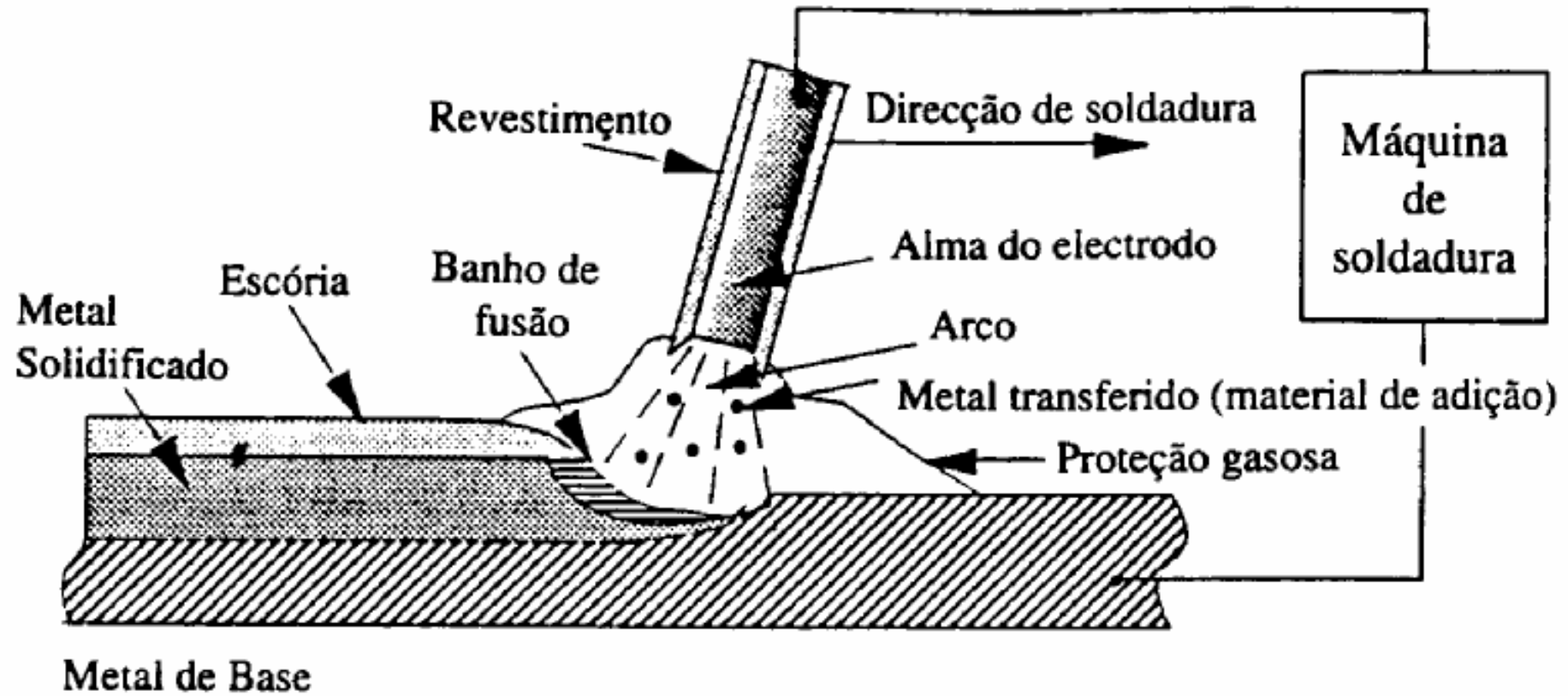


Construção Naval Soldada

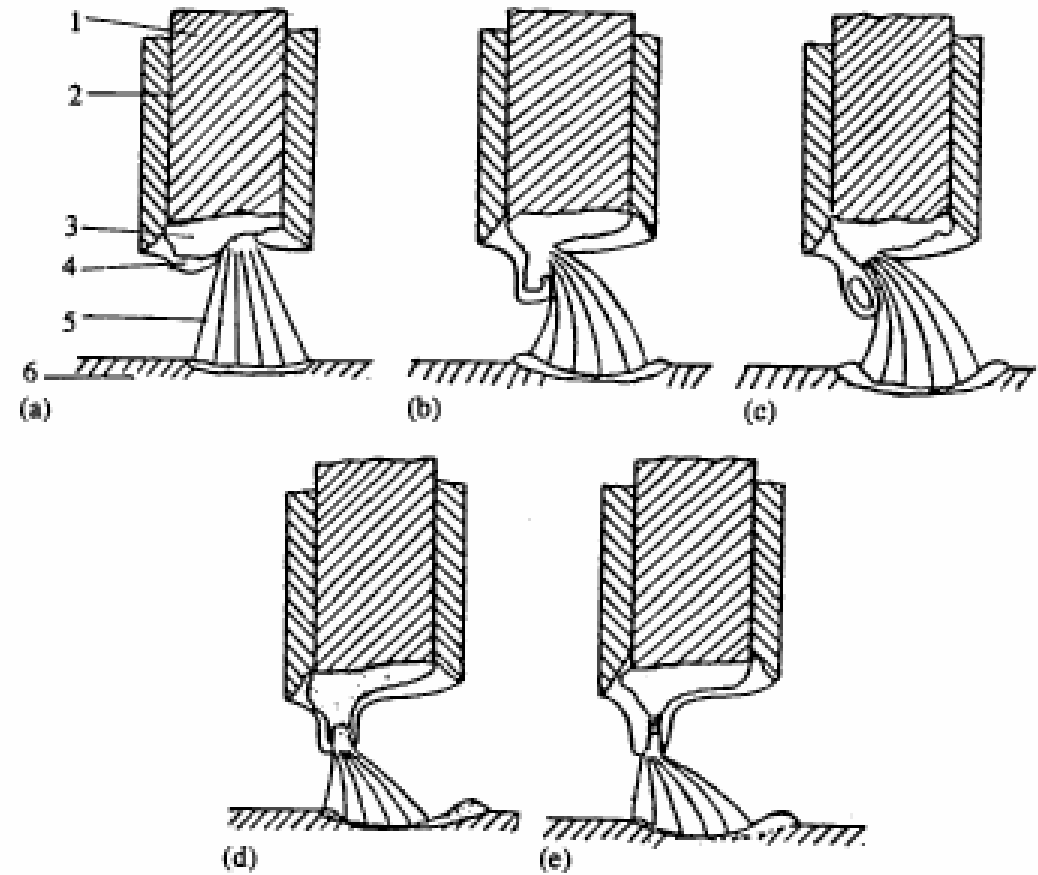
Welded Shipbuilding

Welding Techniques

Manual Arc Welding



Manual Arc Welding - Transfer



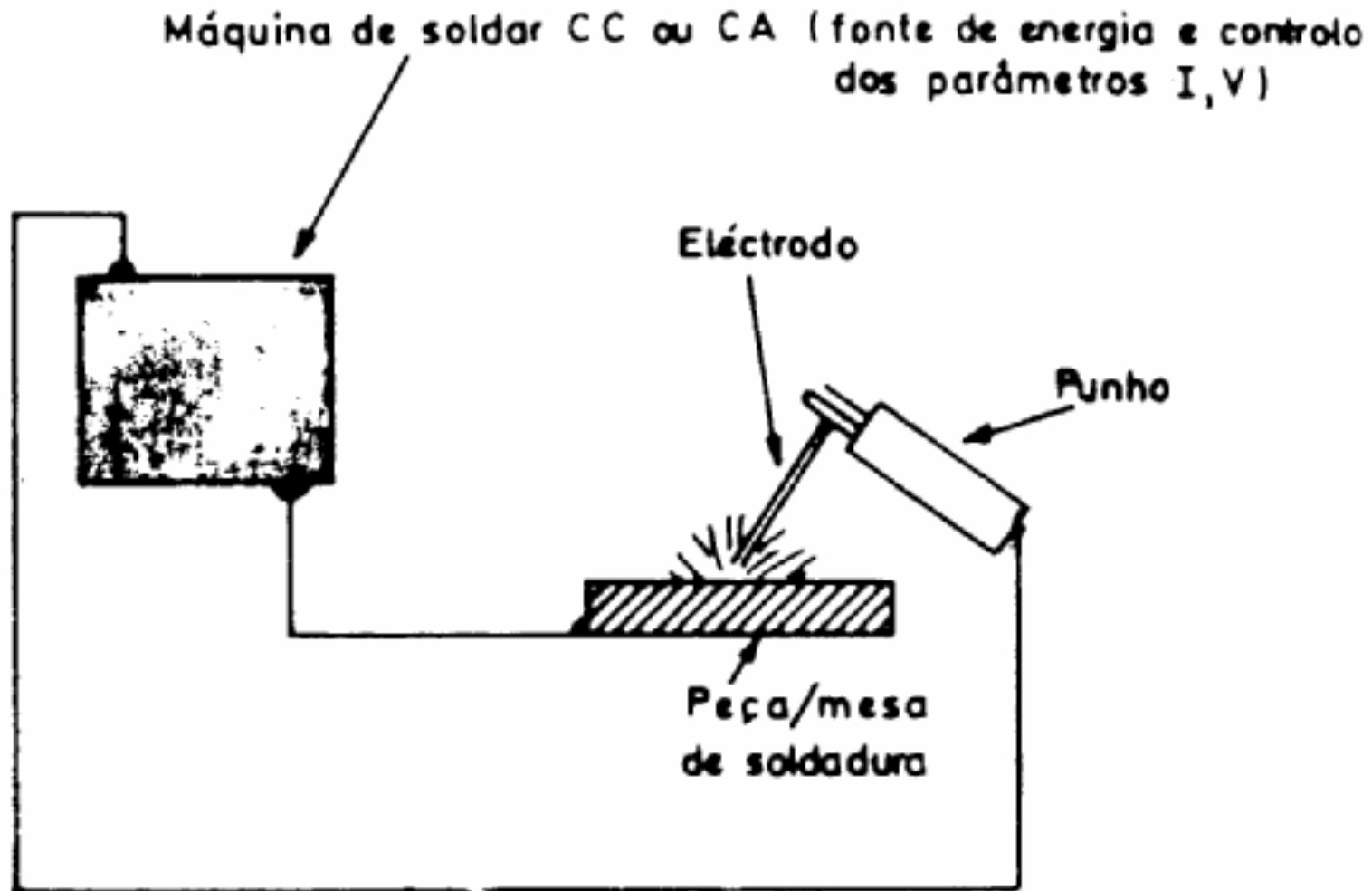
Modos de transferência de eléctrodos revestidos:

