

Natural Ionizing System of Electrical Protection against Atmospheric Discharges (Lightning)

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Abstract: This is the New Highest Technology, 100% Venezuelan and Unique in the World, Technological Innovation, World Patent for Maximum Protection, Security and Zero Risk (0) to all Electrical and Power Generation Systems: Hydroelectric and Thermoelectric Power Plants; Wind, Nuclear and Solar Power Plants; others. It's the only technology around the world that has the potential to disperse and propagate to land mass the enormous energies associated to the Atmospheric Discharges (Lightning), which are in the order: 200,000 to 500,000 Amperes; 1,000 million Kilowatts and High-Level Transient Voltage of 100 million Volts. This New High Technology is the solution to the paradigm of Benjamin Franklin and it's the mechanism to end the "Blackouts" that produces so many damages and losses of billions of dollars to both: generators and users of electrical service, throughout the world.

Keywords: Atmospheric Discharges, Lightning, Electrical Substations, Grounding Protection.

1. Introduction

The Electrical Faults, Interruptions and "Blackouts" generated by Atmospheric Discharges (lightning) in Transmission Lines, Electrical Substations (High Voltage), Power Equipment and Electronic Equipment of High Sensitivity are the main problem in today's Electrical Engineering in the world.

The calculation and design of Protection Systems for Transmission Lines and Electrical Substations (Reticular Mesh of Grounding, Bars and others) that are currently used in Electrical Engineering are inefficient, because those calculations for Reticular Mesh of Grounding are made by taking into account only the electrophysical characteristics of Power Transformers and other items such as: transformers capacity, reactance, capacitance, inductance, secondary current, short circuit current symmetrical and asymmetrical, land resistivity, mesh geometry and others. In other words, Reticular Mesh of Grounding aren't designed or calculated to counteract the destructive effects of lightning.

The dispersion capacity of a Reticular Mesh of Grounding would be in the order of 10,000; 20,000 or 30,000 Amperes. In that sense, the energy values associated to lightning are in the order of: 500,000 Amperes, 1,000 millions of Kilowatts and High-Level Transient Voltage of 100 millions Volts that no Reticular Mesh of Grounding would be able to disperse.

The only existing device to disperse and propagate this huge energy is the Natural Ionizing System of Electrical Protection conformed by: Lightning Rod Ionizing Natural Ionca and Ionic Electrode Active Trimetallic Triac of Grounding, both High Technologies, 100% Venezuelan. (Cabareda, 2006. Science, Technology and Innovation Award, FUNDACITE, Science and Technology Ministry of the Bolivarian Republic of Venezuela). Finally, the only definitive and total solution to avoid Interruptions and Electrical Faults in Electrical Substations, Power Equipment and Electronic Equipment of High Sensitivity generated by Atmospheric Discharges (lightning) and to end "Blackouts" is by installing these devices on existing Towers and Transmission Lines, Electrical Substations and for those to construct.

2. The New Highest Technology, 100% Venezuelan,

2.1. Natural Ionizing Lightning Rod Ionca

It bases its operation on its electrophysical structure and the enormous differences of existing potential and the electrical field in the atmosphere in conditions of storm that allow to generate “crown effect” or “ionizing effect” that produce billions of high ion conductivity, because it has electrodes to atmospheric potential (atmospheric excitatory) and electrodes to grounding potential isolated to each other. This “ionizing effect” is increased by “hit effect” between air molecules and particles (ion) accelerated by the enormous existing electric fields during the storm. This natural ionization generates a “grounding direct discharge” which is the precursory current of lightning and that jointly with the stepped currents that derive from the interaction of the microparticles in the clouds, indicates the way and the trajectory for the Atmospheric Discharge (lightning), which will be lead through Lightning Rod Ionizing Natural Ionca and the Ionic Electrode Active Trimetallic Triac of Grounding to the land mass, scattering and spreading the enormous energies associated to this phenomenon, without causing damages. Electrophysical Characteristics: Height: 620mm. Diameter: 470mm. Weight: 6.4Kg. Material: Stainless Steel 304, Polytetrafluoroethylene (400°C). Vertical Penetration: 50 y 100m. Warranty: 20 years.

