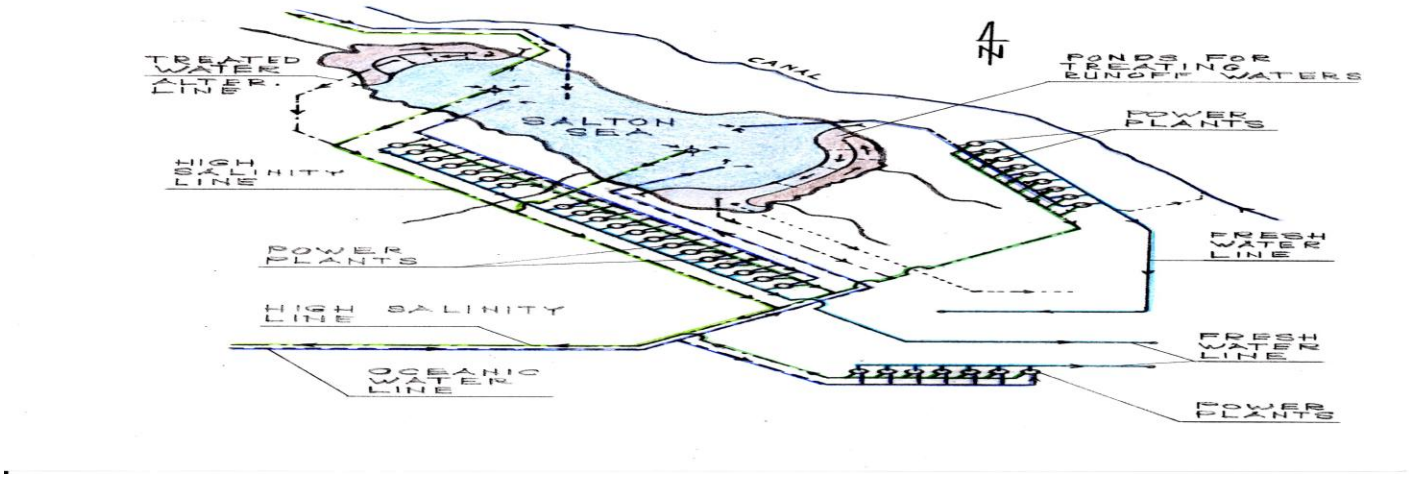
Proposal for the Restoration of the Salton Sea

"Scientific Geothermal Technology"

– Power Point Presentation –

Long Range Plan Committee, CVWD, Palm Desert, CA - February 25, 2016



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EXECUTIVE SUMMARY:

OVERVIEW OF THE SALTON SEA SITUATION (I)

- **The Salton Sea is California's largest lake and is presently 50 % saltier than the Ocean. The Salton Sea is a "terminal lake," meaning that it has no outlets. Water flows into it from several limited sources but the only way water leaves the sea is by evaporation.**

- **The lake is shrinking exposing the lake bed and precipitating higher salinity levels and environmental issues as well as a serious threat to its multi- billion-dollar tourist trade.**

- **Under the terms of the Quantification Settlement Agreement (QSA) the lakes decline is set to accelerate starting in 2018. About the 1/3 of inflow water from the canal will be diverted to San Diego and Coachella Valley.**

- **Runoff water from nearby agricultural fields which contains fertilizers, pesticides and other pollutants from Mexicali contaminate Salton Sea and make it an undesirable tourist destination especially for beach goers.**

OVERVIEW OF THE SALTON SEA SITUATION (II)

- **The lake is 35 miles long, 10 miles wide, and is located south of Palm Springs in a basin 230 feet below sea level.**

- **The Earth's crust at the south end of the Salton Sea is relatively thin. Temperature in the Salton Sea Geothermal Field can reach 680 ºF (360 ºC) less than a mile below the surface.**

- **There have been many complains and studies about consequences for our community if we don't find a solution for the Salton Sea.**

- **There have been several proposals involving importing ocean water, but they failed to address the salt balance and feasibility of the project.** It was wishful thinking – canals, tunnels, pipelines without addressing the practicality of its implementation.

- **This proposal is quite different - it incorporates in final comprehensive design, several patented technologies –** that have not been accessible to the authors of previous proposals.

THE OBJECTIVES OF THE ENCLOSED PROPOSAL FOR RESTORATION OF THE SALTON SEA

1. **Raising and stabilizing the lake's waterline level;**

2. **Preventing further pollution of the lake and treating farmland runoff waters with natural and plant-based filtration systems** – similarly to successfully implemented sewer treatment in Arcata, CA**;**

3. **Providing wildlife sanctuary**;

4. **The equalizing salinity of the salty terminal lake (Salton Sea) water with salinity of the Ocean.**

5. **Possible in process generate electricity** (about 11.5 MWh) - depending of the corridor;

6. **Providing conditions for tourism and making Salton Sea a renewed recreational destination;**

7. **Harnessing prevalent geothermal source of the Salton Sea Geothermal Field (SSGF) for generation of electricity;** and

8. **Production of fresh water with no additional expenses for it;**

PROJECT DESCRIPTION

THE PROPOSAL FOR RESTORATION OF THE SALTON SEA CONSISTS OF FIVE PHASES:

- **This proposal has architectural element which harmoniously incorporates several patented technologies in a functional self-sustaining organism.**

- **Phase I** - **Connecting the Salton Sea with the Ocean** (preferably San Diego / Carlsbad / Oceanside area) with several pipelines (preferably 4 inflows and 1 outflows pipelines) and in process generate electricity (about 11.5 MWh);

- **Phase II** - **Building two main dikes** - One in northern and one in southern part of the Salton Sea and several secondary dikes for forming ponds (wetland) for treatment of farmland runoff waters.

- **Phase III** - **Building one power plant** using (SCI-GHE) system at one of selected sector;

- **Phase IV** - **Building several more power plants** using (SCI-GHE) system - one in each selected sector; and

- **Phase V** - **Continued buildup** of additional power plants using (SCI-GHE) system at each selected sector;

DISALINIZATION OF THE SALTON SEA (I):

- **The desalinization of the Salton Sea and salt balance are the primary issues of this proposal.**

- **In order to compensate for evaporation of about 1.25 million acres/feet per year it has to be inflow at least 1.25 million acres/feet per year.**

- **By separating the lake into three sections with two main dikes we can treat existing inflow and reuse it for farmland,** which otherwise would be useless for farmland as it merge with the salty water of the lake**.**

- **By separating farmlands runoff waters from the central part of the lake, we can fill the central part of the lake with ocean's water and equalize salinity by gradually exchanging waters.**

- **High salinity water (brine) has higher density and has tendency to accumulate at the lowest point(s) at the bottom of the lake where we can access it, pump it up and dispersed into vast ocean.**

- **I am suggesting Pacific Ocean, San Diego area, rather than the Sea of Cortez because ocean currents in the San Diego area are stronger, and to avoid the "Other Country Issues", but because of terrain the Sea of Cortez corridor should be considered at this time and later, when profitable, explore Diego area - tunnel or pass at elevation less than 250 miters.**

DISALINIZATION OF THE SALTON SEA (II):

- **A few miles offshore near Carlsbad there is a trench called "Carlsbad Canyon" through which high salinity water would slide slowly into depth of the ocean and find its way to join existing currents in the vast ocean without negative effect on marine life.**

- **Optionally, we can oxygenate brine on the way to the "Carlsbad Canyon" by injecting air into pipeline in several locations.**