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)

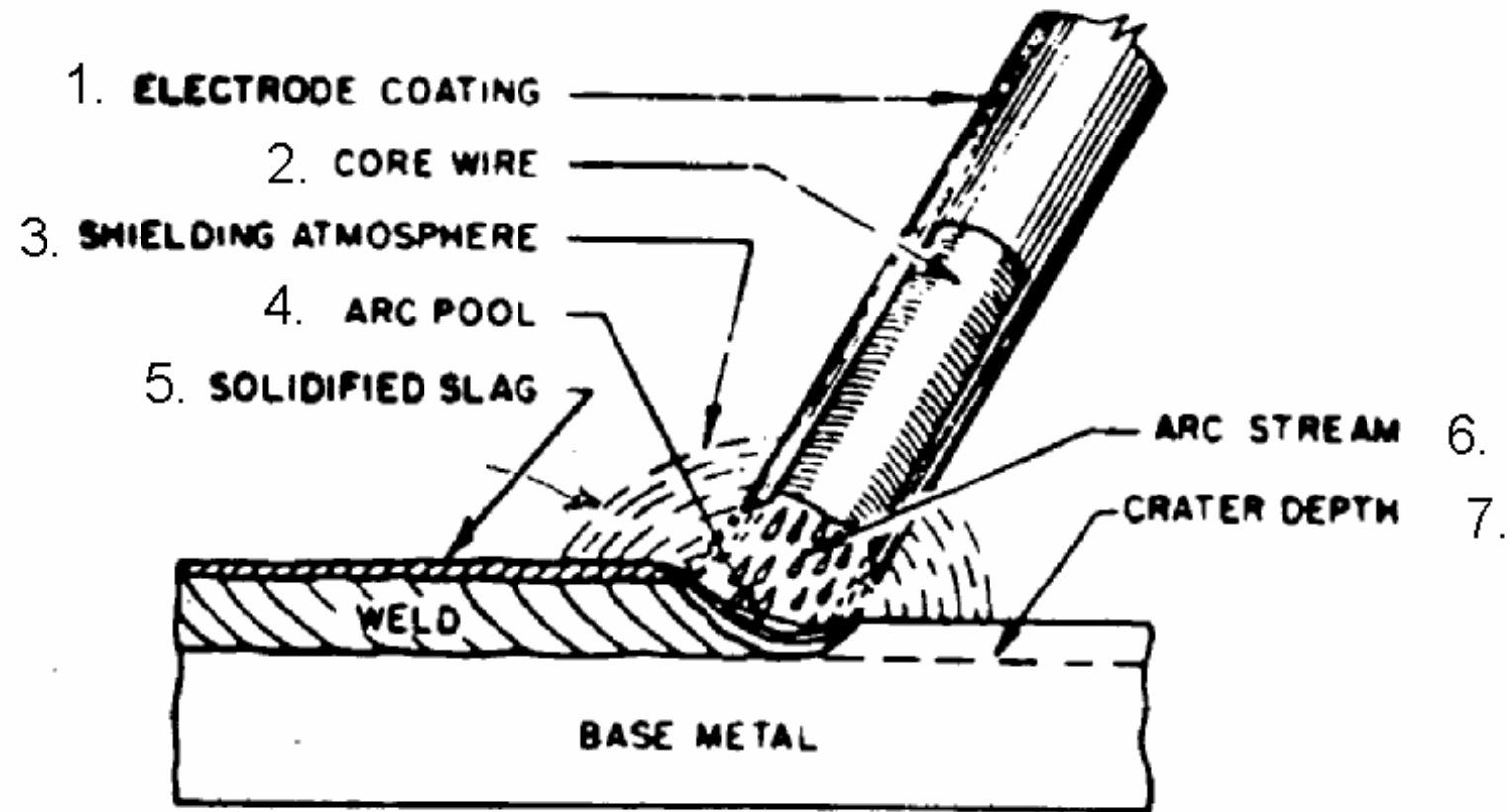
1 - alma do eléctrodo
2 - revestimento
3 - ponta do eléctrodo

4 - escória líquida
5 - arco
6 - peça

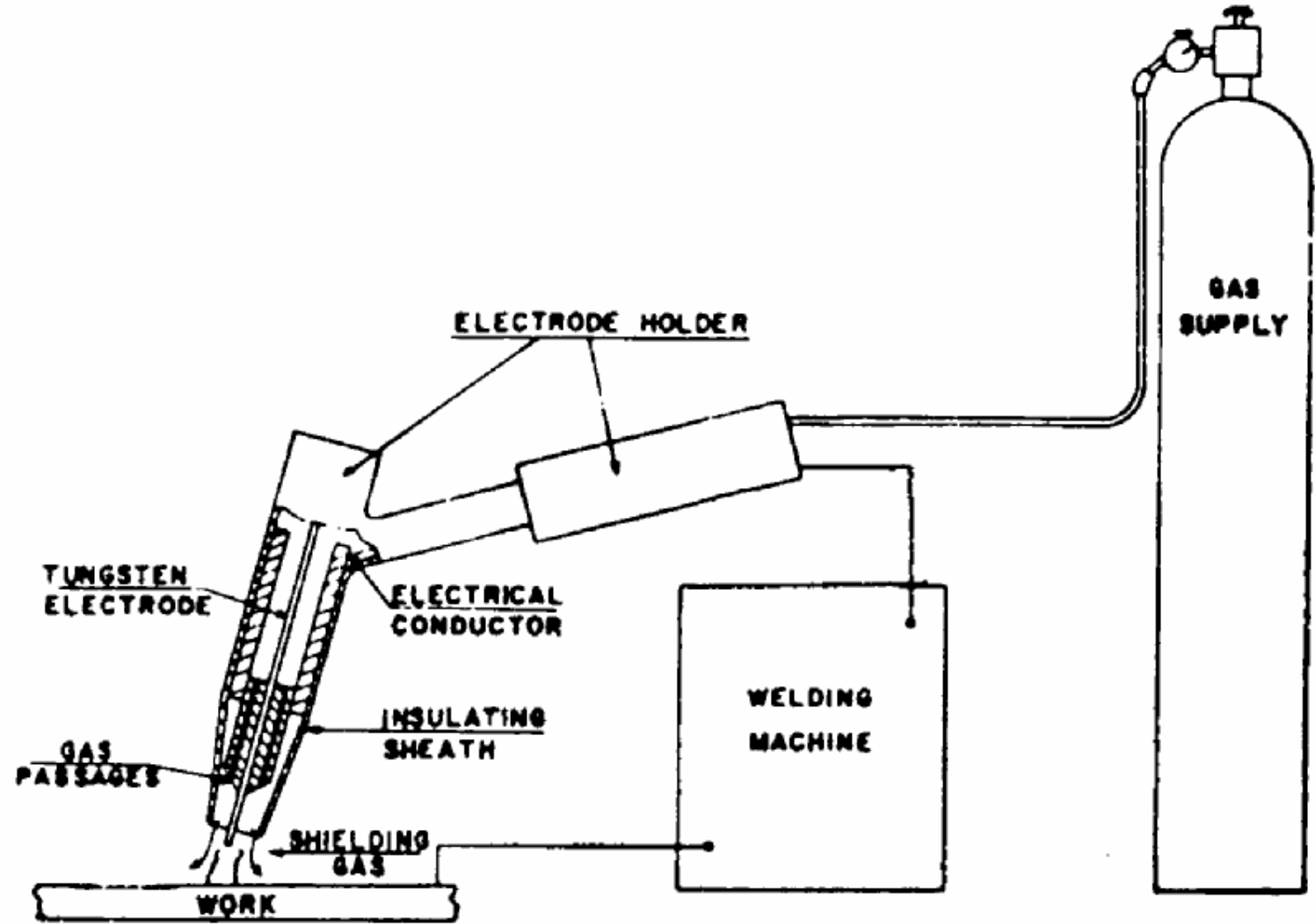
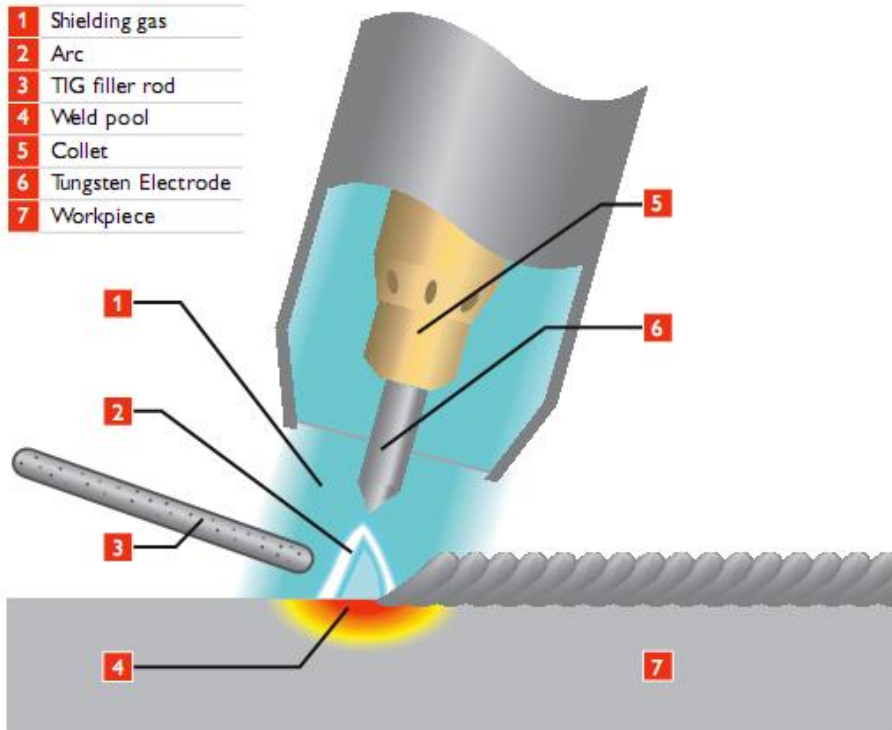
Manual Arc Welding - Circuit