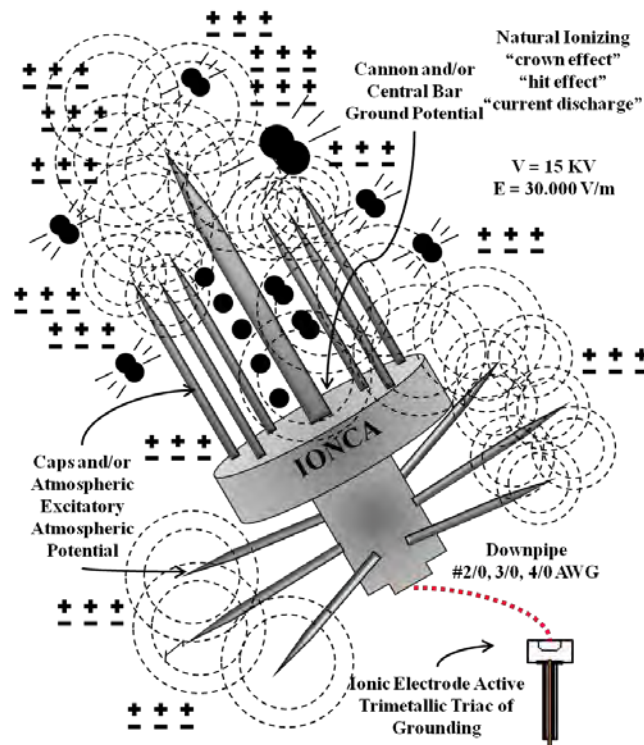


Fig. 1. Natural Ionizing Lightning Rod Ionca. Electrophysical Basis.

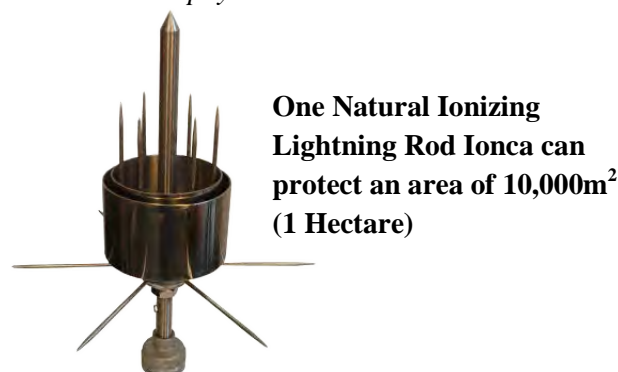


Fig. 2. Natural Ionizing Lightning Rod Ionca.

2.2. Active Trimetallic Ionic Electrode Triac of Grounding

It bases its operation and highest efficiency on its electrophysical characteristics that allow the total and complete adhesion to the land mass, whose land has been dealt chemically with high-electrical conductivity electrolytes that decrease the enormous resistivity and allows: water saturation and humidity retention, total adhesion to the land mass and high indices of alkalinity. The volume of the treated ground is from 18m^3 to 27m^3 approximately and is united to the land mass by the electrolytic and not mechanic adhesion, facilitating the way of dispersion and propagation of the enormous energies associated to the atmospheric discharges (lightning) and electrical faults, generally. Energy Dispersal Capacity to Land Mass: 500,000 Amperes, 1,000 million Kilowatts, Lowest Electrical Resistance $R = 0.86$ to 3Ω (ohm). Land Characteristics: Lowest Land Resistivity, Porosity and Compaction, Maximum Humidity, Temperature, Station of the Year, Electrolytes, PH.