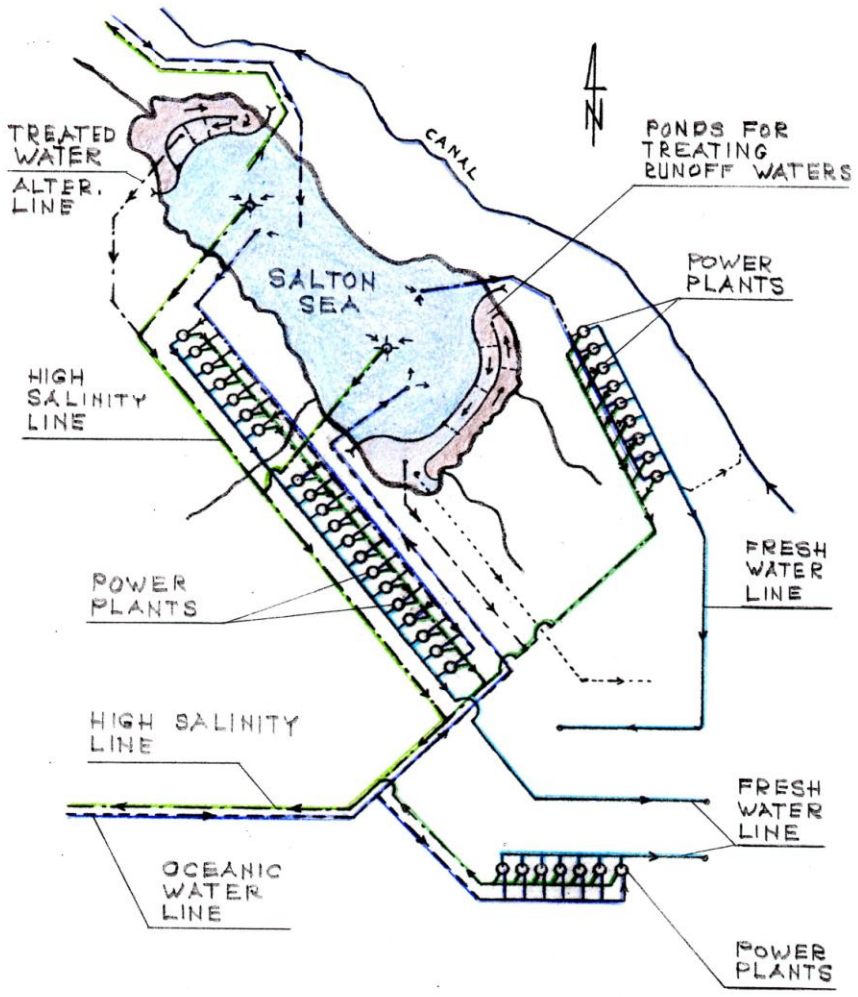
- **Hyper saline water – brine - is in sync with natural occurrence in oceans and together with temperature difference the main engine in currents circulation in Oceans - called "deep ocean currents" or thermohaline circulation.**

- **Optionally, we can use brine for filing existing geothermal reservoirs**

- **Optionally, we can use brine for forming new geothermal reservoirs in the areas where new geothermal power plants (Scientific Geothermal Technology) are proposed for better conduction of the heat.**

- **Equalizing salinity might take several years or decade, but it is the right step in the right direction.** Think of alternative for a moment – a smaller lake and every day saltier and very possible every year smaller.

Summary of the Proposal for Restoration of the Salton Sea



- **Phase I**: **Connecting the Salton Sea with Pacific Ocean** with pipelines for controlling waterline level of the lake; exchanging waters and in process **generating electricity;** and **providing conditions for tourism.**

- **Phase II: Production of two sets of dikes –** one in northern and one in southern part of the Salton Sea forming ponds for **treatment of farmland runoff water and providing wildlife sanctuary, and separating (now) oceanic water in the central part of the lake.**

- **Phase III: Production of the first Power Plant with SCI-GHE system using geothermal sources for production of electricity and fresh water.**

- **Phase IV: Production of two additional power plants on two additional sectors.**

- **Phase V: Continued buildup of subsequent Power Plants at each sector.**

EXHIBIT " A "

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Proposal for Restoration of the Salton Sean

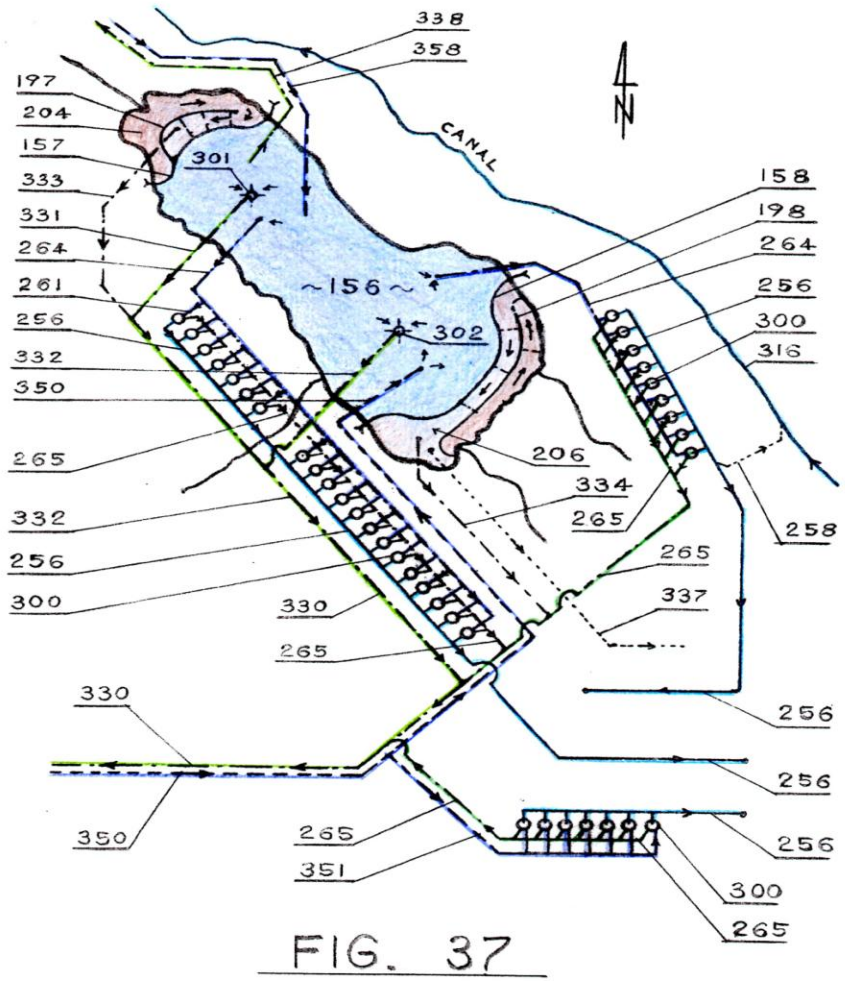

FIG. 37

- **156 – Salton Sea.**
- **157 & 158 – Dikes forming ponds 204 & 206 – for collecting and treating farmland runoff water and providing wildlife sanctuary (wetland).**
- **330 – Outflow pipeline pumping out high salinity water from the Salton Sea and dispersing it into a vast ocean.**
- **350 – Inflow pipeline bringing water from the Pacific Ocean (preferably San Diego area) to the Salton Sea.**
- **300 – Power Plants.**
- **256 – Fresh water line.**

EXHIBIT " B "

GEOTHERMAL WORLDWIDE, INC.

Cross-section of Elevation of the Ocean and the Salton Sea

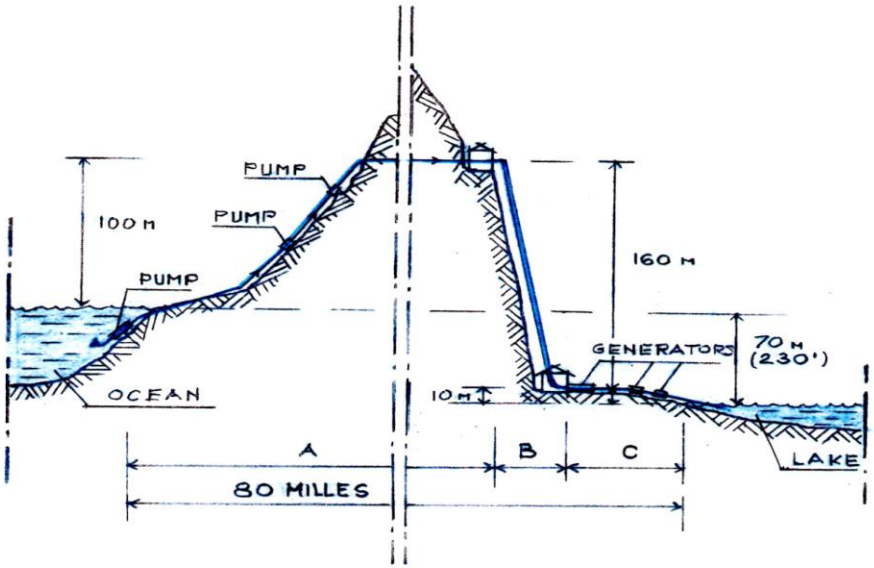

EXHIBIT " C "