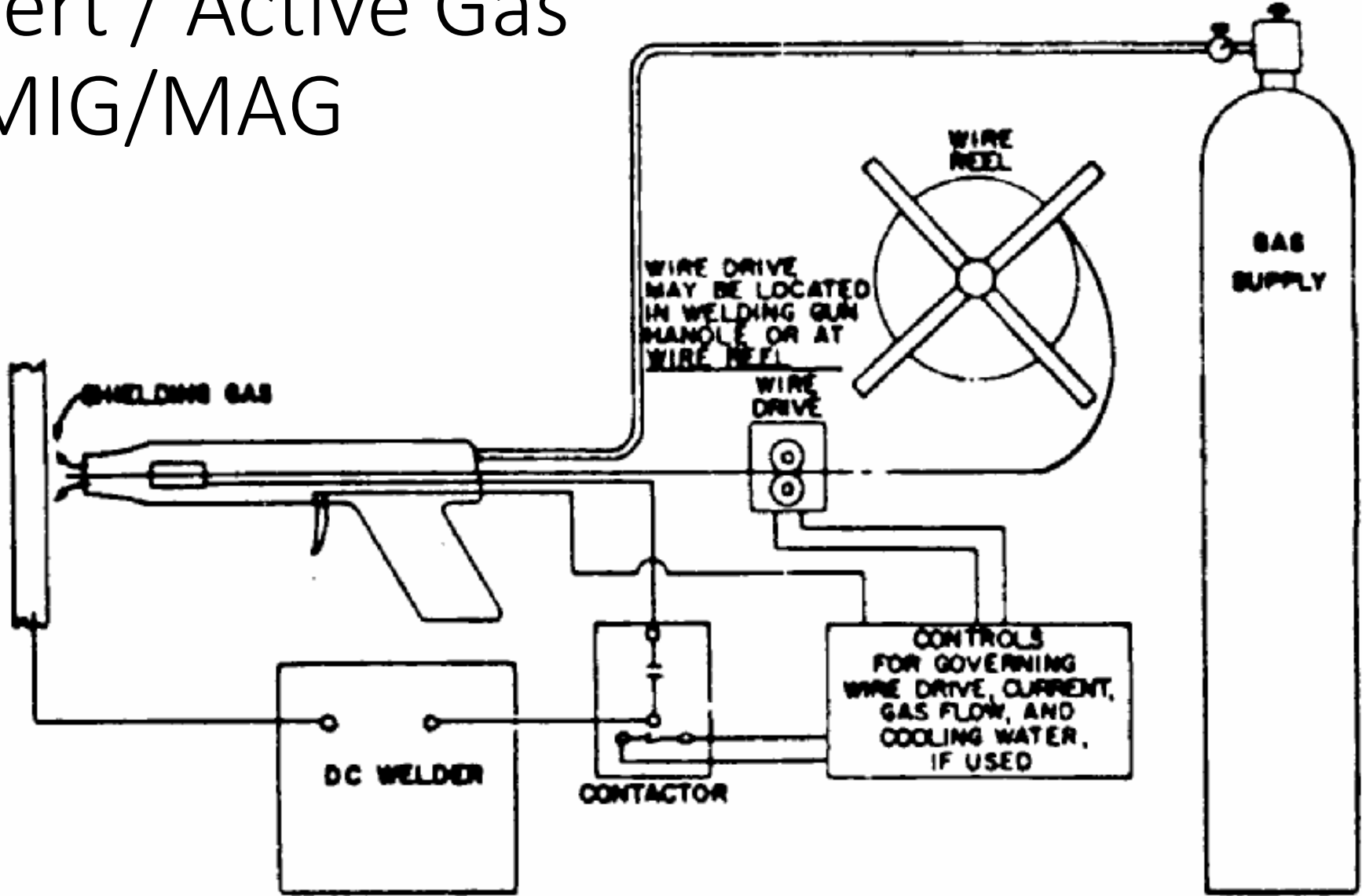
Manual Arc Welding - Nomenclature



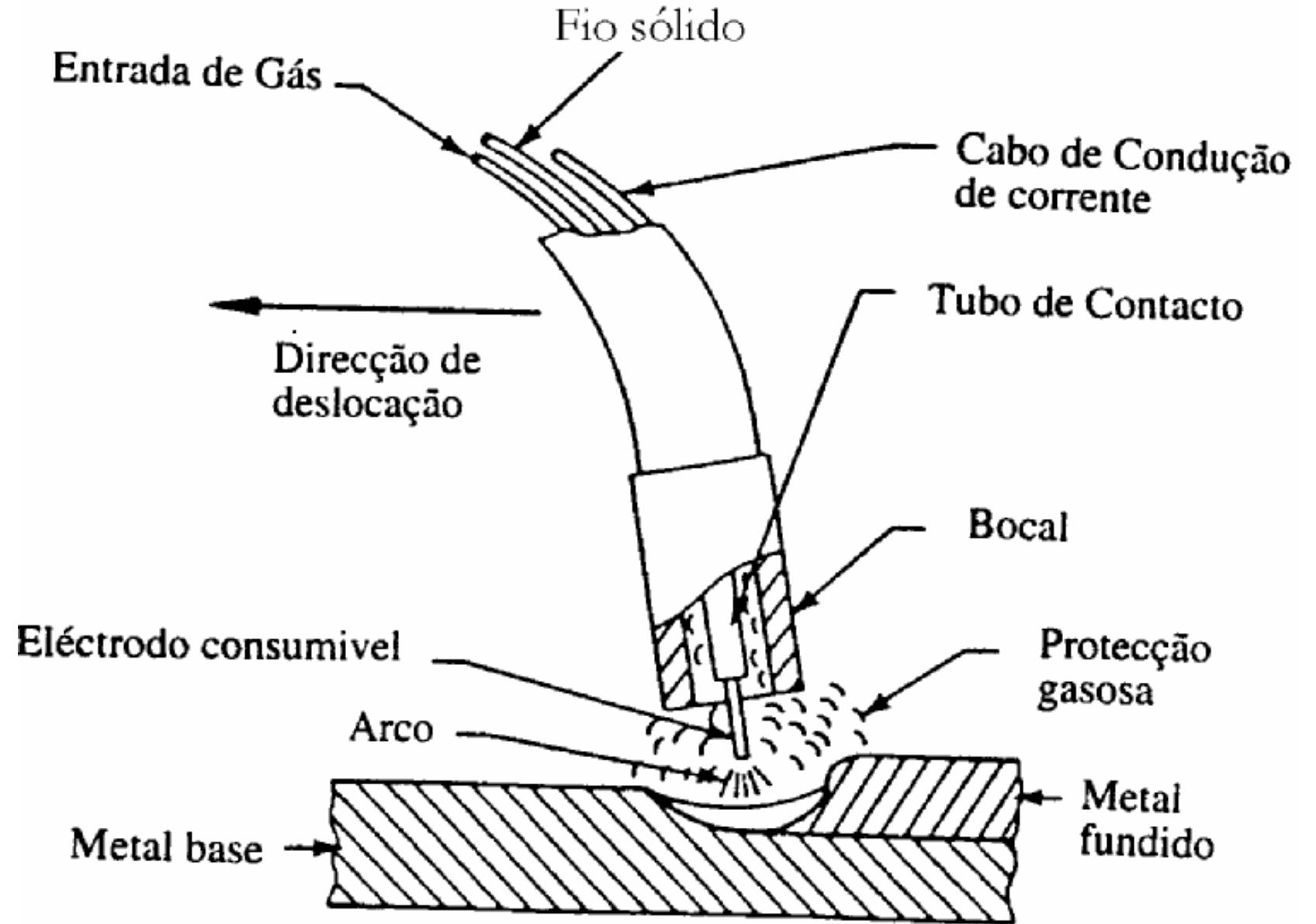
Tungsten Inert Gas Welding - TIG



Tungsten Inert / Active Gas Welding – MIG/MAG

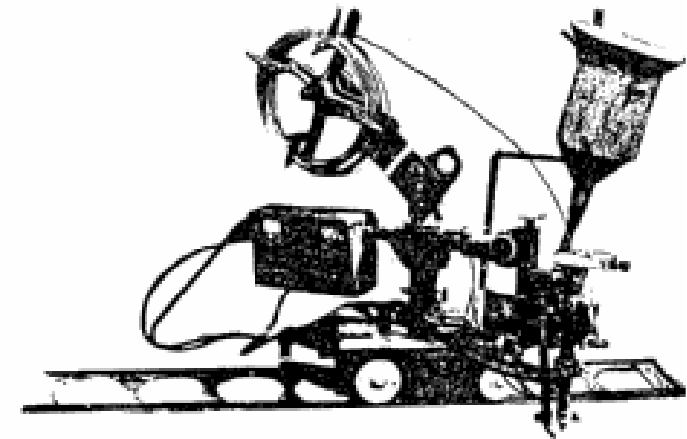
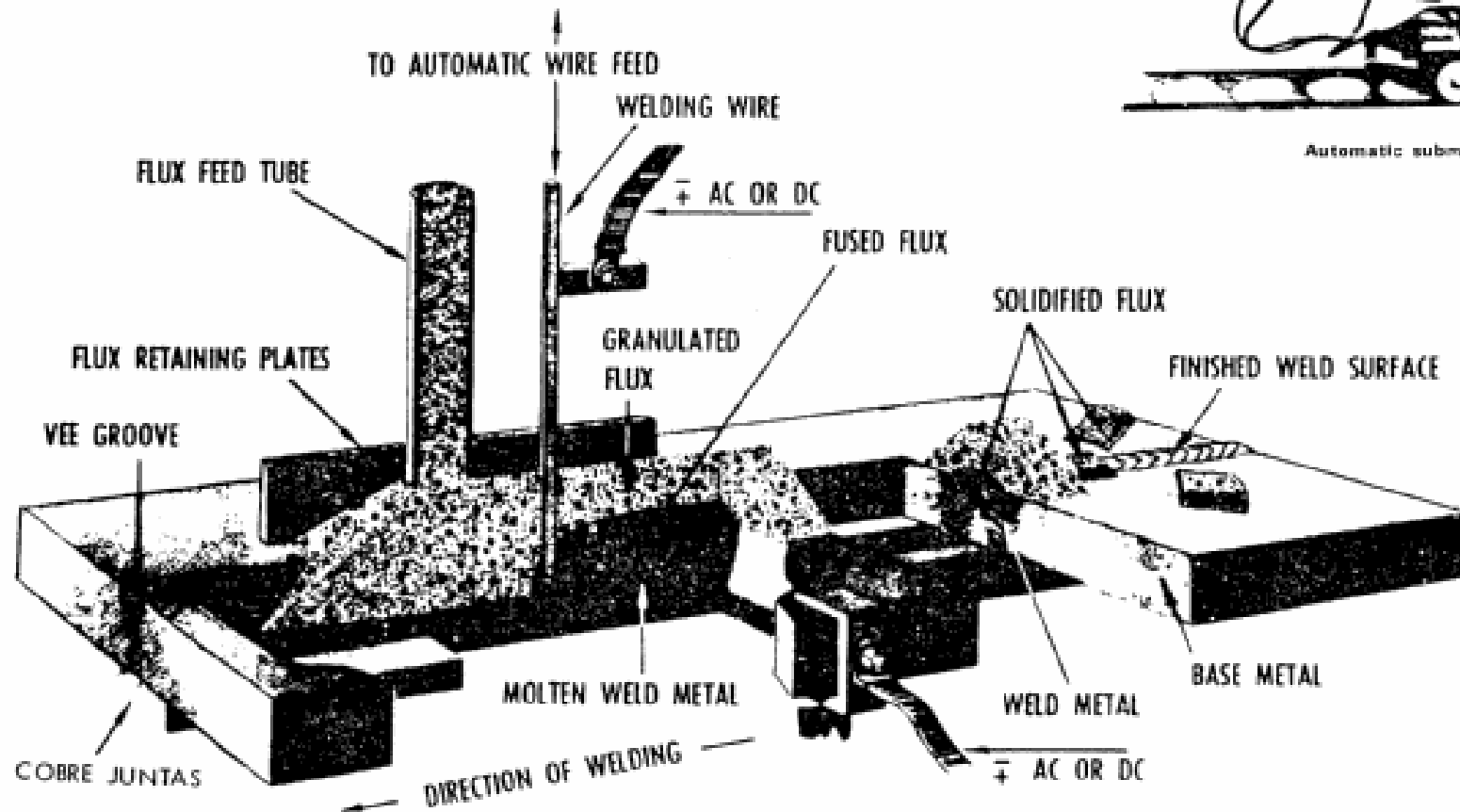