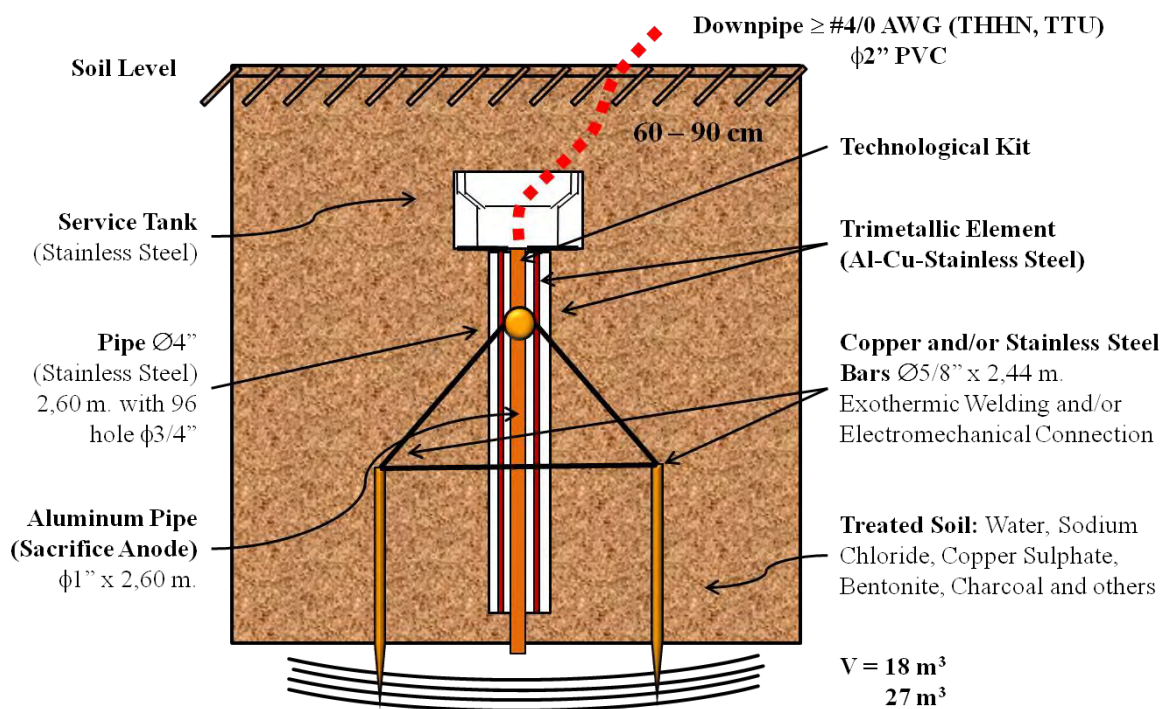


Fig. 3. Active Trimetallic Ionic Electrode Triac of Grounding. Cross Section.