- **Salton Sea's water surface is 230' (70 Meters) below the Ocean.**
- **<u>Phase I</u> - Connecting the Salton Sea with the Ocean (preferably San Diego / Carlsbad / Oceanside area) where ocean current is strong, with several pipelines;**
- **Preferably (4) inflows and (1) outflows pipelines; and**
- **In process generate electricity by 4 inflow lines (downhill) (about 11.5 MWh);**
- **The first "In-line Pump" is submerged in the ocean. Numerous repetitive segments of the "In-line Pump" are installed in the section "A". Numerous segments of the "In-Line-Pump" (now generators) are installed in the section "C";**
- **In order to harness maximum energy from the fall, the first segment (generator) in the section "C" , at the bottom of the fall, have continuous spiral blades, inside the hollow shaft, less exposed with bigger openings in the middle. The subsequent segments (generators) in the section "C", have gradually more exposed continuous spiral blades with smaller openings in the middle, as speed of fluid gradually decreases.**

Proposal for Restoration of the Salton Sea
- Alternative cooling System -

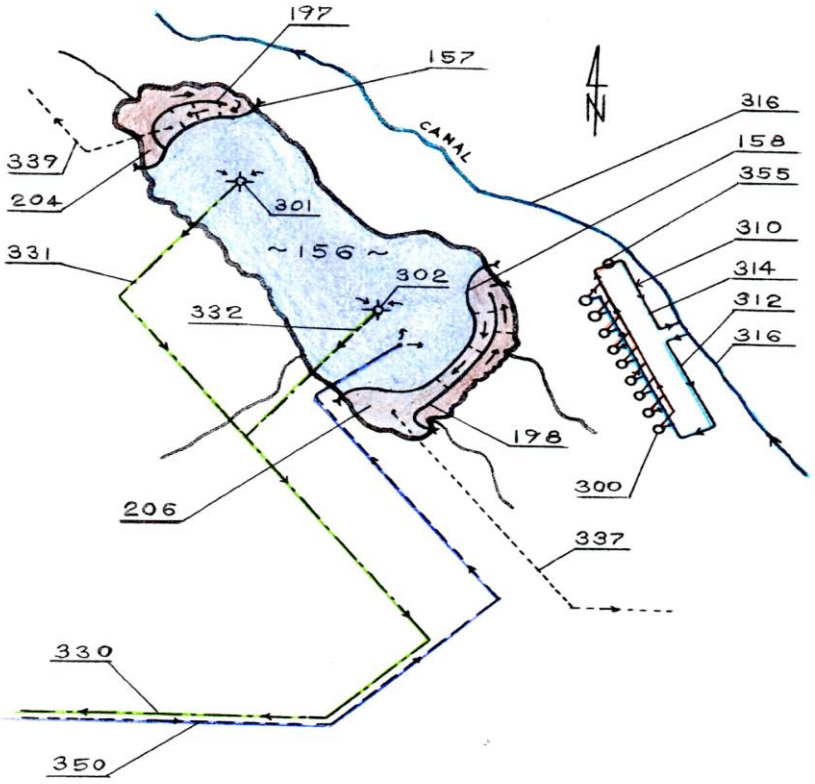

FIG. 38

- **156** – Salton Sea.
- **300 –** Power Plants.
- **316 –** Canal.
- **310 – Closed loop cooling system using water from canal.**
- **312 –** Inflow cooling line.
- **314 –** Outflow cooling line.

EXHIBIT " D "

GEOTHERMAL WORLDWIDE, INC.

Proposal for Restoration of the Salton Sea
Power Plants Southeastern Sector

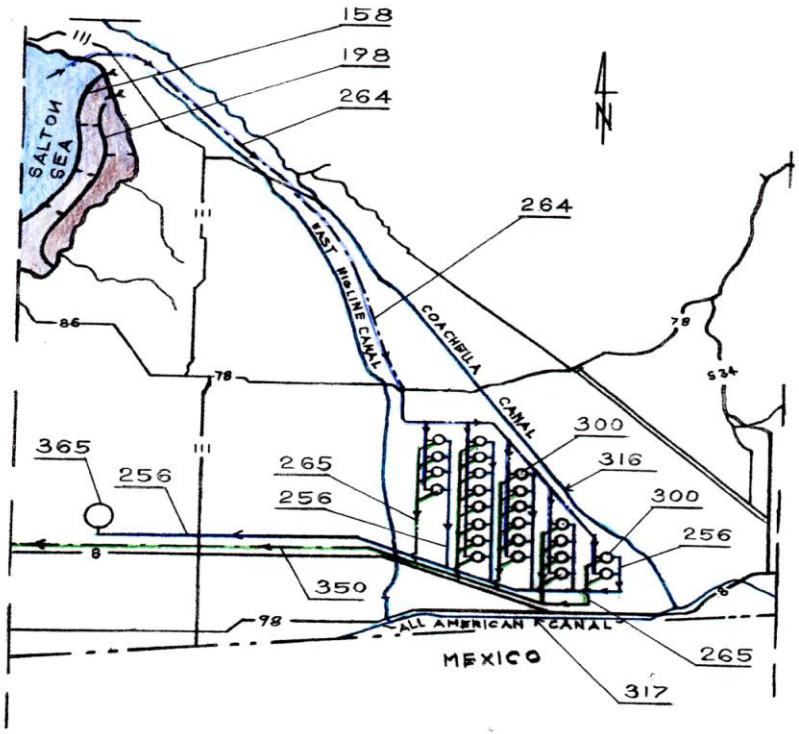

FIG. 39

- **156 – Salton Sea**
- **158 & 198 – Dikes forming ponds for collecting and treating farmland runoff water and providing wildlife sanctuary.**
- **264 – Oceanic water from the lake.**
- **300 – Power Plants Southeast Sector.**
- **265 – High salinity line.**
- **256 – Fresh water line.**

EXHIBIT " E "

GEOTHERMAL WORLDWIDE, INC.

Proposal for Restoration of the Salton Sea
Power Plants Southeastern Sector - Alternative cooling System

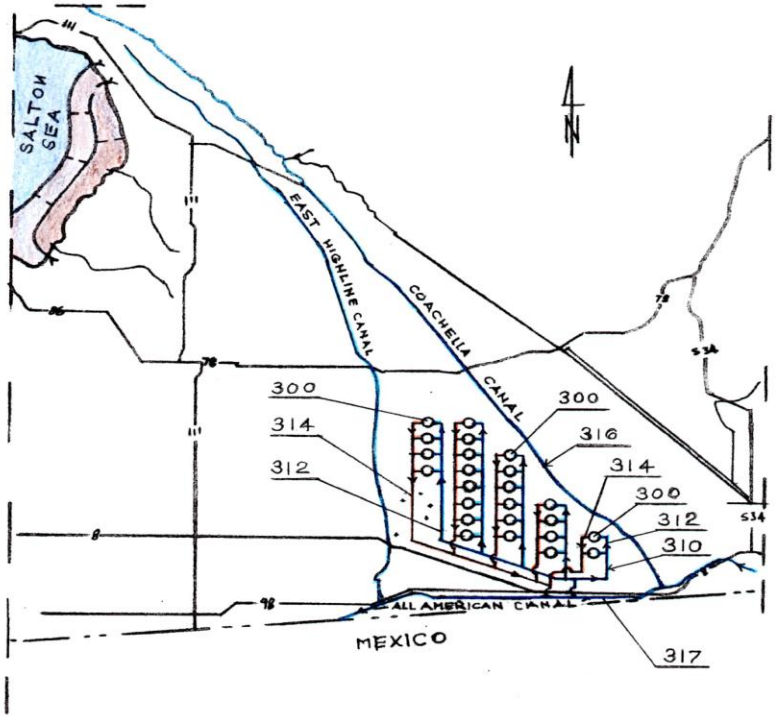

FIG. 40

- **156** – Salton Sea.
- **300** – Power Plants.
- **317** – Canal.
- **310** – **Closed loop cooling system using water from canal.**
- **312** – Inflow cooling line.
- **314** – Outflow cooling line.

EXHIBIT " F "

GEOTHERMAL WORLDWIDE, INC.

