VII. Claims

1. A method of producing electrical power, the method comprising:

creating neutrons via nuclear reactions, said neutrons carrying neutron kinetic energy;

moderating said neutrons to thermal energies to produce moderated neutrons, converting the neutron kinetic energy into heat, and transmitting said heat to a heat exchanger;

creating ions via the nuclear reactions, stopping the ions to produce heat, and transmitting to said heat exchanger the heat generated by the stopping of the ions;

capturing said moderated neutrons with sulfur atoms to produce heat, and

transmitting to said heat exchanger energy released by the capturing of said moderated neutrons;

transmitting energy from decaying radioisotopes created by the capturing of said moderated neutrons to said heat exchanger;

heat exchanging at least some of each said heat and energy in said heat exchanger by converting water into steam; and

generating electrical power with said steam.

2. The method of claim 1, wherein said nuclear reactions includes nuclear fission reactions.

3. The method of claim 1, wherein said nuclear reactions include nuclear fusion reactions.

4. The method of claim 3, wherein said nuclear fusion reactions comprise fusion of deuterium nuclei with other deuterium nuclei.

5. The method of claim 1, wherein said nuclear reactions include radioactive decay of one or more isotopes.

6. The method of claim 1, wherein said nuclear reactions include antimatter annihilation reactions.

7. The method of claim 1, wherein said nuclear reactions include reactions caused by bombarding atoms with energetic particles.

8. The method of claim 1, wherein said nuclear reactions include nucleon exchange reactions.

9. The method of claim 1, wherein said nuclear reactions include reactions caused by energetic photons.

10. The method of claim 1, wherein said moderating is performed by said sulfur atoms.

11. The method of claim 1, wherein said generating produces more electrical power than the total amount of electricity required to perform the steps of creating,

moderating, stopping, transmitting, capturing, heat exchanging, converting, and generating.

12. The method of claim 1, wherein said capturing is performed with sulfur atoms comprising isotope sulfur-32 atoms.

13. The method of claim 1, wherein said capturing is performed with sulfur atoms comprising isotope sulfur-33 atoms.

14. The method of claim 1, wherein said capturing is performed with sulfur atoms comprising isotope sulfur-34 atoms.

15. The method of claim 1, wherein said capturing is performed with sulfur atoms comprising isotope sulfur-36 atoms.

16. The method of claim 1, wherein said capturing is performed with sulfur atoms consisting essentially of the isotopes sulfur-32, sulfur-33, sulfur-34, and sulfur-36 atoms.

17. The method of claim 1, wherein said moderating is also performed with sodium atoms.

18. The method of claim 1, wherein said capturing is also performed with sodium atoms.

19. The method of claim 1, wherein said moderating is also performed with mercury atoms.

20. The method of claim 1, wherein said capturing is also performed with mercury atoms.

21. An apparatus to convert energy from nuclear reactions into electrical power, the apparatus including:

one or more regions in which nuclear reactions occur;

one or more degraders that stop ions emanating from said one or more regions by transforming substantially all kinetic energy of said ions into heat;

one or more moderators that slow down neutrons emanating from said one or more regions by converting substantially all kinetic energy of said neutrons into heat;

a plurality of sulfur atoms that capture neutrons slowed down in said one or more moderators and that convert energy released by said capture of neutrons into heat;

one or more heat exchangers in thermal communication with said one or more degraders, said one or more moderators, and said sulfur atoms, wherein each said heat exchanger is

positioned to absorb electromagnetic radiation emanating from said one or more regions; and

positioned to absorb electromagnetic radiation and heat generated by radioactive decay of said sulfur atoms;

water flowing through said heat exchanger to produce steam;

one or more converters, through which said steam flows, and adapted to convert thermal energy into another form of energy;

one or more couplers connected to said one or more converters; and

one or more generators that receive said energy converted in said one or more converters via said one or more couplers and produce electrical power therefrom.

22. The apparatus of claim 21, wherein said nuclear reactions comprise nuclear fission reactions.

23. The apparatus of claim 21, wherein said nuclear reactions comprise nuclear fusion reactions.

24. The apparatus of claim 23, wherein said nuclear fusion reactions comprise fusion of deuterium nuclei with other deuterium nuclei.

25. The apparatus of claim 21, wherein said nuclear reactions comprise radioactive decay of one or more isotopes.

26. The apparatus of claim 21, wherein said nuclear reactions comprise antimatter annihilation reactions.

27. The apparatus of claim 21, wherein said nuclear reactions comprise reactions caused by bombarding atoms with energetic particles.