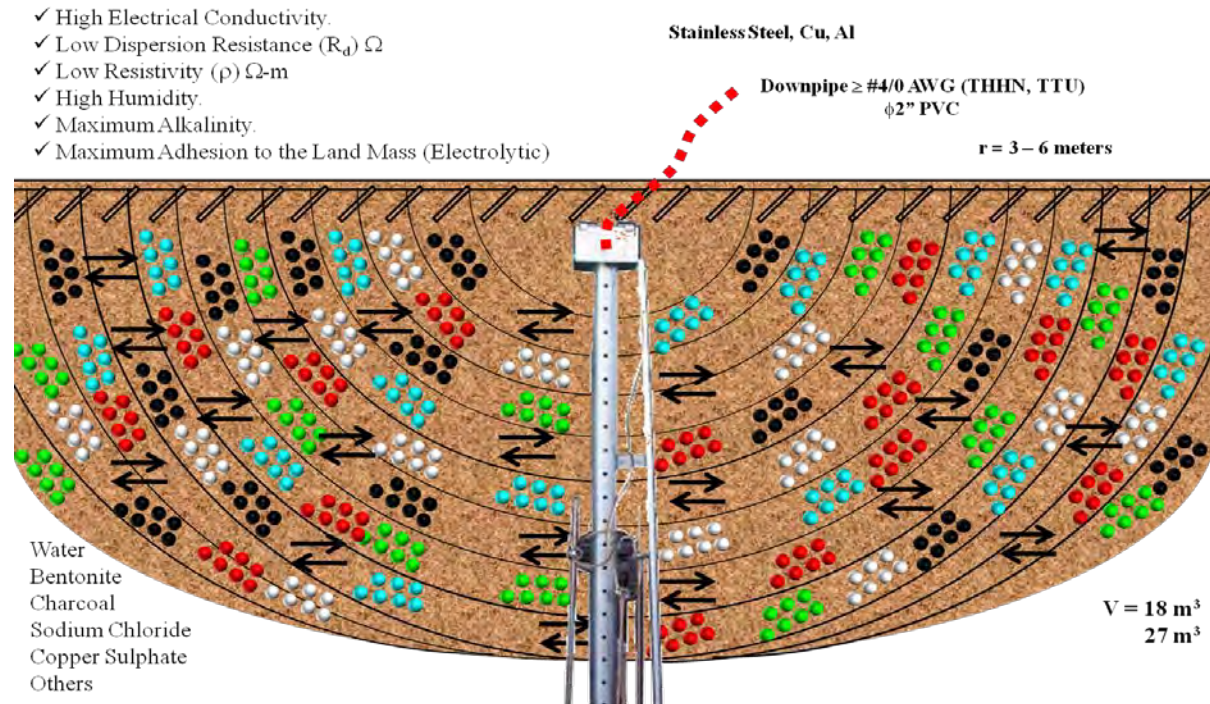


Fig. 4. Active Trimetallic Ionic Electrode Triac of Grounding. Electrophysical Basis.



**HIGH CAPACITY OF DISPERSION
OF THE ENERGY to the land mass:**

- 600,000 Amperes.
- 1,000 million of Kilowatts.
- 100 million of Volts.
- R = 0.86 a 3 Ω (ohmios)

Fig. 5. Active Trimetallic Ionic Electrode Triac of Grounding.

2.3. Energy of Lightning

Lightning, it's an interaction and transmission of elevated electrical charges between the atmosphere and the earth in conditions of storm or Atmospheric Disturbances. On Earth happens: 4,000 storms daily. 9,000,000 lightning daily. The Energy of Lightning is in this order: 200,000 to 500,000 Amperes; 1,000 million KW; 1 millions MW = 1.000.000 MW; 100 millions Volts.

The Energy generated for the biggest Hydroelectric's Dams around the world would only reach 10% of the Energy of a single Lightning: Hydro Québec (Canada) 36.810MW, Guri (Venezuela) 10.000MW, Macagua (Venezuela) 3.140MW, Caruachi (Venezuela) 2.160MW,

Tocoma (Venezuela) 2.160MW, Itaipu (Brazil-Paraguay) 14.000MW, Three Georges (China) 22.500MW, Hoover (USA) 2.080MW, Tehri (India) 2.400MW, Aswan (Egypt) 2.100MW, Inguri (Georgia) 1.300MW, Grand Dixence (Switzerland) 2.000MW, Nurek (Tajikistan) 4.000MW.

2.4. Consequences of Atmospheric Discharges (Lightning)

Damages to Constructions and Electricals Equipment, Electronic, Communications, Computation and Cybernetic, generally: Inductive and Conductive Effects that produce High Levels of Transitory Overvoltages (100 millions Volts). Damages to People: Cardiac and Respiratory arrest, Cerebral Injuries, Burns, Plow of the Eardrum, Pulmonary and Bony Injuries, Post-traumatic Stress. Losses of billions of dollars to both, generators and users of electrical service around the world.

