp, 11 Return cable, 12 Power source



# Electro-slag Welding

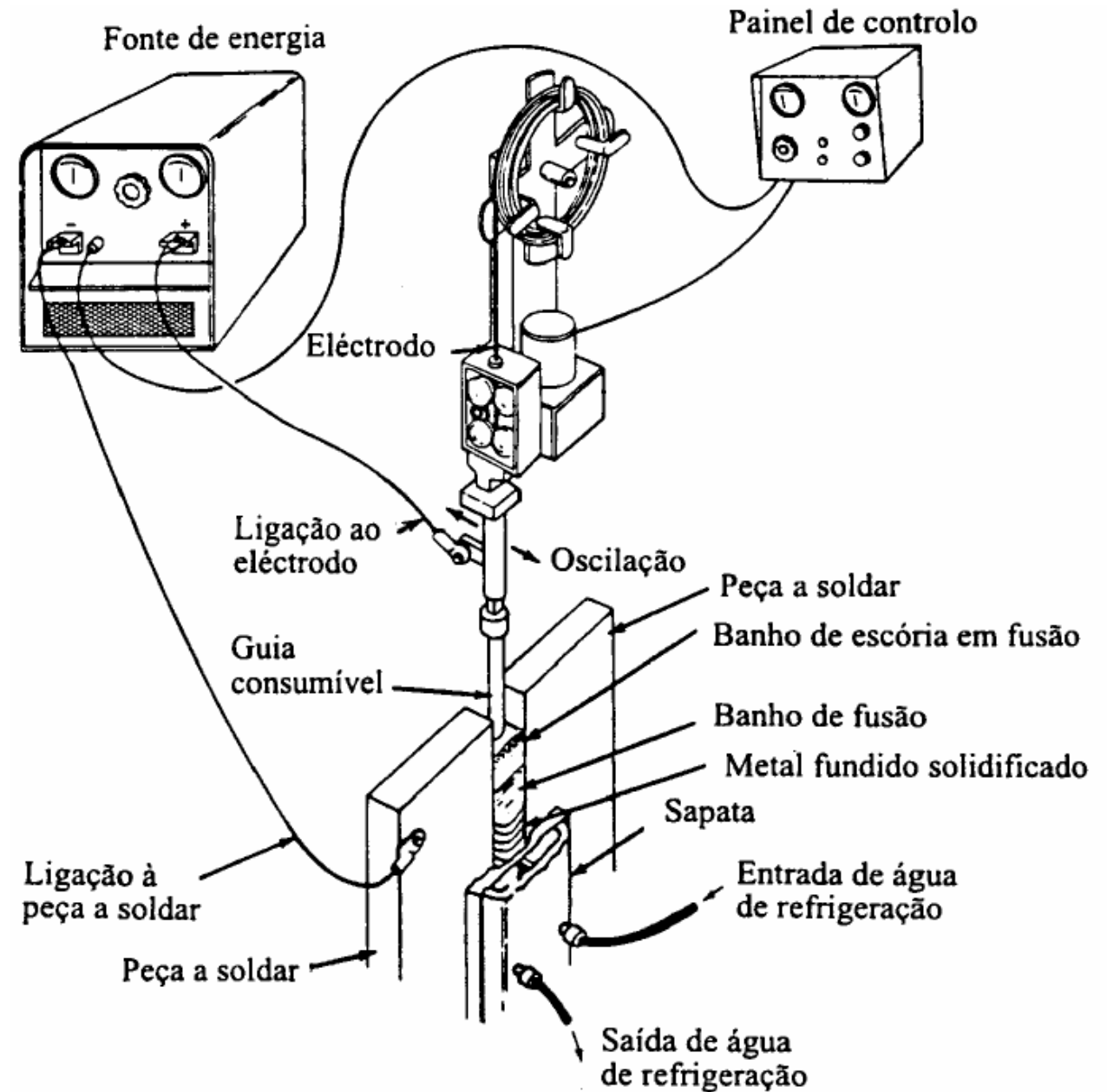
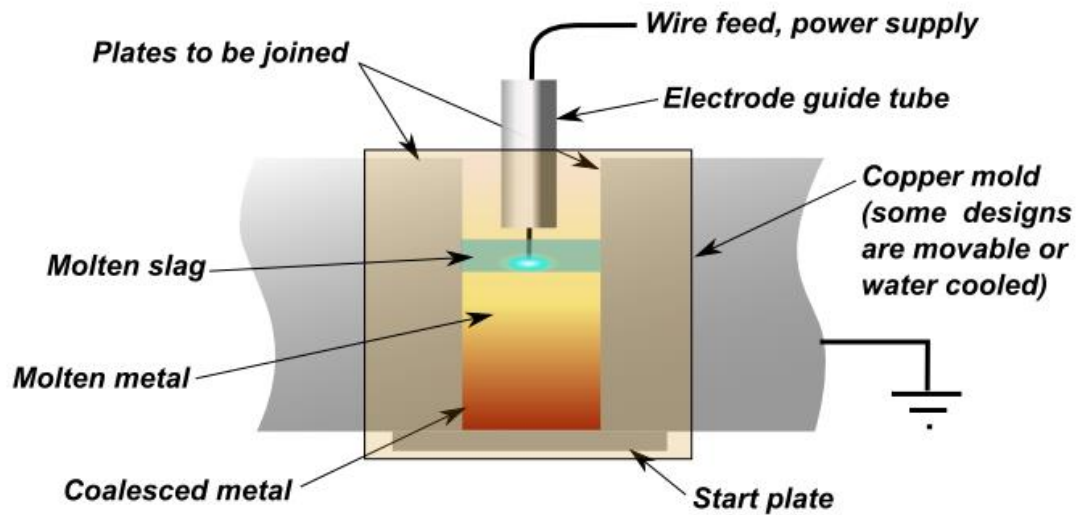