MIG / MAG



Submerged Arc Welding

Figura - Soldadura por arco submerso



Automatic submerged arc welding machine

Submerged Arc Welding - SAW

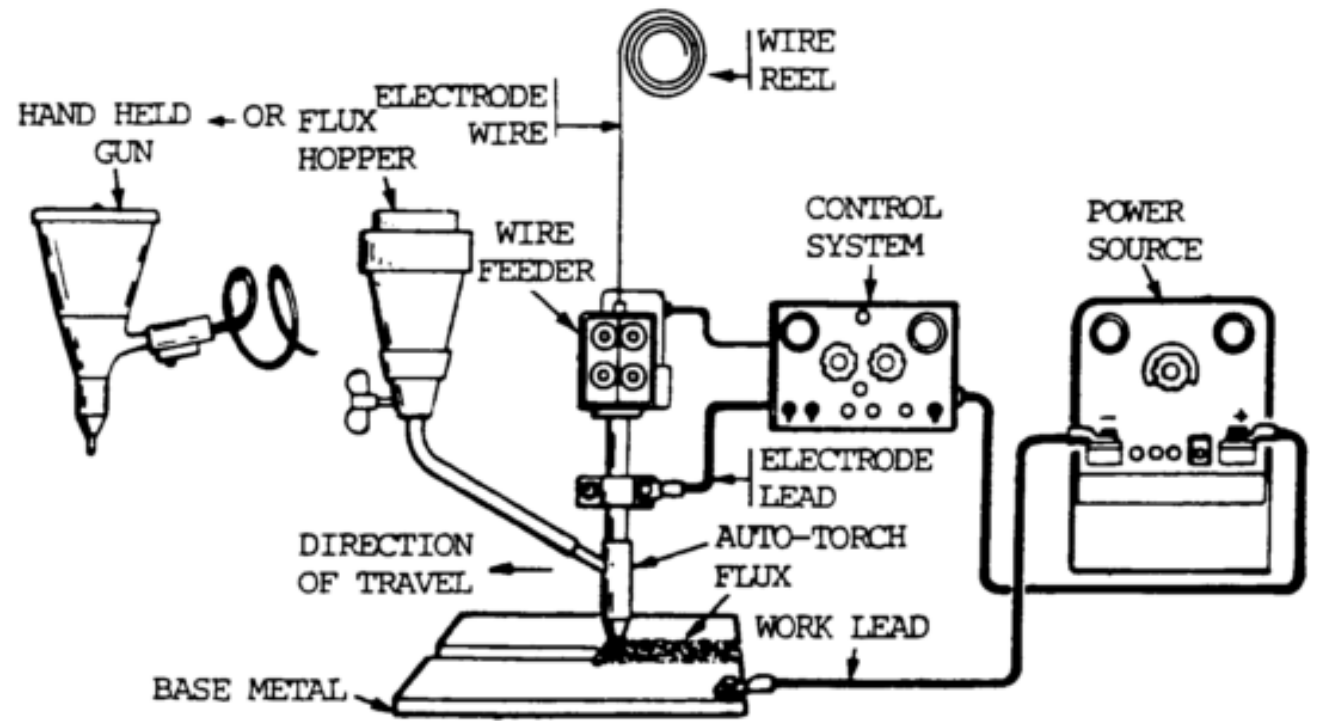
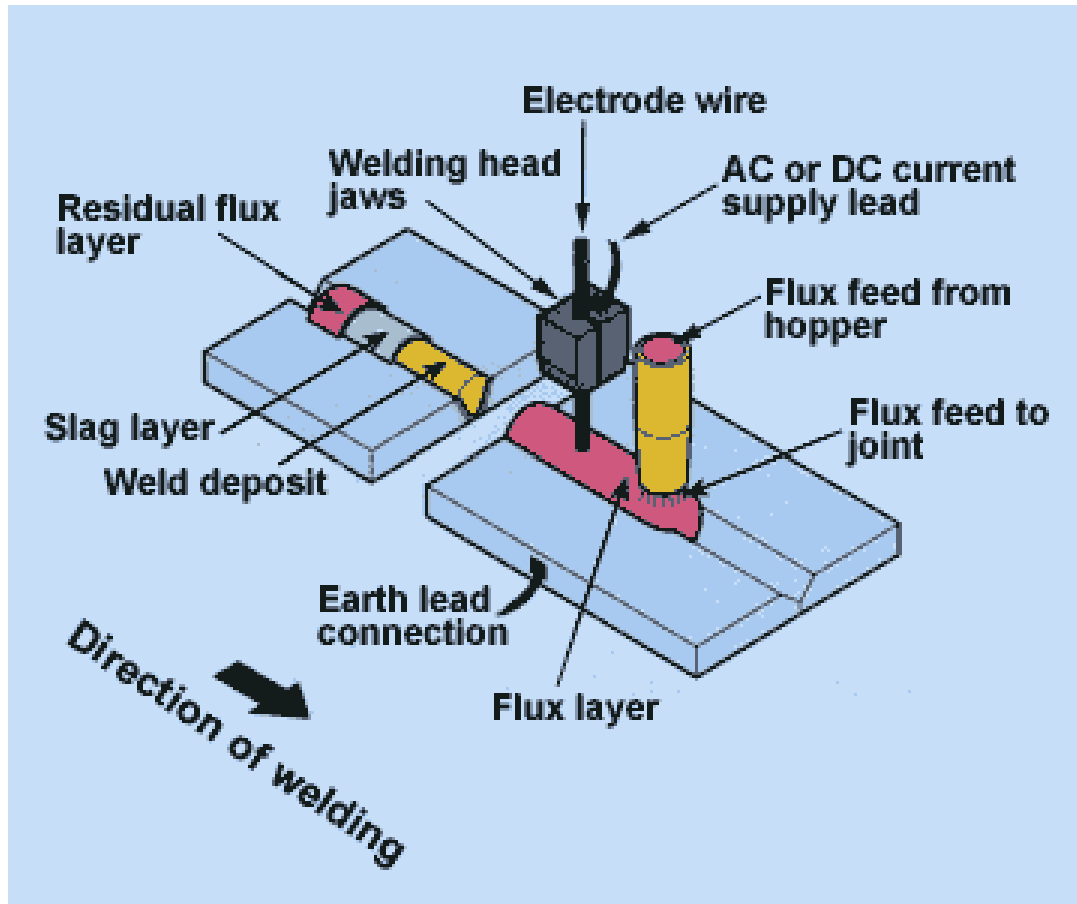
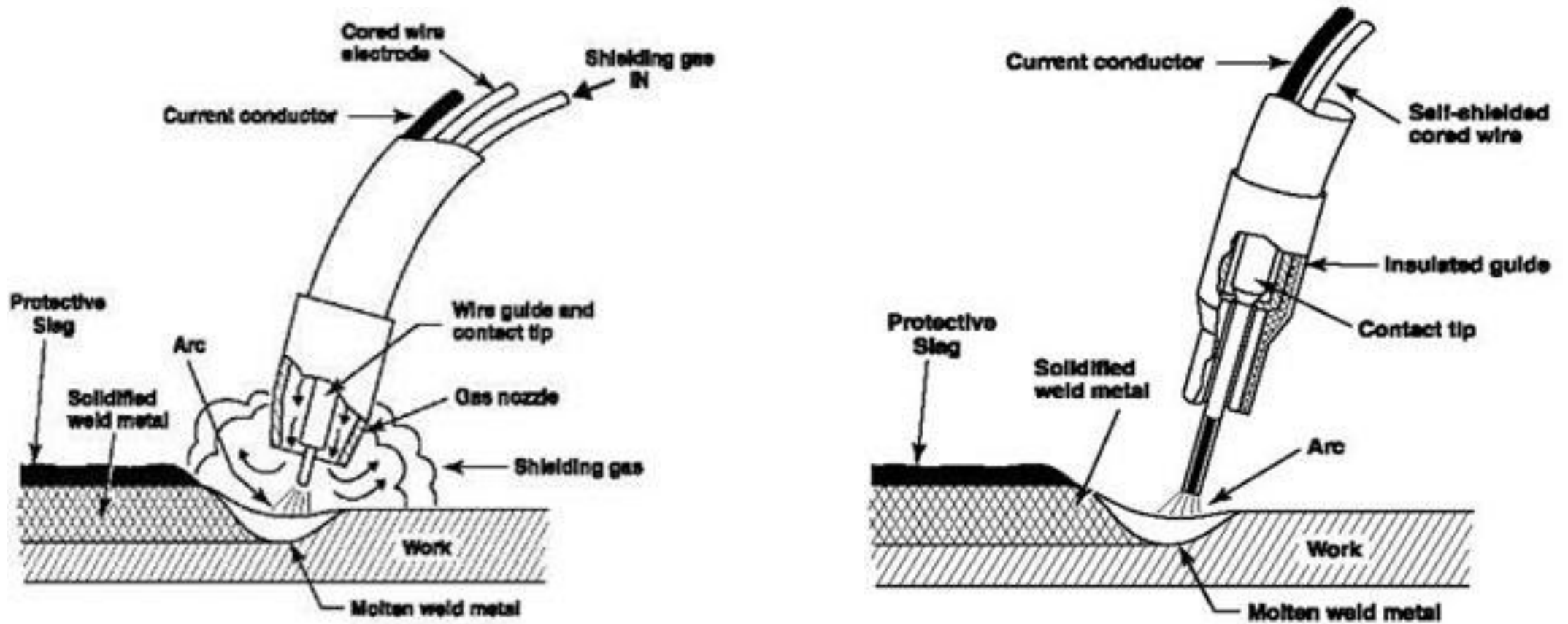