2.5. Characteristics of Atmospheric Discharges (Lightning)

30 - 100 million Volts. 200,000 – 500,000 Amperes. 100 - 1.000 million Kilowatts. Electric Field: 30 Volt/m. Potential Gradient: 15KV. Air Impedance: 5KΩ. Atmospheric Pressure: 100 Atmosphere. Duration Time: 10 – 30 μseg. Energy: 3×10^9 J/m. Temperature: 15,000 to 30,000°C. Acoustic Energy: 25% (thunder) Caloric Energy: 75% (electrical discharged)

2.6. The Lightning Rod

The Lightning Rod is a device conformed by one or several metallic bars with certain geometric disposition united to an grounding electrode by a downpipe conductor, that facilitates the way of the lightning from the cloud to the Earth, allowing the dispersion and propagation of the enormous energies associated, without causing damages to people and/or equipment.

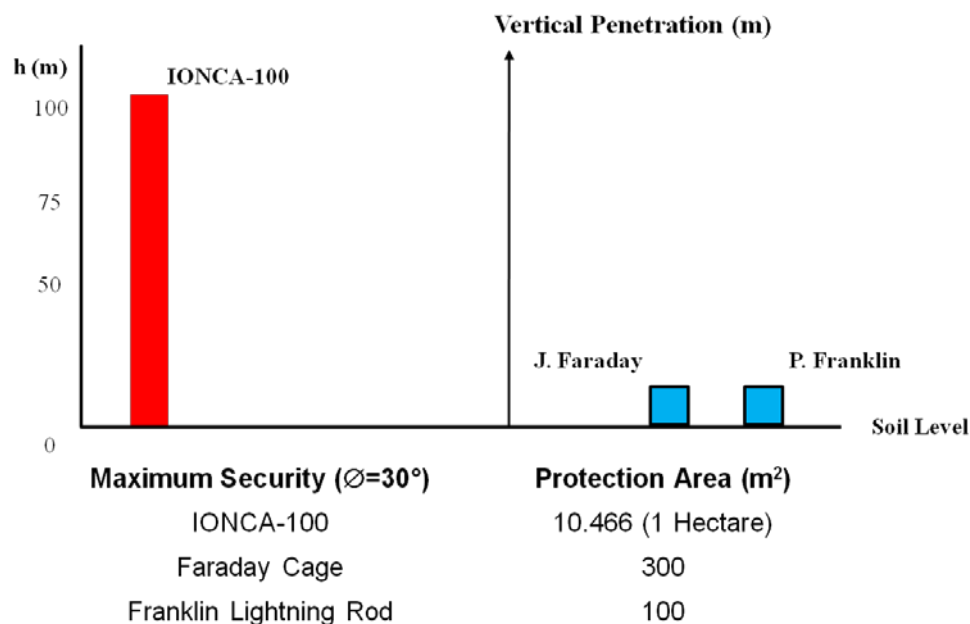


Fig. 7. Traditional Lightning Rods and Natural Ionizing Lightning Rod Ionca comparison.

2.7. Grounding Systems

It's a set of metallic elements directly buried that allow and facilitate the dispersion and propagation of energy associated to a lightning and electrical faults, without causing damage. The adhesion to land mass of Traditional Systems of Grounding like Bars and Reticular Mesh of Grounding is mechanical. The adhesion to land mass of the Active Trimetallic Ionic Electrode Triac of Grounding is Electrolytic.

- It protects people and/or equipment (electrical, electronic, communication, computation).

- It protects against: Lightning, Transitory Overvoltages of Discharge and Low Level, Accidental Contact with Lines of High Tension (HT) and Low Tension (LW).
- It stabilizes the voltage of normal operation.
- It facilitates the switch operations.
- Equipotentiality: Touch Voltage and Step Voltage.
- It allows the dispersion and propagation to land of the associated energy (lightning) to electrical faults, leakage currents and Atmospheric Discharges.