# Electro Slag Welding

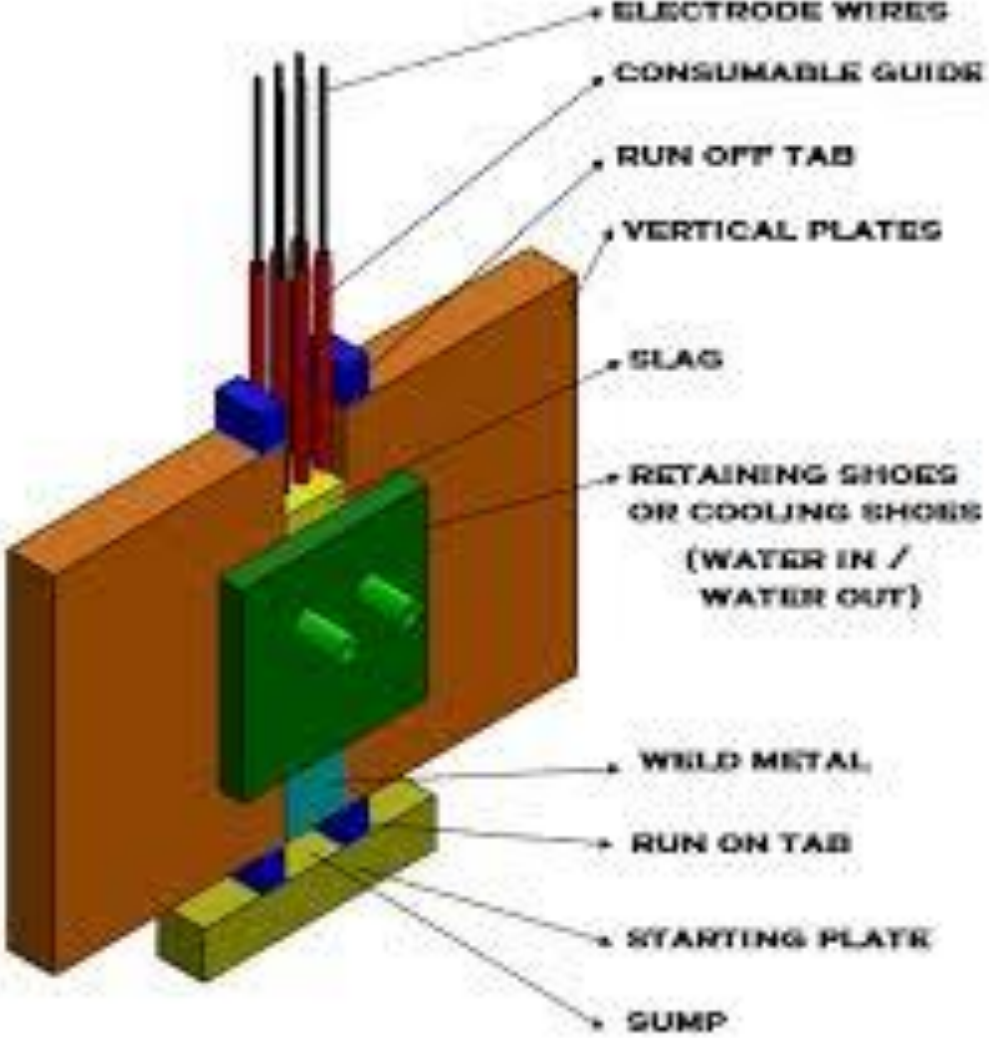