28. The apparatus of claim 21, wherein said one or more degraders also absorb electromagnetic radiation emanating from said one or more regions.

29. The apparatus of claim 28, wherein said electromagnetic radiation includes electrons.

30. The apparatus of claim 28, wherein said electromagnetic radiation includes positrons.

31. The apparatus of claim 21, wherein said sulfur atoms comprise isotope sulfur-32 atoms.

32. The apparatus of claim 21, wherein said sulfur atoms comprise isotope sulfur-33 atoms.

33. The apparatus of claim 21, wherein said sulfur atoms comprise isotope sulfur-34 atoms.

34. The apparatus of claim 21, wherein said sulfur atoms comprise isotope sulfur-36 atoms.

35. The apparatus of claim 21, wherein said sulfur atoms comprise isotopes sulfur-32, sulfur-33, sulfur-34, and sulfur-36 atoms.

36. The apparatus of claim 21, wherein said sulfur atoms comprise sodium atoms.

37. The apparatus of claim 21, wherein said sulfur atoms comprise a quantity of unenriched mercury atoms.

38. The apparatus of claim 21, wherein said sulfur atoms comprise a quantity of mercury atoms wherein the concentration of mercury-199 atoms has been enriched.

39. An apparatus to convert energy from nuclear reactions into electrical power, the apparatus including;

one or more regions in which nuclear reactions occur and thereby create neutrons, ions, and electromagnetic radiation;

one or more degraders, surrounding said one or more regions, that stop the ions and absorbs the electromagnetic radiation emanating from said one or more regions and convert substantially all kinetic energy of the ions, and substantially all of the electromagnetic radiation, into heat;

one or more moderators, surrounding said one or more degraders, that slow down neutrons emanating from said one or more regions, and that pass through said one or more degraders, that convert substantially all kinetic energy of said neutrons into heat;

a plurality of sulfur atoms, within said one or more moderators, that capture neutrons slowed down in said one or more moderators and that convert energy released by said capture of said neutrons into heat;

wherein said one or more moderators is configured to absorb the electromagnetic radiation and absorb heat generated by radioactive decay of said sulfur atoms;

one or more heat exchangers, in thermal communication with said one or more moderators,

water flowing through said one or more heat exchangers to produce steam;

one or more converters, through which said steam flows, adapted to convert thermal energy into another form of energy;

one or more couplers, connected to said one or more converters; and

one or more generators, that receive said energy converted in said one or more converters via said one or more couplers, and thereby generate electrical power.

40. The apparatus of claim 39, wherein said degrader is a vacuum vessel wall separating a vacuum within said one or more regions from said moderator.

41. The apparatus of claim 40, where said vacuum vessel wall is composed of stainless steel.

Claims:

1. A method of producing electrical power, the method comprising:

creating neutrons via nuclear reactions, said neutrons carrying neutron kinetic energy;

moderating said neutrons to thermal energies to produce moderated neutrons, converting the neutron kinetic energy into heat, and transmitting said heat to a heat exchanger;

creating ions via the nuclear reactions, stopping the ions to produce heat, and transmitting to said heat exchanger the heat generated by the stopping of the ions;

capturing said moderated neutrons with sulfur atoms to produce heat, and

transmitting to said heat exchanger energy released by the capturing of said moderated neutrons;

transmitting energy from decaying radioisotopes created by the capturing of said moderated neutrons to said heat exchanger;

heat exchanging at least some of each said heat and energy in said heat exchanger by converting water into steam; and

generating electrical power with said steam.

2. The method of claim 1, wherein said nuclear reactions include at least one of fission reactions, fusion reactions, radioactive decay of one or more isotopes, antimatter annihilation reactions, reactions caused by bombarding atoms with energetic particles, nuclear exchange reactions, and reactions caused by energetic photons.

3. The method of claim 1, wherein said nuclear reactions comprise fusion reactions of deuterium nuclei with other deuterium nuclei.

4. The method of claim 1, wherein said moderating is performed by said sulfur atoms.

5. The method of claim 1, wherein said generating produces more electrical power than a total amount of electricity required to perform the steps of creating, moderating, stopping, transmitting, capturing, heat exchanging, converting, and generating.

6. The method of claim 1, wherein said capturing is performed with sulfur atoms consisting essentially of the isotopes sulfur-32, sulfur-33, sulfur-34, and sulfur-36 atoms.