Power Plant

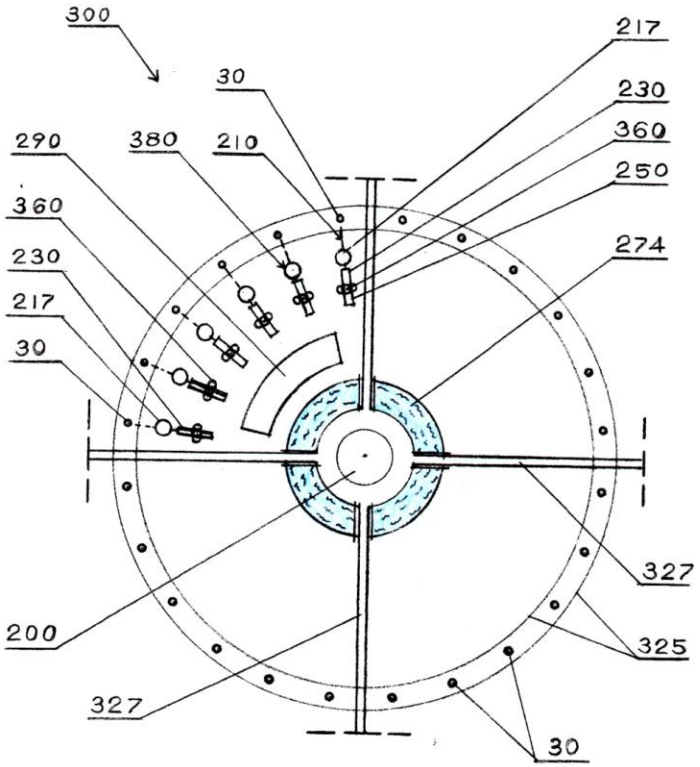

FIG. 41

- **300 – Power Plant.**
- **30 – Wells.**
- **380 – Power Units.**
- **200 – Control Center.**
- **290 – Processing Building.**
- **274 – Fresh water pond.**
- **210 – Heat Exchange system.**
- **325 – Railroad track for maintenance derrick.**

EXHIBIT " G "

GEOTHERMAL WORLDWIDE, INC.

Power Plant – Enlarged One Section

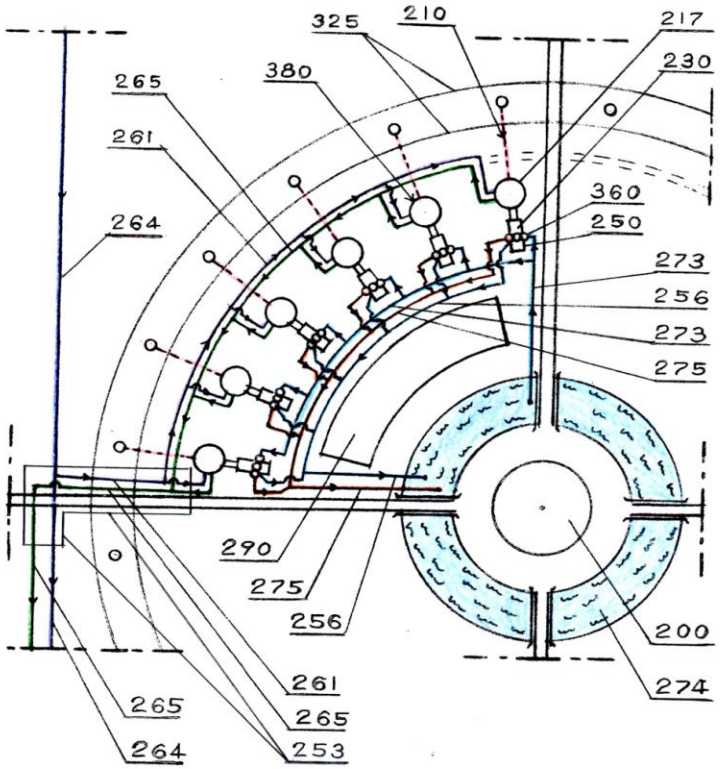

FIG. 42

- 30 – Wells.
- 380 – Power Units.
- 200 – Control Center.
- 290 – Processing Building.
- 274 – Fresh water pond.
- 210 – Heat Exchange system.
- 264 & 261 – Feeding lines from Salton Sea to the boiler 217.
- 273 – Inflow cooling line.
- 275 – Outflow cooling line.
- 256 – Condensed fresh water line.

EXHIBIT " H "

GEOTHERMAL WORLDWIDE, INC.

Power Plant – Enlarged One Section - Alternative

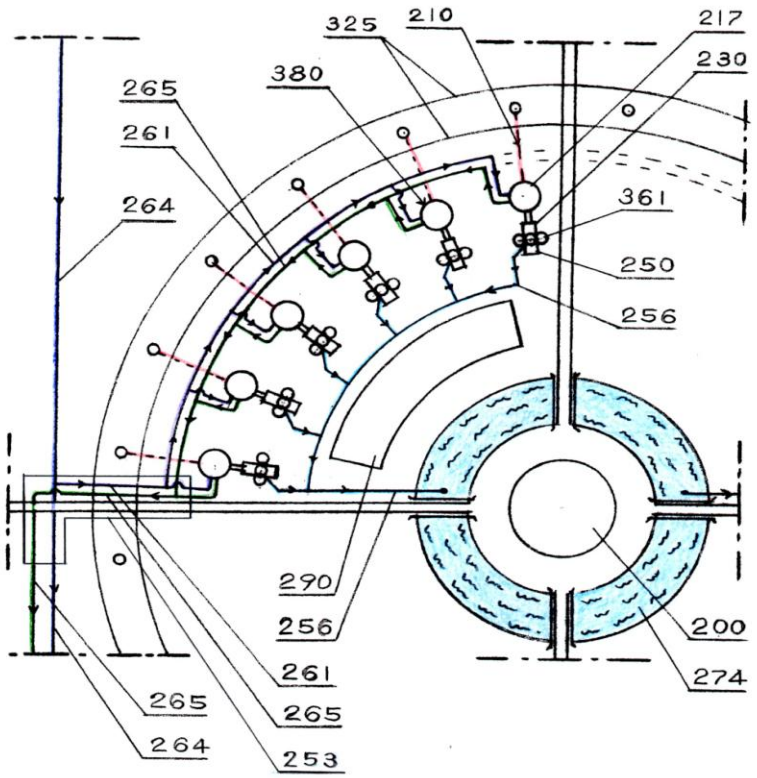

FIG. 43

- 30 – Wells.
- 380 – Power Units.
- 200 – Control Center.
- 290 – Processing Building.
- 274 – Fresh water pond.
- 210 – Heat Exchange system.
- 264 & 261 – Feeding line from Salton Sea to the boiler 217.
- 360 – Condenser with air cooling.
- 256 – Condensed fresh water line.

EXHIBIT " I "

GEOTHERMAL WORLDWIDE, INC.

Power Plant – Enlarged One Section - Alternative

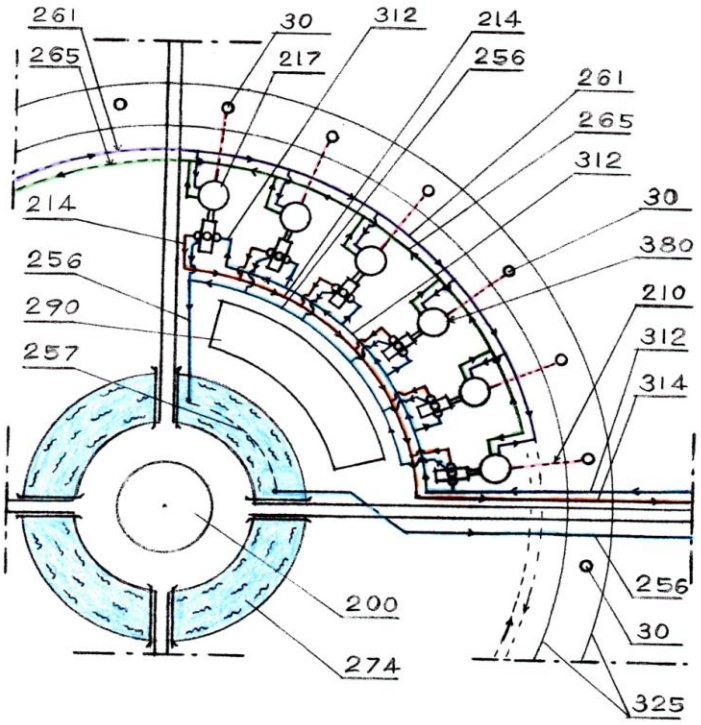

FIG. 44

- **30 – Wells.**
- **380 – Power Units.**
- **200 – Control Center.**
- **290 – Processing Building.**
- **274 – Fresh water pond.**
- **210 – Heat Exchange system.**
- **261 – Feeding line from Salton Sea to the boiler 217.**
- **312 – Inflow cooling line - water from canal.**
- **314 – Outflow cooling line.**
- **256 – Condensed fresh water line.**

EXHIBIT " J "

GEOTHERMAL WORLDWIDE, INC.