# Electro Slag Welding – Consumable guide

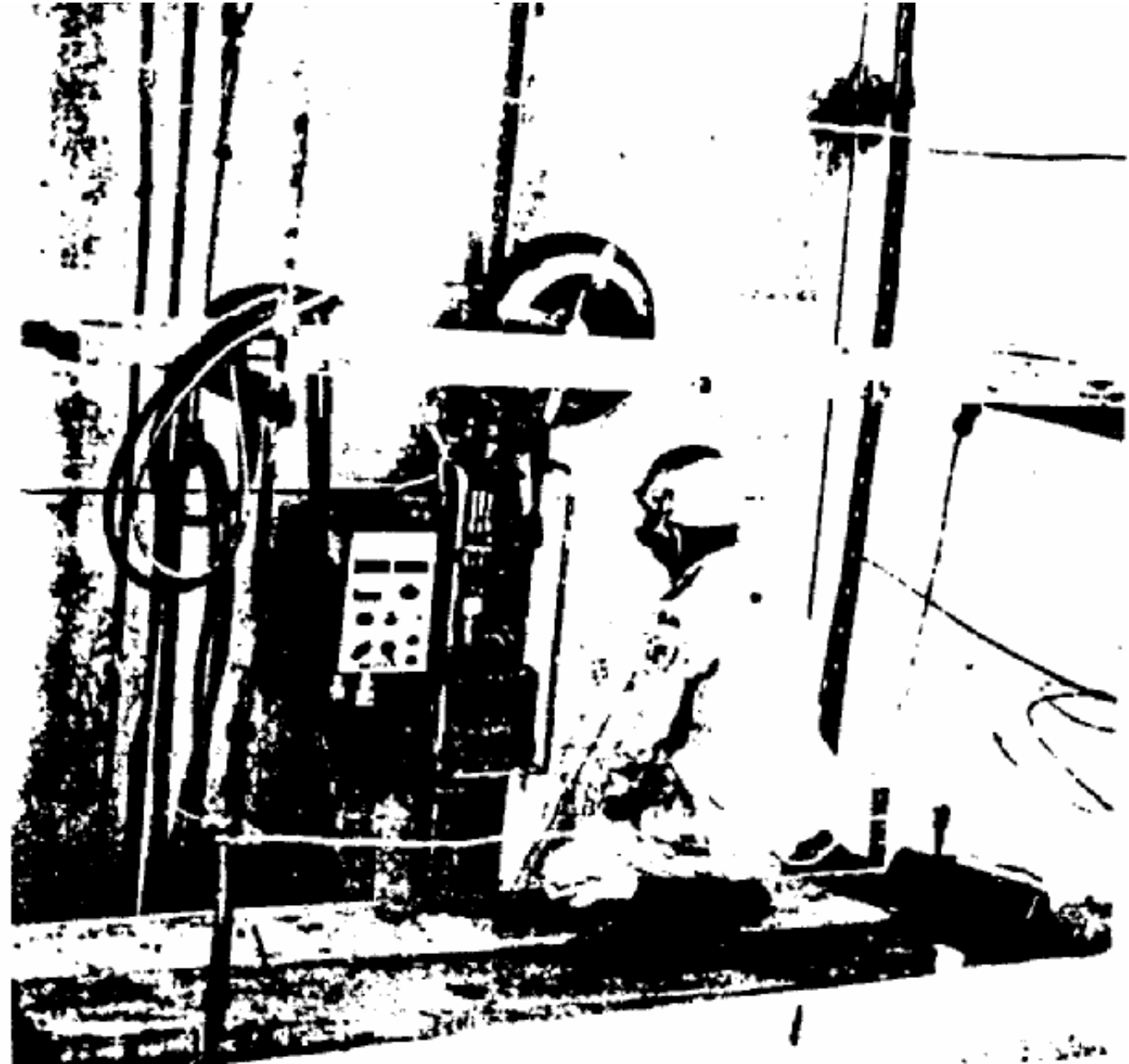
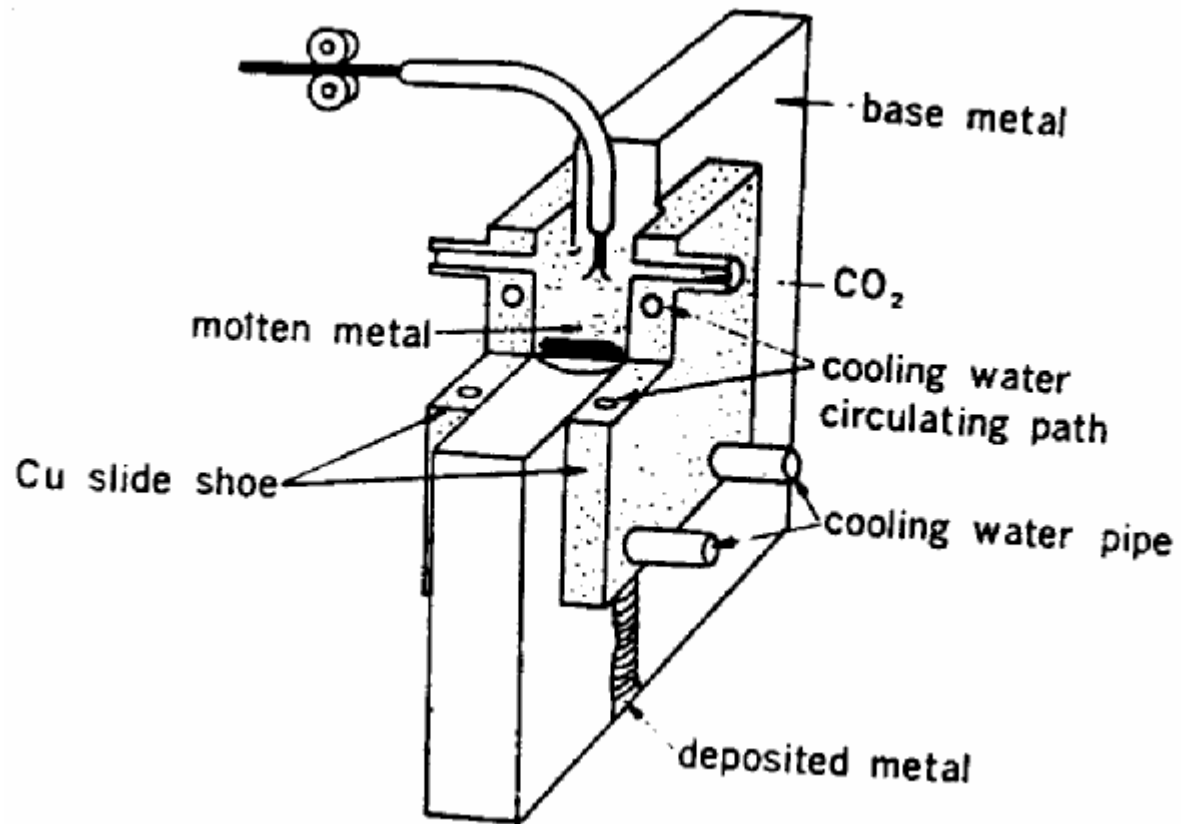