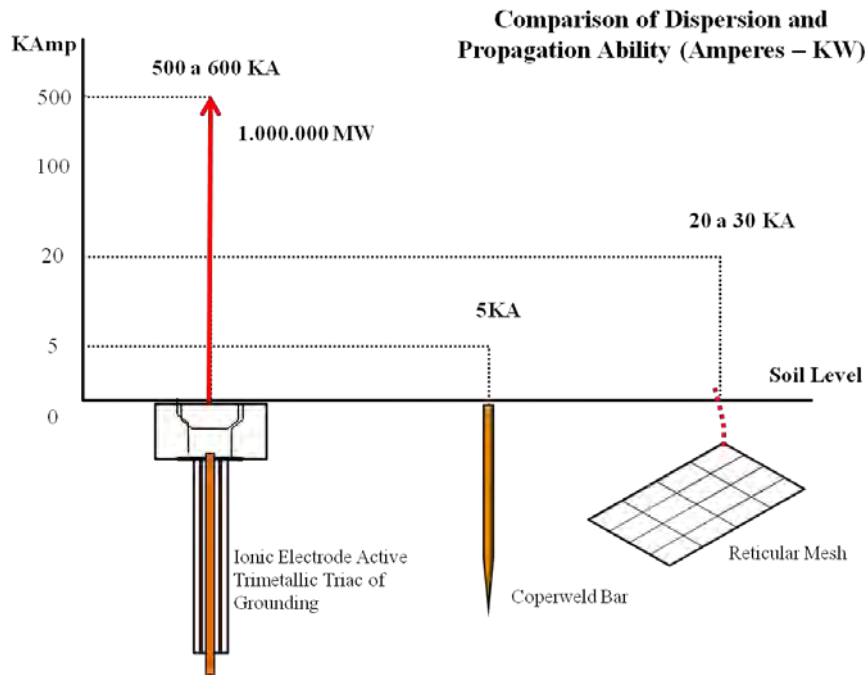


Fig. 8. Comparison of Traditionals Systems of Grounding with the Active Trimetallic Ionic Electrode Triac of Grounding.

2.8. Actual Electrical Substation

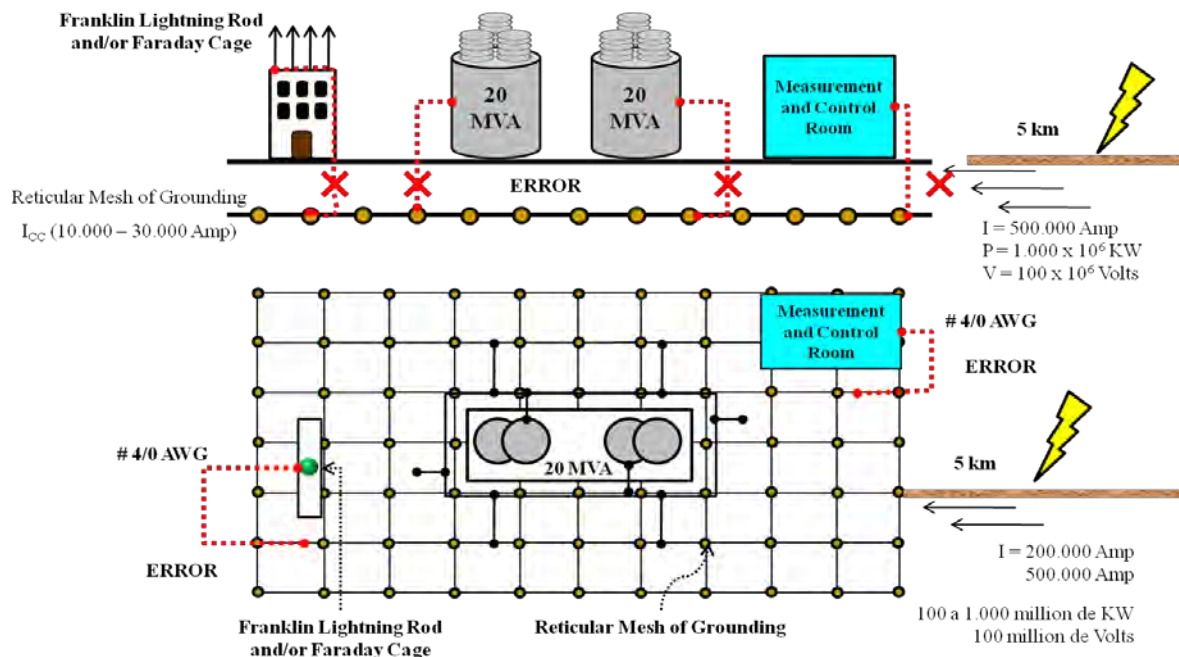


Fig.9. Actual and Traditional Systems of Grounding (ERROR)