Figure 10-59. Block diagram - SAW.

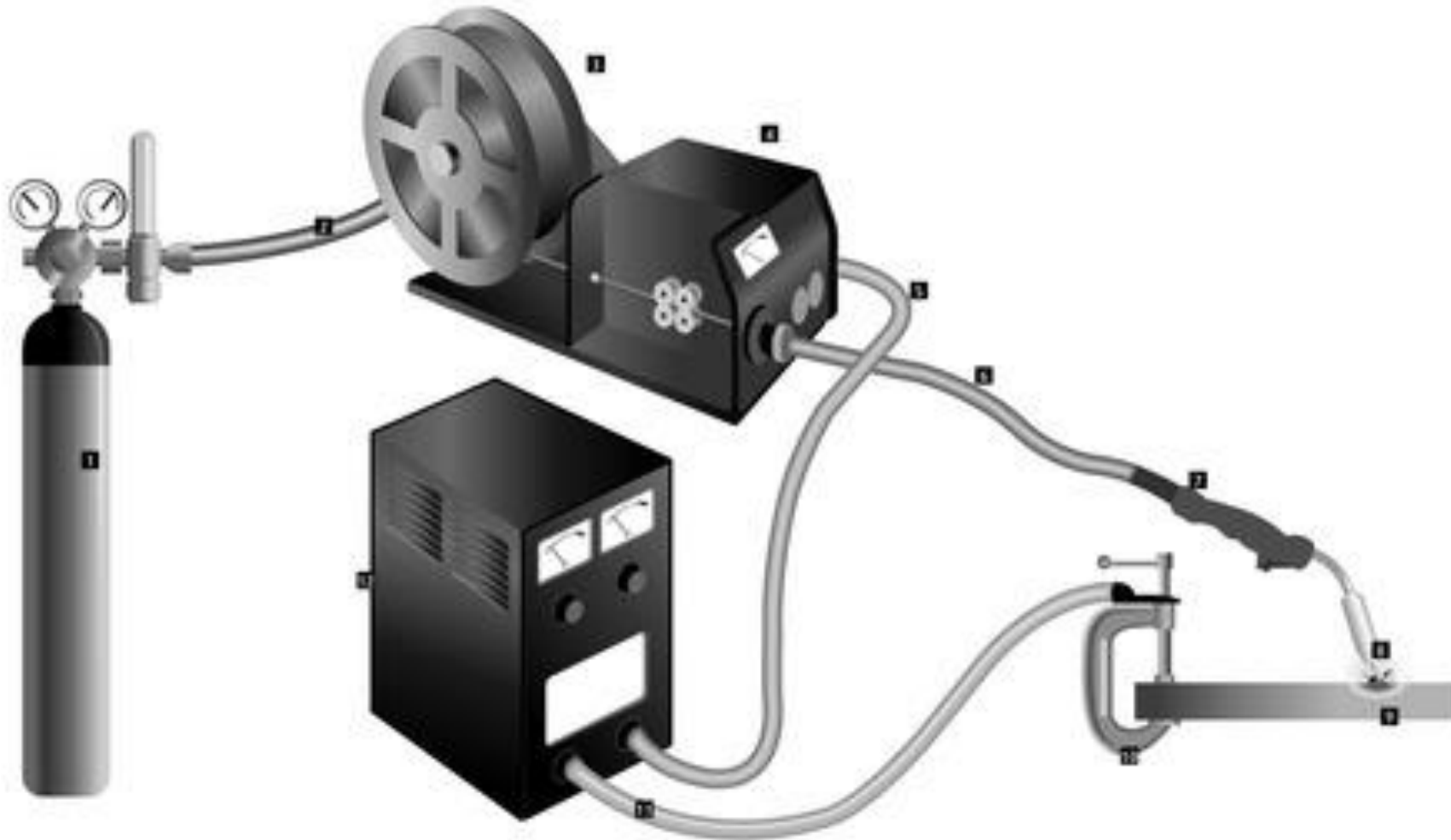
Flux Cored Arc Welding - FCAW



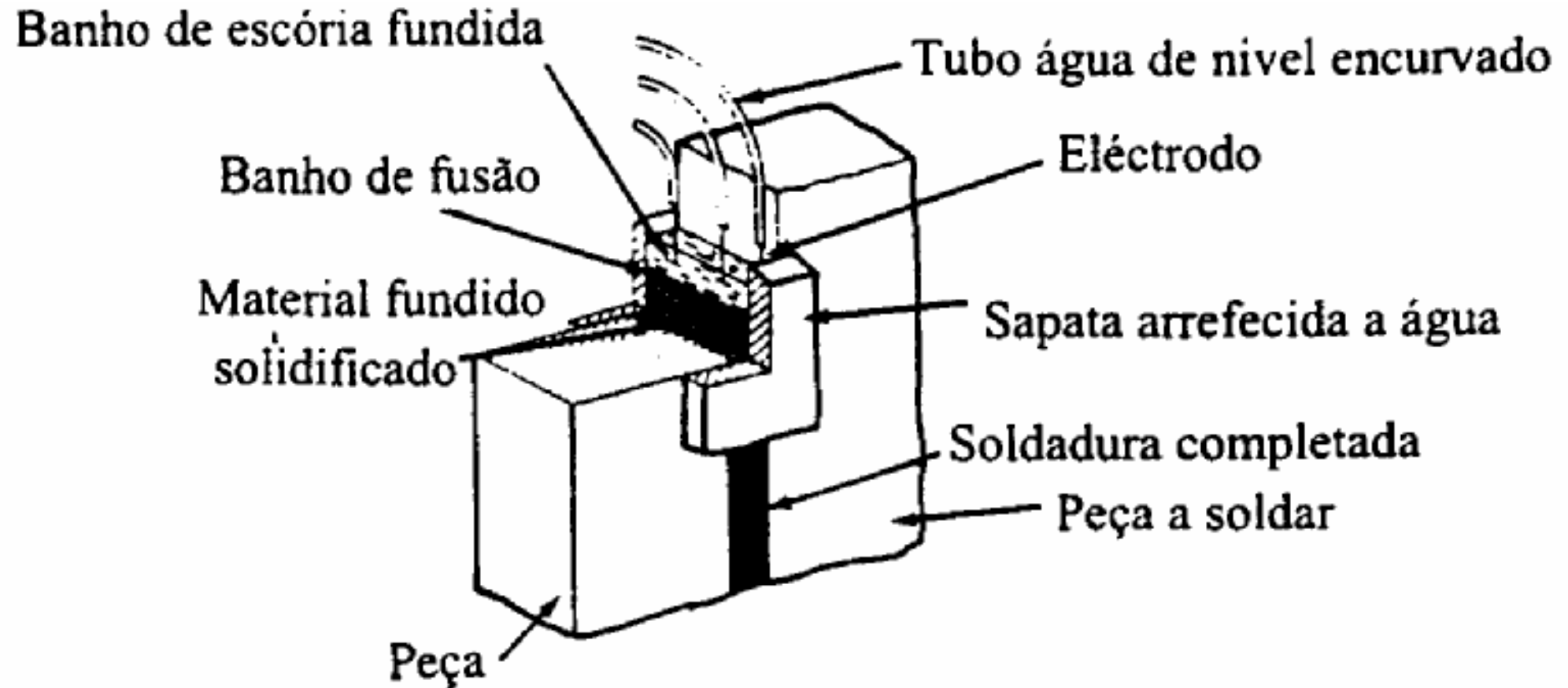
FCAW - Equipment

Process schematic diagram for MIG/MAG, FCAW and MCAW

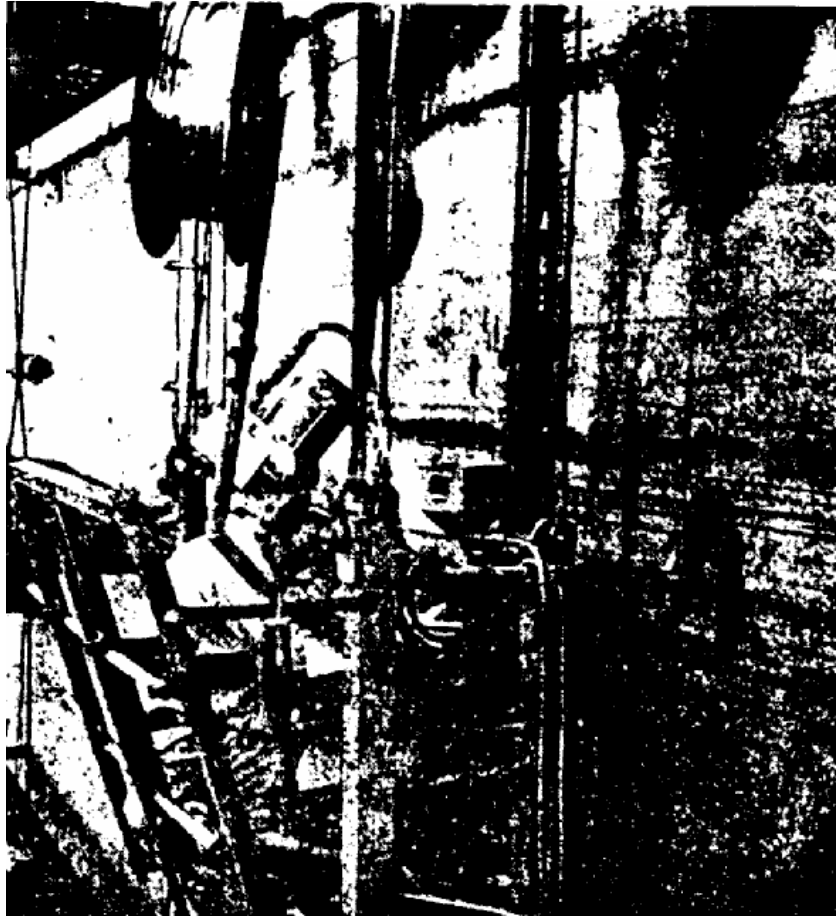