# ESW

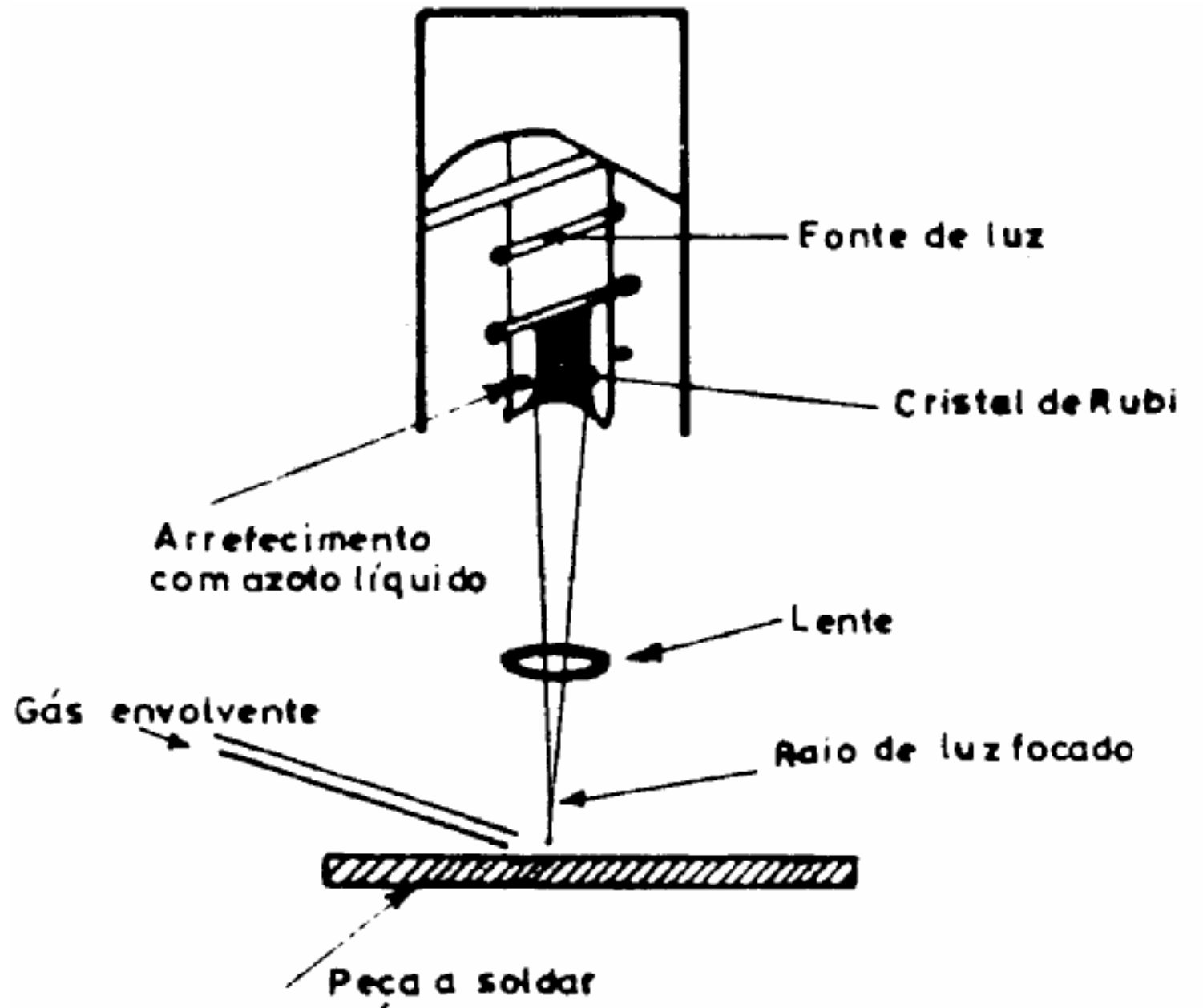
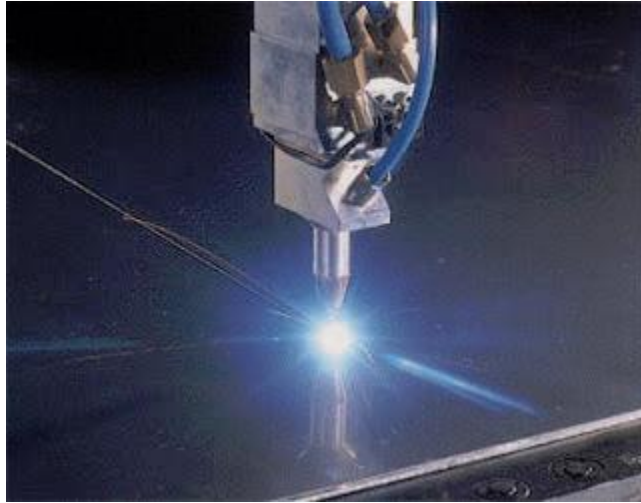