Cross-Sectional view of one Power Unit – SCI-GHE System

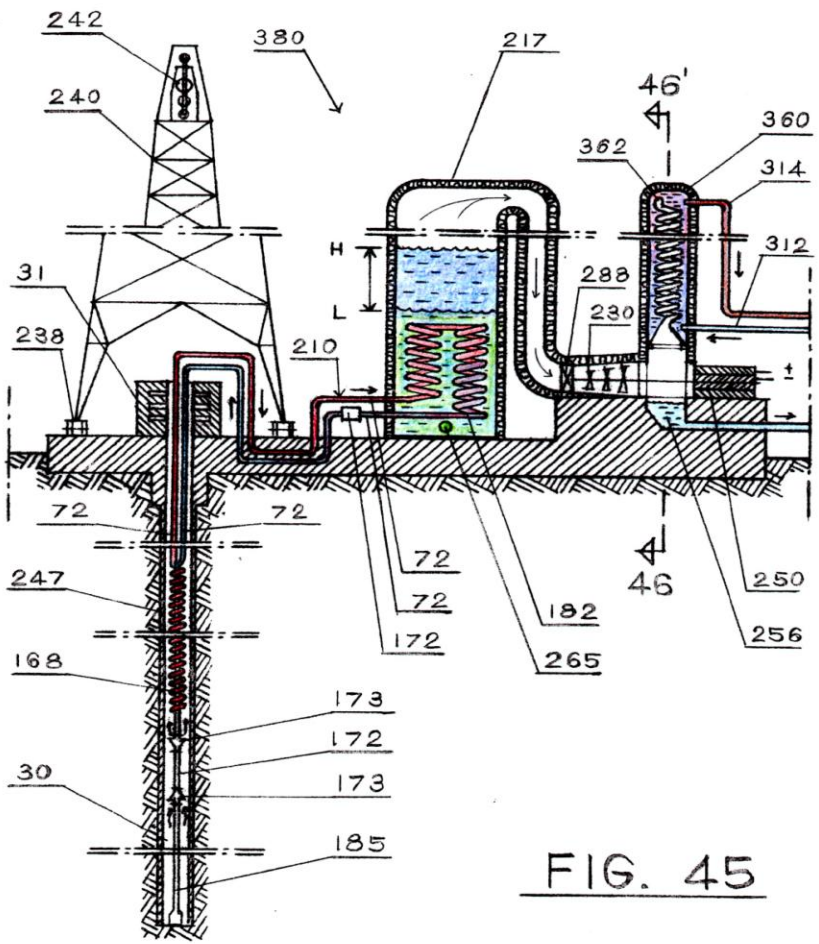

FIG. 45

- **30 - Well.**
- **240 - Derrick.**
- **380 - Power Units.**
- **210 - Heat Exchange system.**
- **217 - Boiler / Distiller.**
- **230 - Turbine.**
- **360 - Condenser.**
- **250 - Generator.**
- **312 - Inflow cooling line – water from canal.**
- **314 - Outflow cooling line.**
- **256 - Condensed fresh water line.**

EXHIBIT " K "

GEOTHERMAL WORLDWIDE, INC.

Cross-Sectional view of three Condensers of Power Unit

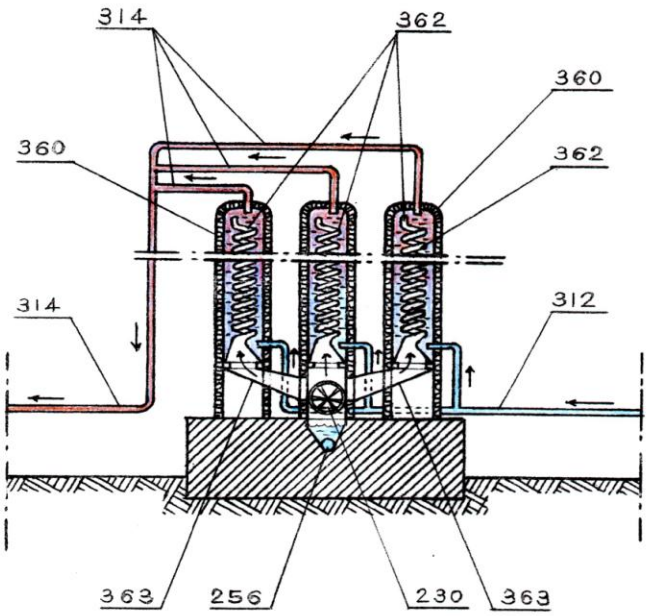

FIG. 46

- **360 - Condenser.**
- **362 - Inner Pipes.**
- **230 - Turbine.**
- **312 - Inflow cooling line.**
- **314 - Outflow cooling line.**
- **256 - Condensed fresh water line.**

EXHIBIT " L "

GEOTHERMAL WORLDWIDE, INC.

Schematic Plan view of Power Unit with alternative two secondary binary Power Units

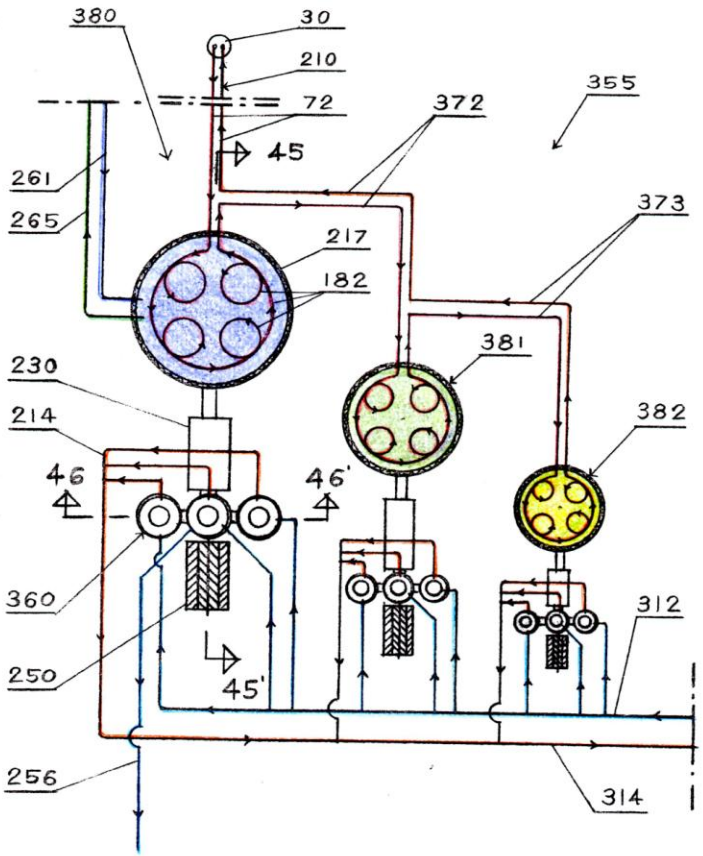

FIG. 47

- **30** - Well.
- **380** - Power Units.
- **210** - Heat Exchange system.
- **217** - Boiler / Distiller.
- **230** - Turbine.
- **360** - Condenser.
- **250** - Generator.
- **312** - Inflow cooling line.
- **314** - Outflow cooling line.
- **256** - Condensed fresh water line.
- **381 & 382 - Binary Power Units.**

EXHIBIT " M "

GEOTHERMAL WORLDWIDE, INC.