1 Gas cylinder, 2 Gas hose, 3 Continuous wire, 4 Wire feed unit, 5 Power cable, 6 Torch conduit, 7 Welding torch, 8 Arc, 9 Workpiece, 10 Earth clamp, 11 Return cable, 12 Power source



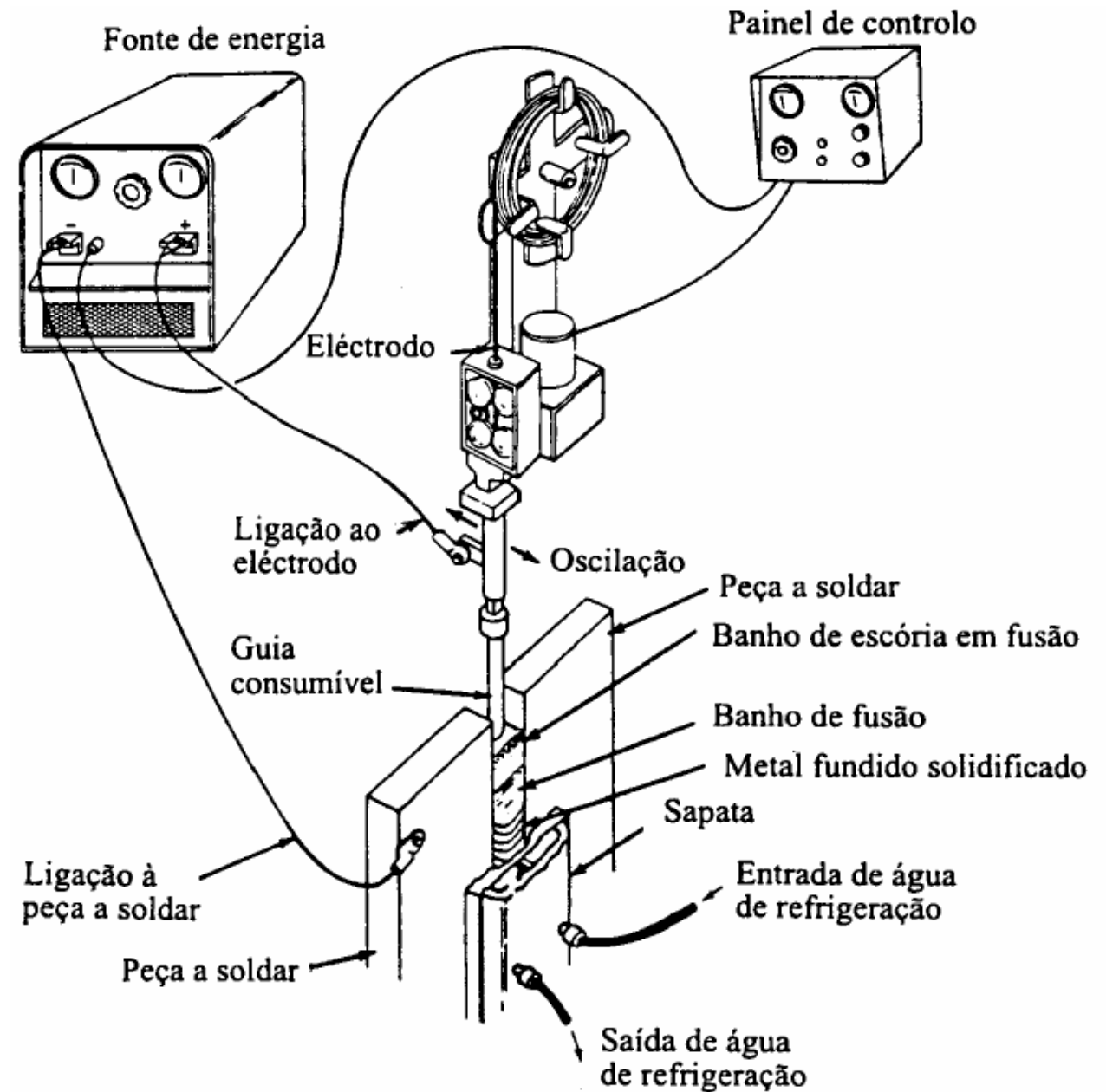
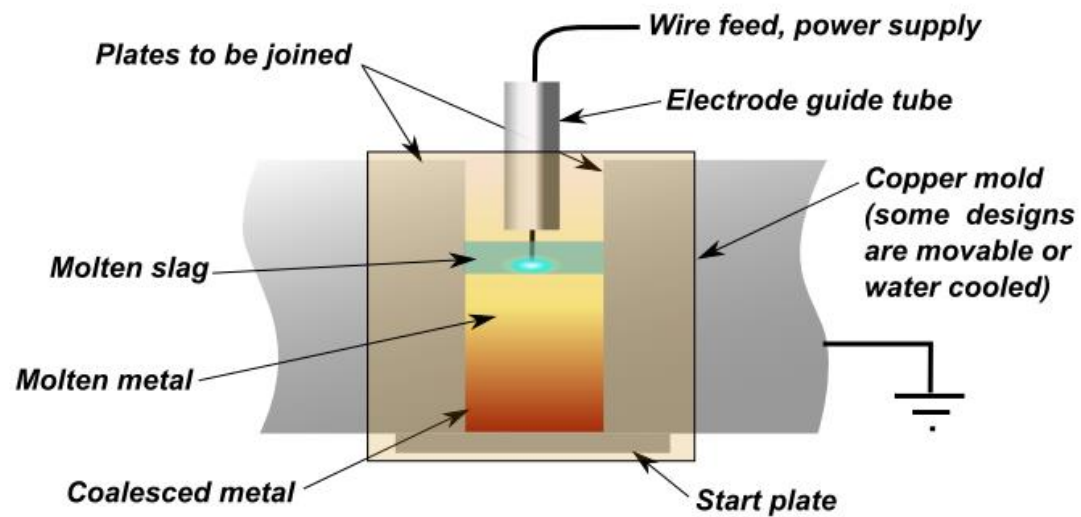
Electro-slag Welding