7. The method of claim 1, wherein said moderating is also performed with sodium atoms.

8. The method of claim 1, wherein said capturing is also performed with mercury atoms.

9. An apparatus to convert energy from nuclear reactions into electrical power, the apparatus including:

one or more regions in which nuclear reactions occur;

one or more degraders that stop ions emanating from said one or more regions by transforming substantially all kinetic energy of said ions into heat;

one or more moderators that slow down neutrons emanating from said one or more regions by converting substantially all kinetic energy of said neutrons into heat;

a plurality of sulfur atoms that capture neutrons slowed down in said one or more moderators and that convert energy released by said capture of neutrons into heat;

one or more heat exchangers in thermal communication with said one or more degraders, said one or more moderators, and said sulfur atoms, wherein each said heat exchanger is

positioned to absorb electromagnetic radiation emanating from said one or more regions; and

positioned to absorb electromagnetic radiation and heat generated by radioactive decay of said sulfur atoms;

water flowing through said heat exchanger to produce steam;

one or more converters, through which said steam flows, and adapted to convert thermal energy into another form of energy;

one or more couplers connected to said one or more converters; and

one or more generators that receive said energy converted in said one or more converters via said one or more couplers and produce electrical power therefrom.

10. The apparatus of claim 9, wherein said nuclear reactions comprise at least one of fission reactions, fusion reactions, radioactive decay of one or more isotopes, antimatter annihilation reactions, reactions caused by bombarding atoms with energetic particles, nuclear exchange reactions, and reactions caused by energetic photons.

11. The apparatus of claim 9, wherein said nuclear reactions comprise fusion reactions of deuterium nuclei with other deuterium nuclei.

12. The apparatus of claim 9, wherein said sulfur atoms comprise isotopes sulfur-32, sulfur-33, sulfur-34, and sulfur-36 atoms.

13. The apparatus of claim 9, wherein said plurality comprises sodium atoms.

14. The apparatus of claim 9, wherein said plurality comprises unenriched mercury atoms.

15. The apparatus of claim 9, wherein said plurality comprises mercury atoms enriched with a higher percentage of isotope mercury-199 atoms with respect to natural abundance.

16. An apparatus to convert energy from nuclear reactions into electrical power, the apparatus including;

one or more regions in which nuclear reactions occur and thereby create neutrons, ions, and electromagnetic radiation;

one or more degraders, surrounding said one or more regions, that stop the ions and absorbs the electromagnetic radiation emanating from said one or more regions and convert substantially all kinetic energy of the ions, and substantially all of the electromagnetic radiation, into heat;

one or more moderators, surrounding said one or more degraders, that slow down neutrons emanating from said one or more regions, and that pass through said one or more degraders, that convert substantially all kinetic energy of said neutrons into heat;

a plurality of sulfur atoms, within said one or more moderators, that capture neutrons slowed down in said one or more moderators and that convert energy released by said capture of said neutrons into heat;

wherein said one or more moderators is configured to absorb the electromagnetic radiation and absorb heat generated by radioactive decay of said sulfur atoms;

one or more heat exchangers, in thermal communication with said one or more moderators,

water flowing through said one or more heat exchangers to produce steam;

one or more converters, through which said steam flows, adapted to convert thermal energy into another form of energy;

one or more couplers, connected to said one or more converters; and

one or more generators, that receive said energy converted in said one or more converters via said one or more couplers, and thereby generate electrical power.

17. The apparatus of claim 16, wherein said degrader is a vacuum vessel wall separating a vacuum within said one or more regions from said moderator.

18. The apparatus of claim 17, where said vacuum vessel wall is composed of stainless steel.

19. An apparatus comprising;

a containment vessel surrounded by thermal insulation, said containment vessel comprising:

a reservoir of molten sodium;

a volume of a molten mixture of sodium and sulfur;

a solid electrolyte separating said reservoir and said volume;

a negative terminal in electrical contact with said molten sodium; and

a positive terminal in electrical contact with said molten mixture of sodium and sulfur;

wherein the reservoir and the volume are arranged so that energetic neutrons are moderated and captured in the containment vessel to produce a temperature sufficient to operate the apparatus as a battery.

20. The apparatus of claim 19, wherein said energetic neutrons are generated by at least one of fission reactions, fusion reactions, radioactive decay of one or more isotopes, antimatter annihilation reactions, reactions caused by bombarding atoms with energetic particles, nucleon exchange reactions, and reactions caused by energetic photons.