Schematic Plan view of an alternative Power Unit modified for generation of electricity, fresh water and extraction of minerals

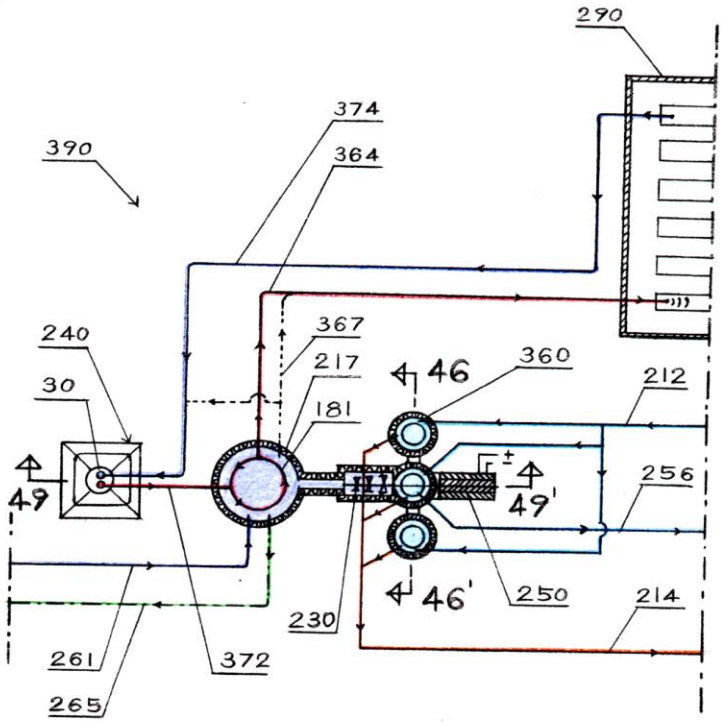

FIG. 48

- **30** - Well.
- **390** - Power Units.
- **217** - Boiler / Distiller.
- **230** - Turbine.
- **360** - Condenser.
- **250** - Generator.
- **312** - Inflow Cooling Line.
- **314** - Outflow Cooling Line.
- **256** - Condensed Fresh Water Line.
- **372** - **Brine Excavation Line.**
- **364** - **Brine Line to Processing Building**
- **374** - **Return Brine Line to Well.**
- **290** - **Processing Building.**

Cross-Sectional view of Power Unit modified for production of electricity, fresh water and extraction of minerals

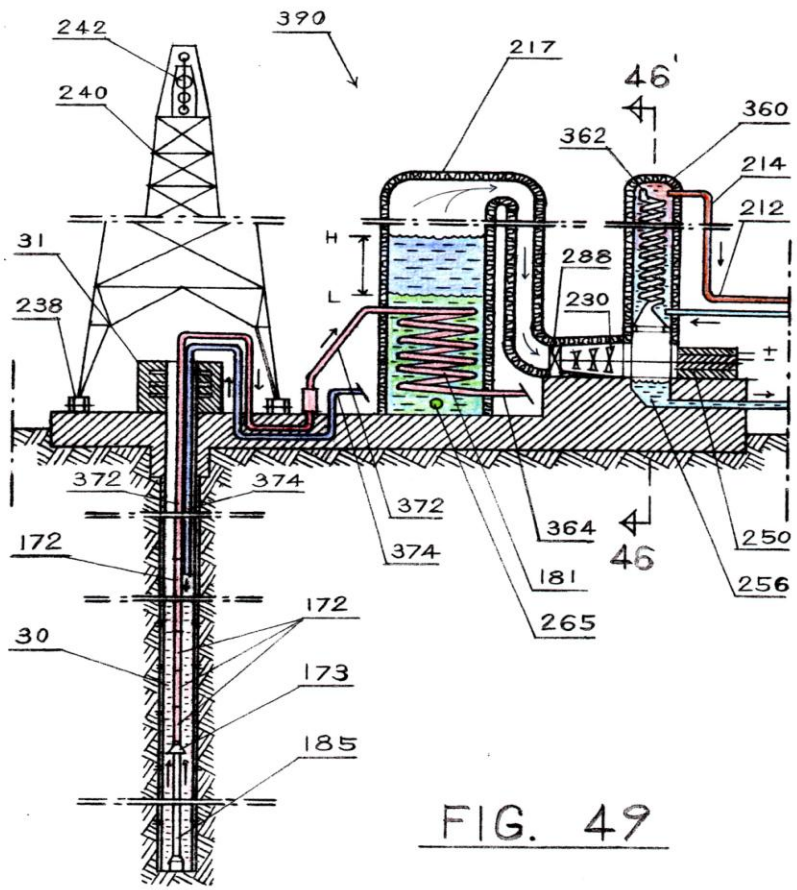

FIG. 49

- **30** - Well.
- **390** - Power Units.
- **217** - Boiler / Distiller.
- **230** - Turbine.
- **360** - Condenser.
- **250** - Generator.
- **312** - Inflow Cooling Line.
- **314** - Outflow Cooling Line.
- **256** - Condensed Fresh Water Line.
- **372 - Brine Excavation Line.**
- **364 - Brine Line to Processing Building**
- **374 - Return Brine Line to Well.**

EXHIBIT "O "

GEOTHERMAL WORLDWIDE, INC.

Schematic Plan View of a Power Plant for Production of Electricity and an Alternative for Desalinization of the Salton Sea by using SCI-GHE System

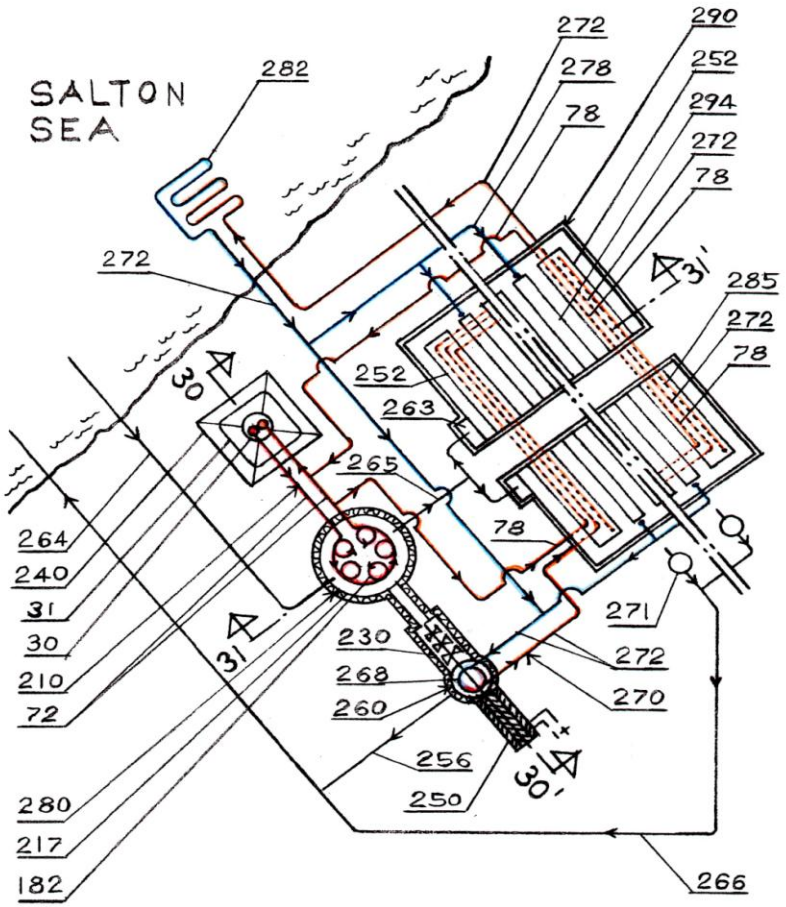

FIG. 29

- The power plant 280 for generation of electricity, consisting of: wellbore 30; first closed loop system 210; distiller 217; turbines 230; generator 250; and a condenser 260;
- Salty water from Salton Sea is injected into the boiler/evaporator 217 through a pipeline 264.
- Fresh water from the condenser 260 is, optionally, returned to the Salton Sea through line 256.
- Remaining salty water from distiller 217 is distributed through a pipeline 265 into desalinization processing building 290;
- Additional closed loop system 270 is used for cooling condenser 260, heating salty water and cooling condenser in building 290.
- Produced salt from removable pans 252 is periodically collected, loaded and transported.

EXHIBIT " P "

Schematic cross-sectional view of a Power Plant taken along line 30-30' of FIG. 29.