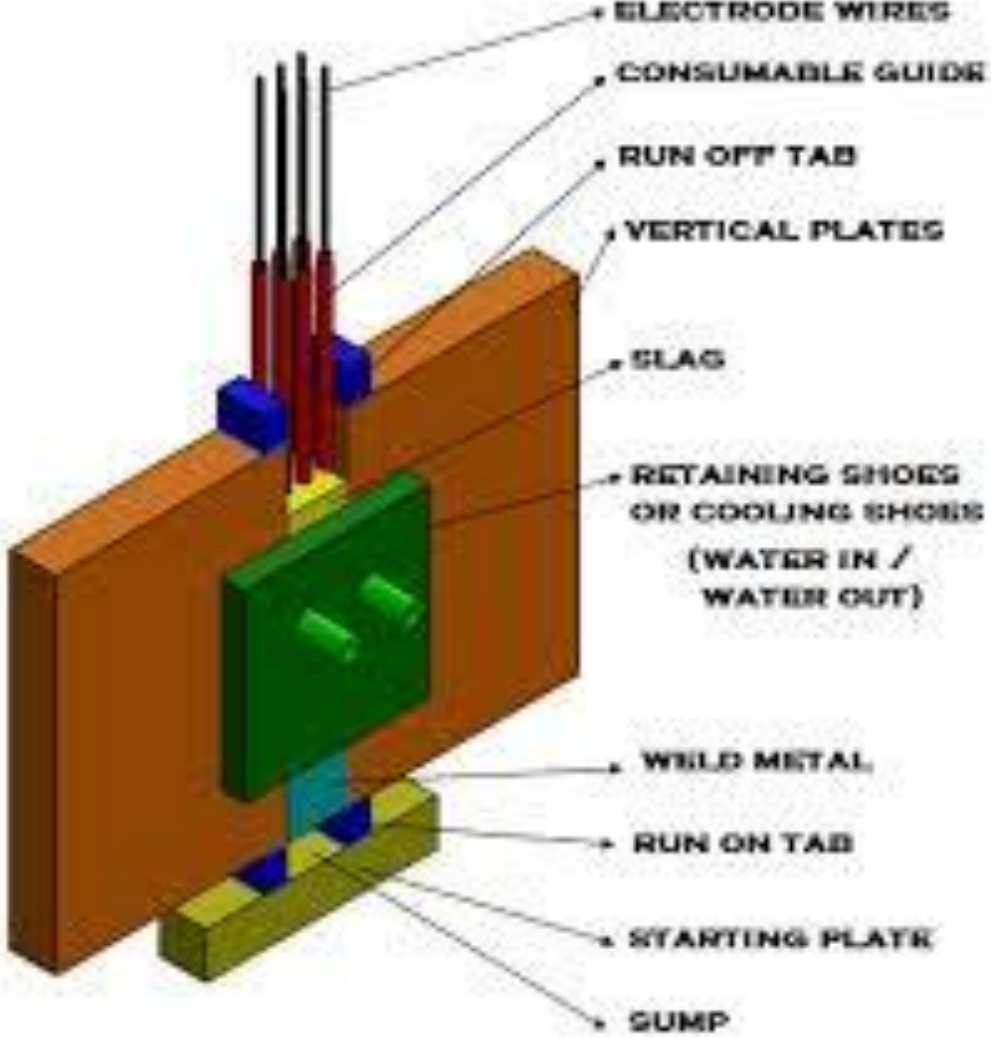
Electro Slag Welding



Electro Slag Welding – Consumable guide

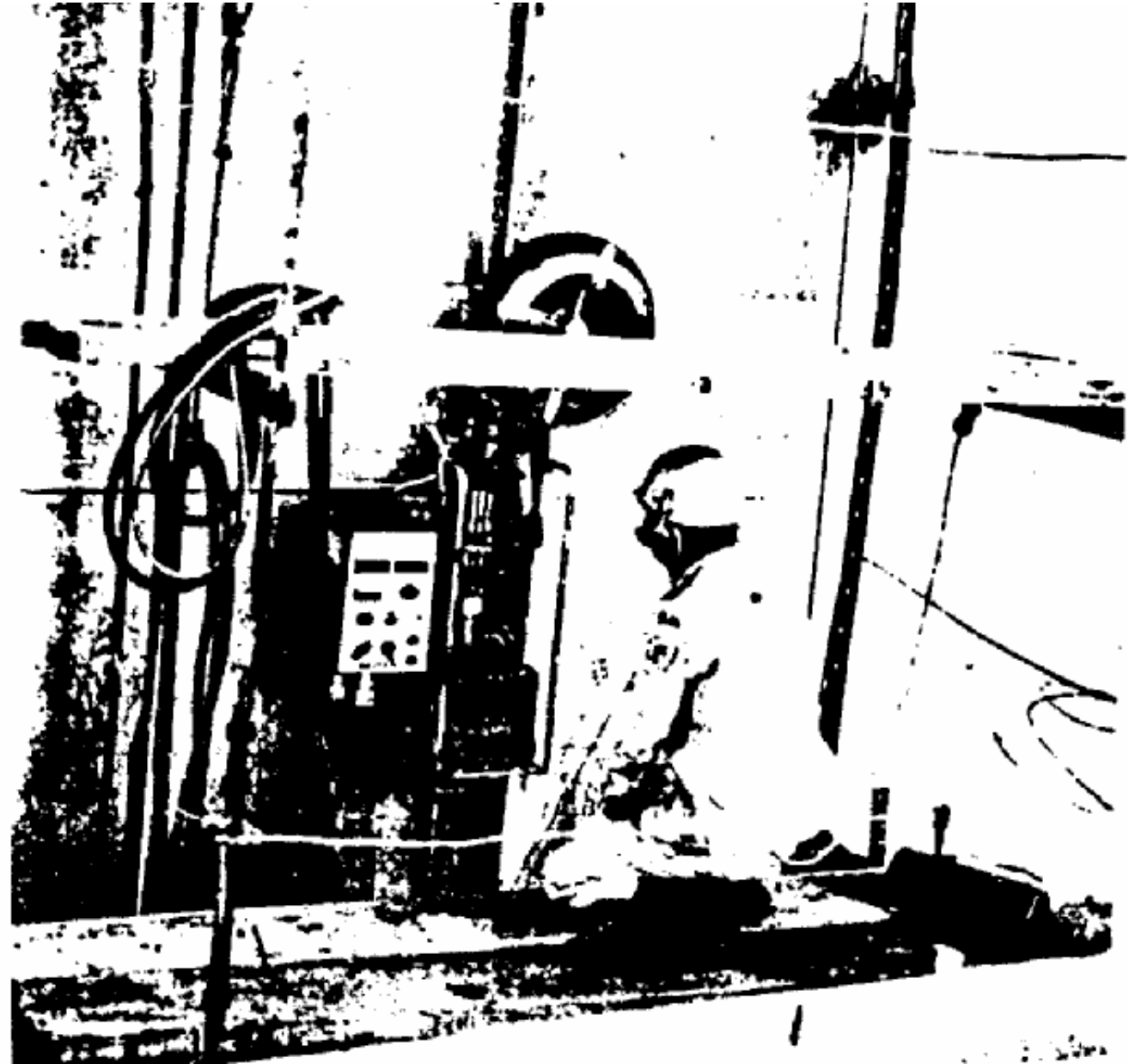
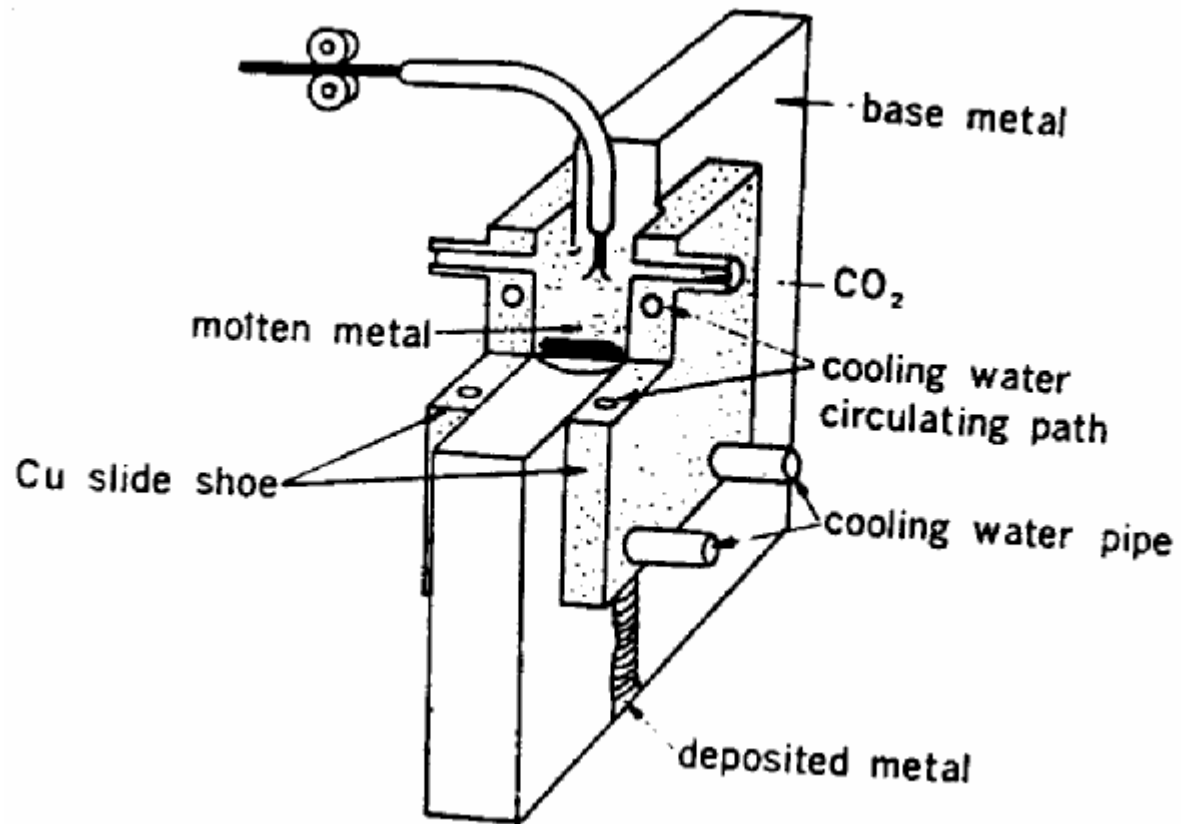


