CLAIMS

1. Electric power supply apparatus for an electric arc furnace (60) comprising at least one electrode (62) and connectable to a power network (50) to supply to said electrode (62) the electric energy to generate an electric arc to melt a metal mass, said power network being a three phase electric network with three phases, said apparatus comprising an electric regulation unit (12) interposed and connected to the power network (50) and to the electrode (62) and configured to regulate at least one electric quantity for powering said electrode (62), wherein said apparatus comprises at least one detection device (20, 22) to detect said electric quantity interposed between the electrode (62) and said electric regulation unit (12), a positioning device (46) configured to move the at least one electrode (62) nearer to/away from the metal mass to be melted and a control and command unit (16) connected to said electric regulation unit (12), to said power network (50), and to said positioning device (46) in order to control said electric regulation unit (12) and said positioning device (46) and to carry out a first control of the electric arc by acting on the electric regulation unit (12) and respectively a second control of the electric arc by acting on the positioning device (46), **characterized in that** said electric regulation unit (12) comprises a converter device (18) configured to convert the electric energy of the power network (50) in electric energy to power said electrode (62) and provided with a plurality of modules (34), connected in parallel with each other and with the power network (50), ~~and~~ in that each module (34) comprises ~~comprising a phase~~ three sub-modules (34R, 34S, 34T), one for each of the phases (R, S, T) of the power network (50), each phase sub-module (34R, 34S, 34T) comprising a straightening circuit (36), configured to straighten and regulate the respective phase current supplied by the power network (50), an intermediate circuit (38), in direct current, configured to store energy and create a separation between the external power network (50) and the electrode (62), and an inverter circuit (40) configured to invert the current regulating the frequency and the amplitude of the fundamental of the alternate current at exit, ~~said inverter circuit (40) being a multi-impulse commutation circuit~~.

2. Apparatus as in claim 1, **characterized in that** each phase sub-module (34R, 34S, 34T) is connected with a star connection and the star centers of the individual power phase sub-modules (34R, 34S, 34T) are connected to each other to ~~the~~ a neutral (N).

(16).

9. Apparatus as in claim 8, **characterized in that** said positioning device (46) is connected to an electrode control device (44), configured to command the positioning device (46) so that the electric arc is stable, said electrode control device (44) being connected at least to said voltage detection device (22) to command the activation of the positioning device (46) as a function of the arc voltage (UA) and of the reference voltage (UR).

10. Electric power supply method for an electric arc furnace (60) that provides to generate an electric arc by at least one electrode (62) powered by a power network (50), said power network being a three phase electric network with three phases, and to regulate at least one electric quantity for powering the electrode (62) by means of an electric regulation unit (12) interposed and connected to the power network (50) and to the electrode (62), wherein said method comprises detecting said electric quantity with at least one detection device (20, 22) interposed between the electrode (62) and said electric regulation unit (12), moving said at least one electrode (62) nearer to/away from a metal mass to be melted with a positioning device (46), and controlling said electric regulation unit (12) and said positioning device (46) in order to carry out a first control of the electric arc by acting on the electric regulation unit (12) and respectively a second control of the electric arc by acting on the positioning device (46), **characterized in that** it comprises converting the electric energy of the power network (50) in electric energy to power said electrode (62) with a converter device (18) provided with a plurality of modules (34) connected in parallel with each other and with the power network (50) ~~and~~ in that each module comprises~~comprising a~~ three phase sub-modules (34R, 34S, 34T) one for each of the phases (R, S, T) of the power network (50), in each phase sub-module (34R, 34S, 34T) being provided a straightening and regulation of the respective phase current supplied by the power network, a temporary storing of energy, and separation between the external power network (50) and the electrode (62) with an intermediate circuit (38) in direct current, and an inverting of the current, regulating the frequency and the amplitude of the fundamental of the alternate current at exit, with an inverter circuit (40).