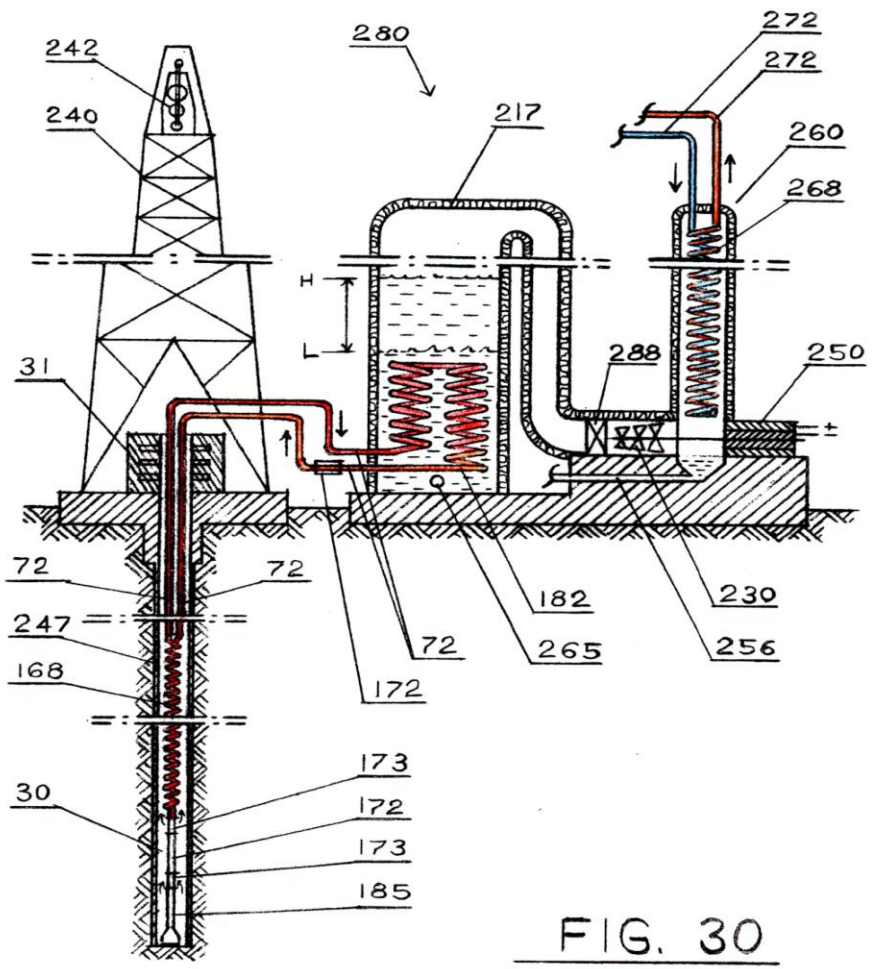

FIG. 30

- The first heat exchanger 168 of the closed loop system 210 is lowered at heat source and second heat exchanger 182 is coupled into boiler/evaporator 217.
- Salty water from Salton Sea is injected into boiler/evaporator 217 to the level "H".
- Salty water is heated by heat exchanger 182 and steam is produced which spins turbine 230, which drives generator 250, which generates electricity.
- The power unit 280 has a condenser 260 which is cooled with additional closed loop system 270.
- Remaining salty water, level "L", from distiller 217 is distributed through pipe line 275 into desalinization processing building 290;

EXHIBIT " Q "

Schematic cross-sectional view of a Power Plant taken along line 31-31' of FIG. 29.

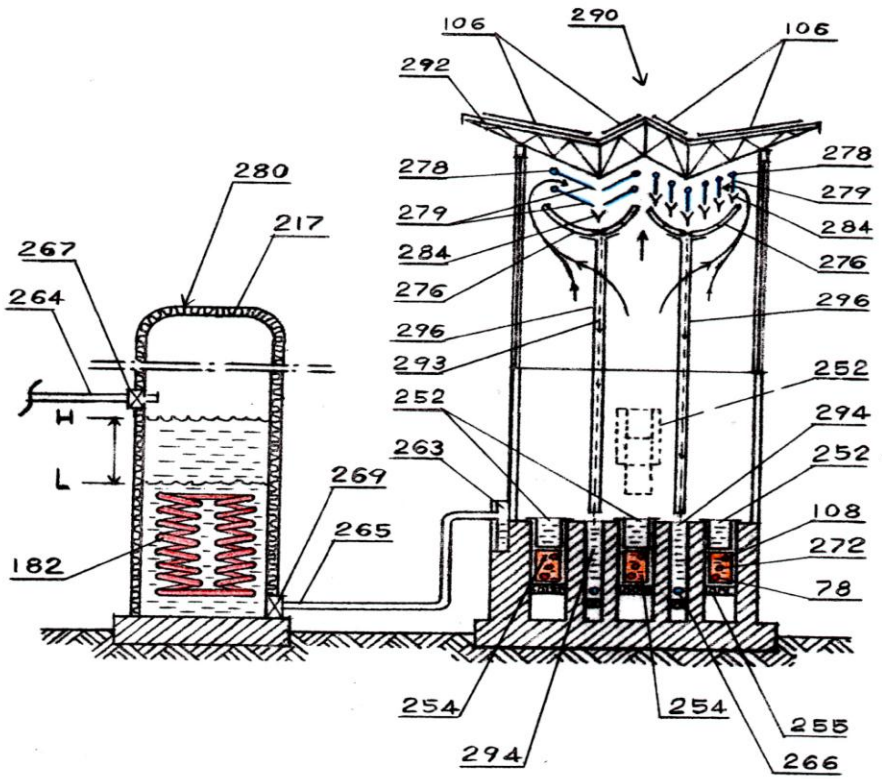

FIG. 31

- **Remaining, more concentrated, salty water, now level "L", from distiller 217 is distributed through pipe line 265 into removable pans 252 in the desalinization processing building 290;**
- **Salty water in removable pans 252 is heated by system of pipes from first closed loop system 210 and from cooling condenser 260.**
- **Evaporated moisture is condensed through system of condensers 279 at upper portion of the building and funneled through tubes 296 into fresh water channels 294.**
- **Produced salt from removable pans 252 is periodically collected, loaded and transported.**

EXHIBIT " R "

GEOTHERMAL WORLDWIDE, INC.

Schematic cross-sectional view of an alternative heat exchange system used in desalinization plant shown in FIGS. 29-31

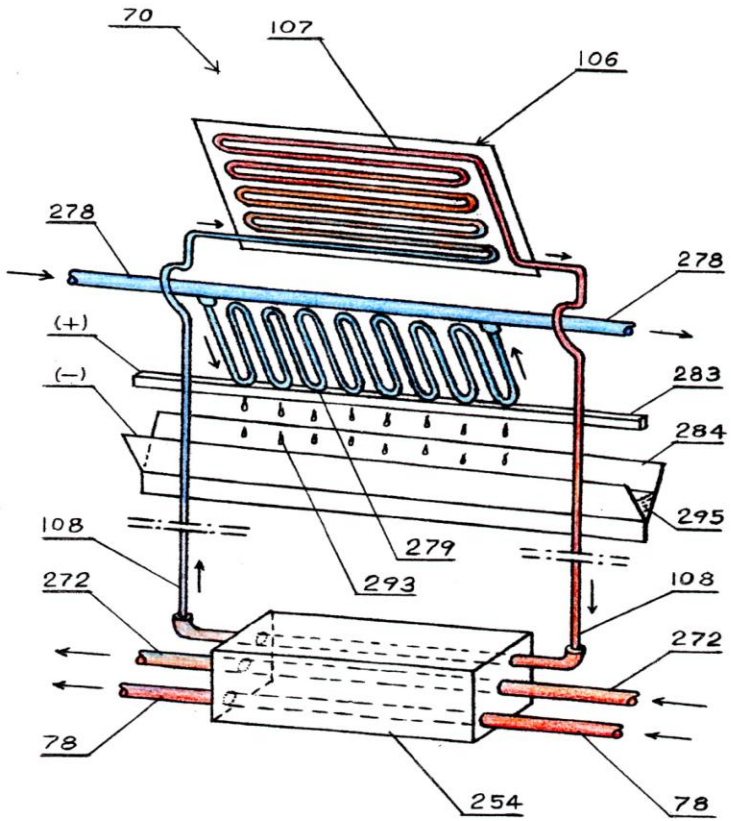

FIG. 32

- **FIG. 32 illustrates a perspective cross sectional diagram of an alternative thermo-solar heat exchange system 70 to be used in desalinization plant shown in FIGS. 29-31.**
- **Here is illustrated, an optional solution, a thermo-solar panel 106 positioned on the roof of the desalinization processing building 290 to be used for heating heat exchange fluid in the containers 254 and indirectly heating salty water in pans 252 to induce evaporation.**
- **Evaporated moisture is condensed through system of condensers 279 at upper portion of the building and collected through pans 284.**
- **This system can function with geothermal support or independently.**

EXHIBIT "S"