2.9. Electrical Substation: The New Highest Technology

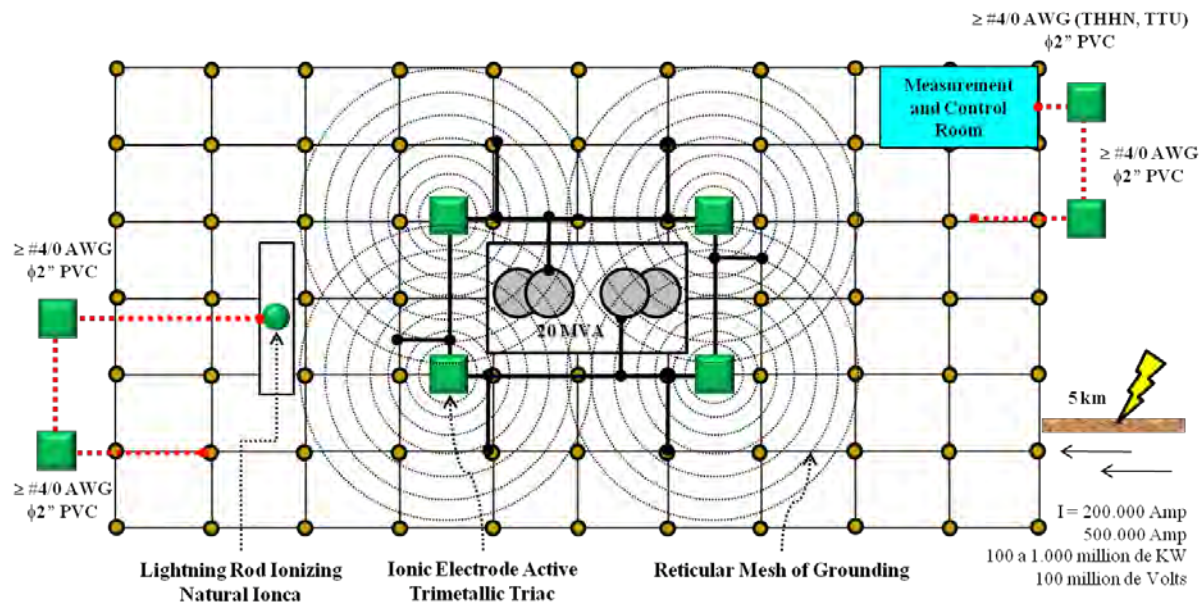


Fig. 10. Natural Ionizing System of Electrical Protection. New Concept, Design and Calculation of Engineering in Electrical Substations. (CORRECT)

3. Results/Conclusion

Power generation is vital and very important, but provide protection and security to the energy generated is perhaps even more important. We must avoid the energy losses with an efficient and effective protection. The 85% of major “Blackouts” and Electrical Faults in power generation, Power Equipment and Electronic Equipment of High Sensitivity in the world are produced by the destructive effects of Atmospheric Discharges (Lightning). This results in loss of lives and billions of dollars each year.

The New Highest Technology, 100% Venezuelan, Unique in the World, Natural Ionizing System of Electrical Protection conformed by the Lightning Rod Ionizing Natural Ionca and the Ionic Electrode Active Trimetallic Triac of Grounding of world-wide standard whose operation and electrophysical basis are based on phenomenon and events scientifically verified like: Atmospheric Discharges (lightning), “crown effect”, “hit effect”, “grounding direct discharge”, metallic and atmospheric ionization, electromagnetic and electric fields, ionizing potential and electronic affinity, electrical potential presented in the atmosphere in conditions of electrical storm, resistance and atmospheric pressure, tripole in the cloud, cosmic rays, physical state of the water (liquid, solid and gaseous), electrolytes, resistivity of the ground and resistance of dispersion, effects to improve the ground resistivity to give high degree of alkalinity), principle water humidity and retention (properties of the charcoal, copper sulphate, sodium chloride and the bentonite), substances, equipotential lines and equipotentiality of a system (properties of the steel, receives and aluminum like good electrical conductors), exothermic weld.