**ELECTRO SLAG WELDING**

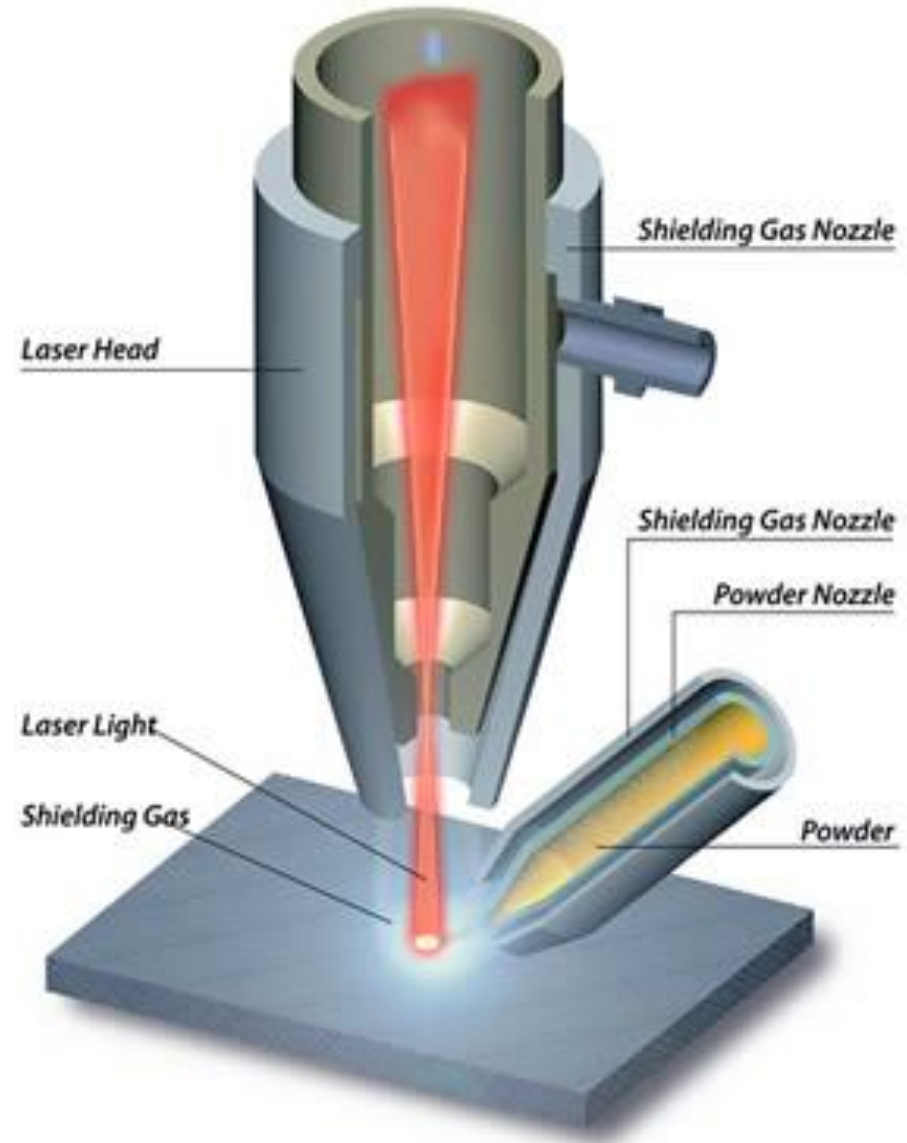
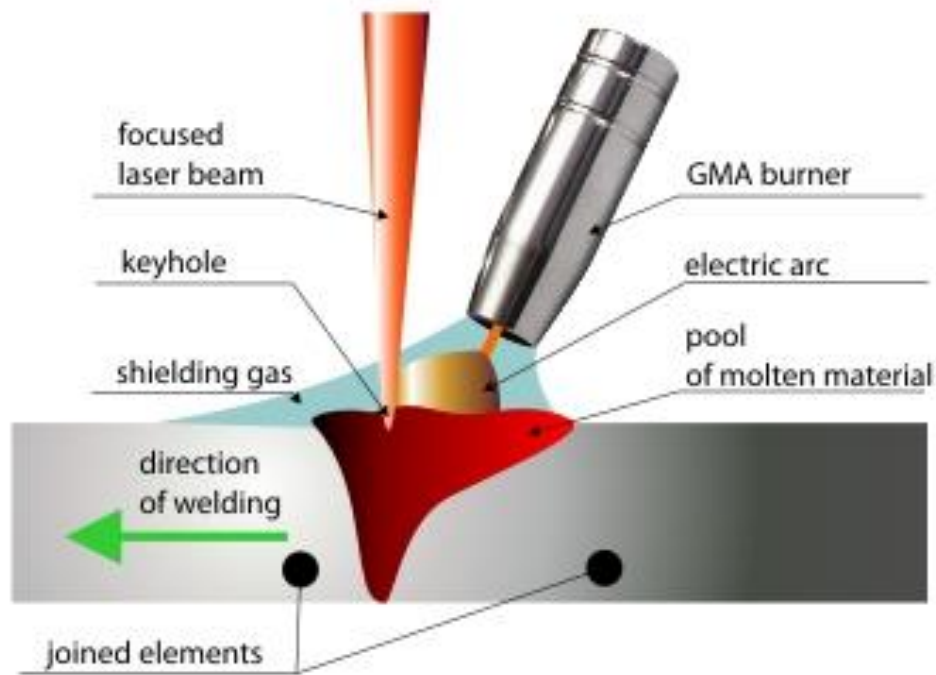
# Electro Gas Welding



# LASER Welding



# Laser Welding and Hybrid Welding



(Picture: non-coaxial powder feed)

# Friction Welding



# Comparison between welding procedures and technologies

1 – better / high 6 – worst / low	Manual SMAW	FCAW	Gravity	Submersed arc (SAW)	Electro gas Electro slag	MIG/MAG	TIG
Deposition speed of material	5	4	3	2	1	6	7
Equipament Cost	6	3	5	2	1	3	4
Mechanical properties (Resiliência)	3	2	4	5	6	2	1
Position	All	All	Down	Down	Vertical	All	All
Cost (relative value)	1-2	4	2	3-40	4-60	4	2-20
General opinion	Versatile	Good	No special training	High speed & production	No edge preparation.  Affected by wind. (electrogás)	Easy to initiate arc.  Affected by wind.	