ESW

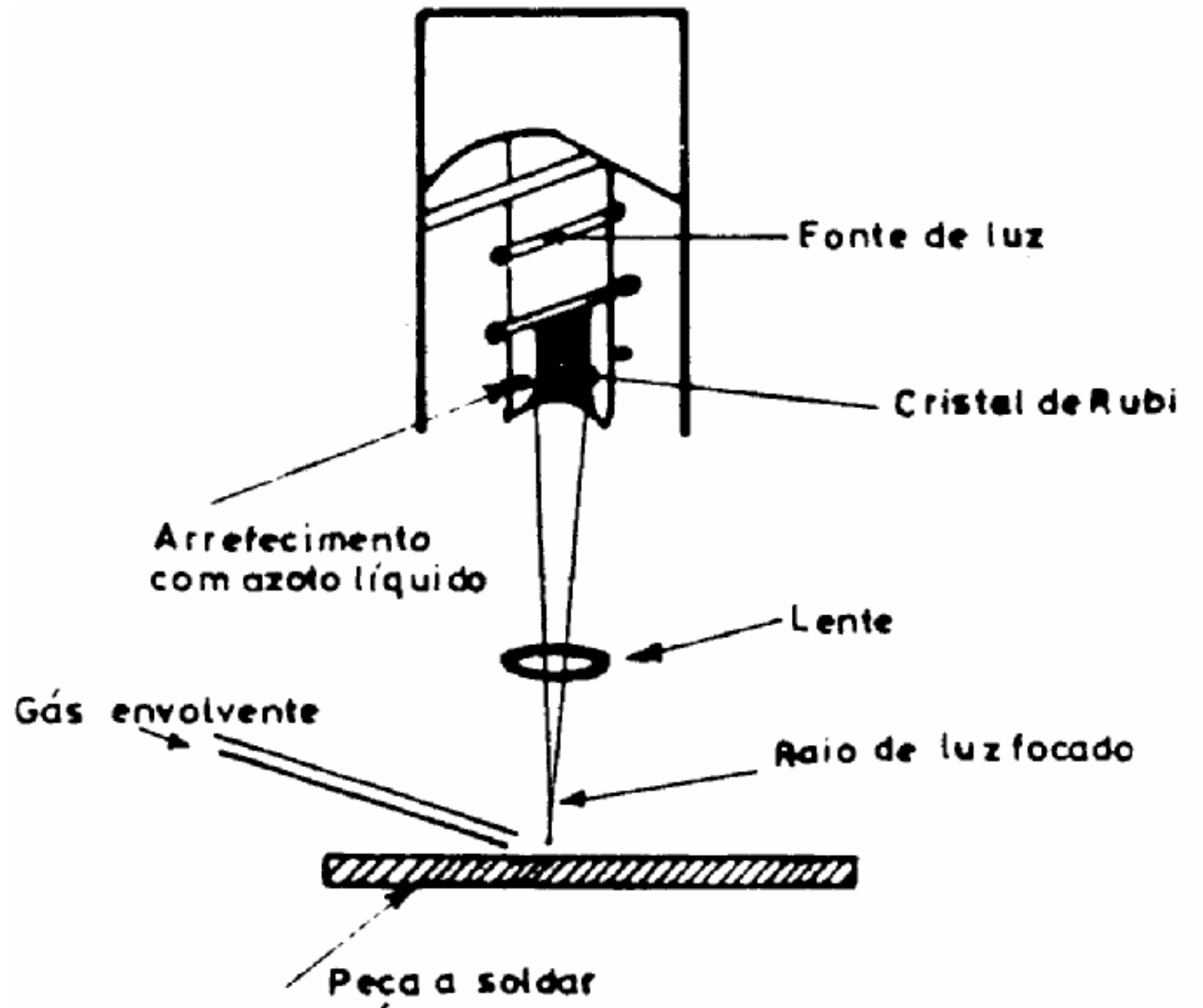
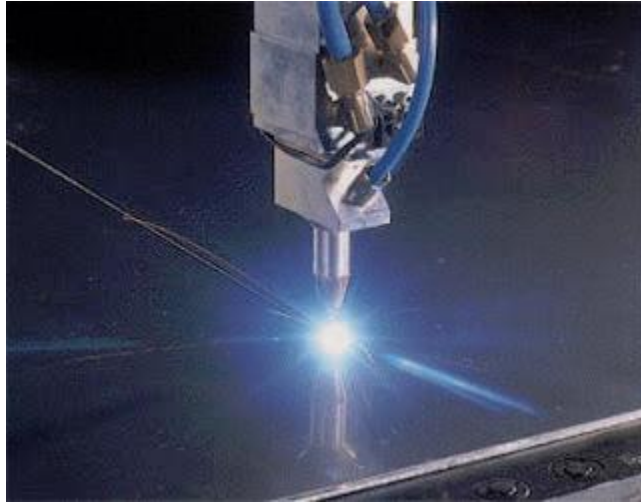


ELECTRO SLAG WELDING

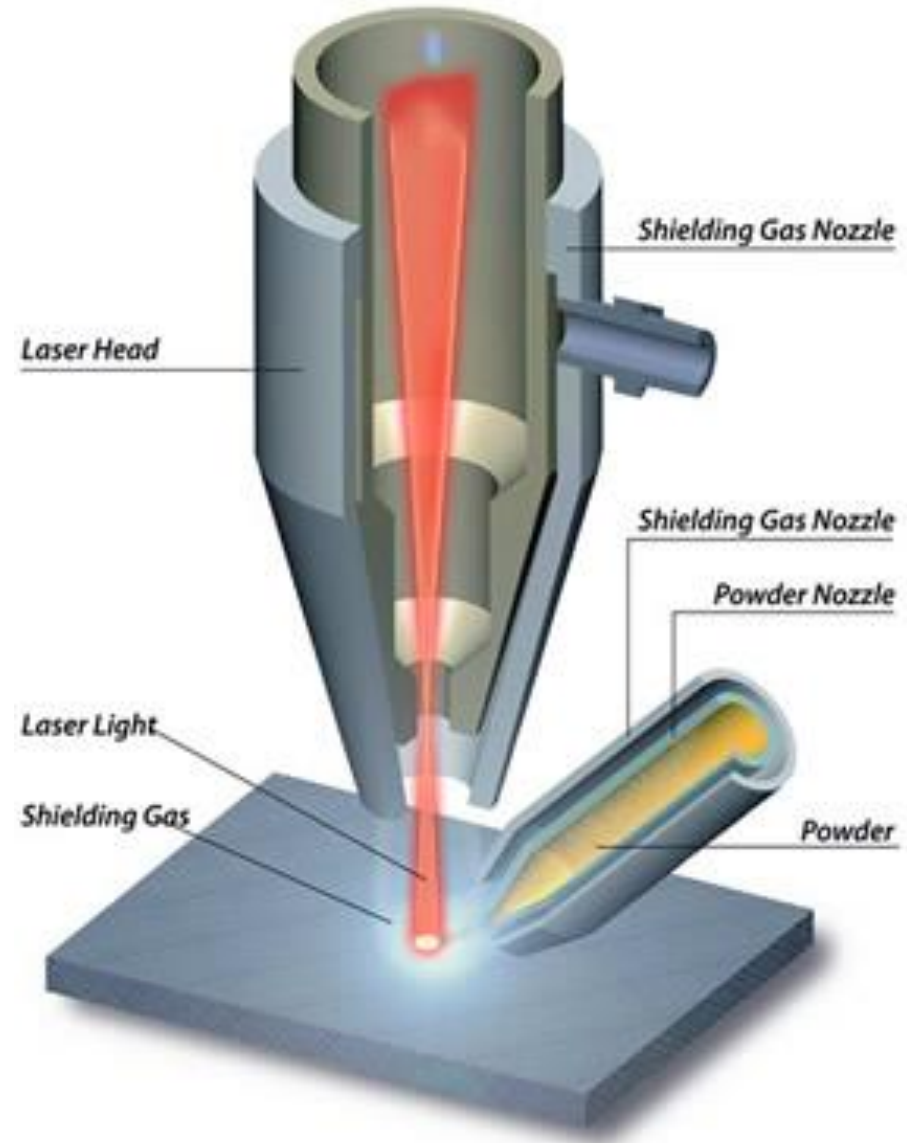
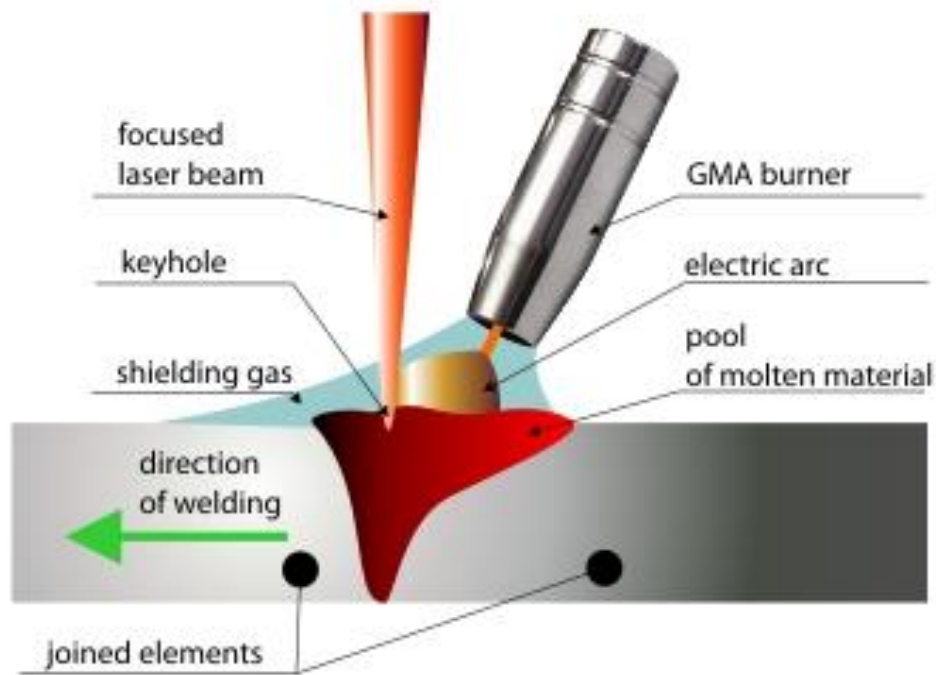
Electro Gas Welding



LASER Welding



Laser Welding and Hybrid Welding



(Picture: non-coaxial powder feed)

Comparison between welding procedures and technologies

1 – better / high 6 – worst / low	Manual SMAW	FCAW	Gravity	Submersed arc (SAW)	Electro gas Electro slag	MIG	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.	