This New High Technology, 100% Venezuelan is the definitive and total solution against Electrical Faults and Interruptions generated by Atmospheric Discharges (lightning) and affect Electrical Substations, Power Equipment and Electronic Equipment of High Sensitivity, Oil Exploration, Drills, Tanks and Stations of Fuel Provision. At the same time, avoiding “the burning” of Electronics Cards in Electronics Equipment of High Sensitivity (Rx, CT, MRI). It’s the mechanism to end the “blackouts” that produces so many damages and losses of

billions of dollars around the world. It's scientifically proved and globally accepted that the existing Electrical Systems of Protection at the moment like: Reticular Mesh of Grounding and Coperweld Bars don't have capacity to disperse and propagate to land mass the enormous energies associated to the Atmospheric Discharges (lightning), which are in the order: 500,000 Amperes, 1,000 million Kilowatts and High-Level Transient Voltage of 100 million Volts, enormous energies that cannot be dispersed by Reticular Mesh of Grounding, which it has a maximum capacity between 20,000 and 30,000 Amperes. This is the principal cause of major Blackouts and Electrical Faults around the world.

Finally remarks

The Lightning Rod Ionizing Natural Ionca and the Ionic Electrode Active Trimetallic Triac of Grounding are Ecological, Natural, Don't Contaminate the Environment and fulfill all Electrical Codes and Norms International and National such as: IEEE, NFPA, ANSI, BSCP, WMO, NFC, NEC, CODELECTRA, COVENIN; and it has received the Certification and Recognition by: IEEE, The Institute of Electrical and Electronics Engineers, Latin America and The Caribbean Region. XXI World Energy Congress, WEC 2010, Canada, Author, Presenter, Venezuela Delegate. The New Highest Technology Paper: The International Energy Technology Data Exchange (www.etde.org); US Department of Energy Office of Scientific and Technical Information, OSTI, Library and Archives Canada and Scientific Libraries Worldwide. IEEE, XV International Congress of Electrical, Electronic and Systems Engineer, INTERCON 2008, Peru, Author, Presenter, Venezuela Delegate. Polytechnic Experimental National University "Antonio Jose de Sucre" (UNEXPO), Arbitrated University, Venezuela. Antenor Orrego Private University (UPAO), Peru. Science, Technology and Innovation Award granted by Foundation for the Development of Science and Technology (FUNDACITE), Ministry of Science, Technology and Intermediate Industries, 2006, Venezuela. General Department of Science and Technology Research, Ministry of Science, Technology and Intermediate Industries, Venezuela. National Center of Technological Innovation. CVG MINERVEN. National and Internationals Publics and Private Companies. Projects and Construction built: Church La Chiquinquirá. CVG MINERVEN (Gold Mining). Promotora Minera Guayana (PMG), AGAPOV Group (Rusian) – Gold Mining. Corporación 80.000, C.A., AGAPOV Group (Rusian) – Gold Mining. CVG ALCASA (Aluminum). CVG VENALUM (Aluminum). Clinics: Medical Specialty Center, La Floresta, Chilemex, Maracay Medical Center. FIOR Venezuela (Iron Briquettes). CVG CARBONORCA (Anodes). Project: Toyota Venezuela (Toyomaya). Engineering Projects: Petróleos de Venezuela (PDVSA), PDVSA Boquerón, ENELBAR (Electrical Substations: Bárbula, Morón, Valle Seco, Chivacoa, Nirgüa, Yaritagüa), CADAPE (Electrical Substations: Tucupita, Temblador).

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