SPECIFIC BENEFIT TO THE SALTON SEA

- **This proposal is a long-term solution for the Salton Sea and our community and it can be considered as a "Project of the Century" in California;**
- **It would employ many people during construction and after construction;**
- **It would cost less than $10 billion (preferably $7 billion), with the final result of "really" saving the Salton Sea and maintaining its water level of 50s and 60s.**
- **Preventing further pollution of the lake by dividing lake in three sections;**
- **Bringing ocean's water, and providing conditions for tourism - Beaches, Resorts, Hotels, Motels, Front water properties, etc. - and in process of filling it with ocean's water, generate electricity 24/7 (about 12 MWh);**
- **Providing wildlife sanctuary. Birds can chose which section to inhabit;**
- **Harnessing prevalent geothermal energy with a "Scientific Geothermal Technology" using a complete closed loop system (not conventional geothermal technologies);**
- **Producing potable water as a byproduct with no additional expenses for it;**
- **Generating hundred billion dollars in a few decades for our economy and it will continue so in the future.**

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PROJECT FEASIBILITY

PRELIMINARY COST ESTIMATE FOR PHASES I & II

- **This proposal is a preliminary design explaining the feasibility of the concept. The second stage would require collaboration with potential contractors and would contain more details, including more detailed cost estimate, which would follow with the final production design.**

- **The range of cost today of installed pressure pipe of 48-inch diameter in various terrains is about $600 – $1,000 per linear foot.**

- **Here is used most conservative option $1,000 per linear foot. A mile = 5,280' x $1,000 = $5,280,000; ==> $5,280,000 x 400 miles** (80 miles x 5 pipelines) **= $2,112,000,000.**

- **Connecting the Salton Sea with Pacific Ocean (San Diego area) distance about 80 miles comes to: 80 miles x 5 pipelines = 400 miles of pipelines would cost about $2.112 billion. Because of mountain terrain the final prize might be substantially higher.**

- **As an alternative, the corridor to Sea of Cortez should be seriously considered even if distance to the sea is double -** about 160 miles**. Because of relatively flat terrain the price for pipe of 48-inch diameter per linear foot might be about $800 or less.**
  $800 x 5280 (feet in a mile) = $4,224,000 x 160 miles = $675,840,000 x 5 (pipelines) = **$3,38 Billion.**

  Adding several pump stations, several freeway underpasses, right-of-way permits - it still might be under $4 billion.

- **Two main dikes (about 15 miles), separating the Salton Sea and several secondary dikes (another 15 miles), including treatment plants, could cost about $2 billion which would add up (I & II phase) to about $6.0 billion.**

PRELIMINARY COST ESTIMATE FOR PHASE III & IV

- **Proposed Geothermal Power Plant(s) the "Scientific Geothermal Technology" consist of 24 well-bores and with many projected power plants (in 100s) drilling is most expensive part, therefore we need to implement a new system for drilling faster, deeper and wider wellbores.**
- **Cost for 48" diameter wellbore 8,000 feet deep might cost about $3 M;**
- **24 wellbore x $3M = $75,000,000;**
- **Binary Power Unit of 4 MW might cost about $100,000;**
  (Binary Power Unit of 4 MW is modest assumption.)
- **24 Binary Power Unit x $100,000 = $2,400,000;**
- **Control Center might cost about $4,600,000;**
- **Potable water pond might cost about $5,000,000;**
- **Piping system might cost about $2,000,000;**
- **A new derrick might cost about $9,000,000;**
- **One Geothermal Power Plant might cost about $95,000,000; ~ $100,000,000;**
- **10 Power Plant might cost about $1,000,000,000;**

PRELIMINARY COST ESTIMATE FOR PHASE III & IV (continue)

- **The new drilling system is more expensive at this earlier stage because of development cost, but in the long term it would be better and less expensive solution.**
- **Those several power plants on several sectors around the Salton Sea would be able to finance subsequent power plants.**
- **More power plants we build with initial budget the faster we will proceed with subsequent power plants and whole project which final result will be more clean electricity and more potable water.**
- **The Phases I – IV, would cost less than $10 billion dollars, (preferably $7 billion dollars) with the final result of "really" saving the Salton Sea and providing condition for tourism, clean energy, potable water, and prosper economy.**

CONSTRUCTION TIME SHEDULE ESTIMATE

- **Preliminary and exploratory work on all three necessary phases (I, II and III) could start right away;**
- **Soon after necessary permits are obtained, construction of first three phases (I, II and III) could start at the relatively same time and preferably finished in about two years.**
- **Phase IV could start soon after and preferably finished in two years.**
- **Phase V could start during construction of Phase IV and will be continues process in the future.**

PRODUCTION CAPACITY OF ONE GEOTHERMAL POWER PLANT

- **Proposed Geothermal Power Plant(s) the "Scientific Geothermal Technology" consist of 24 well-bores and 24 Binary Power Units;**
- **24 Binary Power Units x 4 MW = 96 MWh; ~ 100 MWh;**
- **Assumed price of $60 per MWh;**
- **$60 x 96 MWh = $5,760 per hour;**
- **$5,760 x 24h = $138,240 per day;**
- **$138,240 x 365 days = $50,457,600 per year;**

PRELIMINARY ESTIMATE FOR HYDRO ELECTRIC POWER DURING INFLOW FROM THE OCEAN

- For general things :

  PE (Potential Energy) = M G H
  ==> mass x gravitation x Height (in meters)

- For water passing through pipe under pressure and on turbine:
  (KE Kinetic energy) = $^{1}/_{2}$ **x M x V²**
  M = mass
  V = velocity of the water at the nozzle (exit))

- Difference between surface of the Ocean and surface of the Salton Sea is 230 feet (about 70 meters).

- Although corridor to vicinity of San Diego or Carlsbad would be preferable, to avoid "Other Country Issue" following calculation is more suited to corridor to Sea of Cortez.

- This assumption is that because of topography of the area (several FWY underpasses, etc.) we need to raise the pipeline from the ocean towards highest pass about 328 feet (about 100 meters). It would increase final elevation drop to about 558 feet (about 170 meters).

PRELIMINARY ESTIMATE FOR HYDRO ELECTRIC POWER DURING INFLOW FROM THE OCEAN

- **Free Fall:**
  $S = \frac{1}{2}g \times t^2$; S = Vertical distance ; g = gravity = 9.81 ; t = time

- **Free Fall values at 70 meters drop**:
  $S = \frac{1}{2}g \times t^2$
  $70 = \frac{1}{2} \times 9.81 \times t^2$
  $t^2 = 140 / 9.81 = 14.27$
  $t = \sqrt{14.27} = 3.77$ seconds

- Speed of water at nozzle at the bottom of the vertical fall at 70 meters drop:
  $V = g \times t$
  $V = 9.81 \times 3.77 = 37.05$ meters per second

- **Free Fall values at 165 meters drop:**
  $S = \frac{1}{2}g \times t^2$
  $165 = \frac{1}{2} \times 9.81 \times t^2$
  $t^2 = 330 / 9.81 = 33.64$
  $t = \sqrt{33.64} = 5.80$ seconds

- Speed of water at nozzle at the bottom of the vertical fall at 160 meters drop:
  $V = g \times t$
  $V = 9.81 \times 5.8 = 56.90$ meters per second

PRELIMINARY ESTIMATE FOR HYDRO ELECTRIC POWER DURING INFLOW FROM THE OCEAN

- 48” diameter pipe
  $A = \pi r^2$ = 3.14 x (2x2) = 12.56 sf
  12.56 sf / 9 = 1.39 sy = 1.16 m^2

- **Free Fall values at 10 meters drop:**

  $S = \frac{1}{2} g \times t^2$
  $10 = \frac{1}{2} \times 9.81 \times t^2$
  $t^2 = 20 / 9.81 = 2.038$
  $t = \sqrt{2.038} = 1.42$ seconds

- **Speed of water at nozzle at the bottom of the vertical fall at 10 meters drop:**

  $V = g \times t$
  V = 9.81 x 1. 42 sec. = 13.92 meters per second => (15.22 yards per second)

- Volume = 1.3 x 15.22 yards = 21.15
  21.15 x 31,536,000 (seconds in year) = 672,032,160 per year
  672,032,160 x 27 = 18,144,868,320 = 416,549 acre cubic feet.

- We need 3 pipes of diameter 48” @ water speed = 13.92 meters per second (15.22 yards per second) to bring 1.25 million acre cubic feet per year.

PRELIMINARY ESTIMATE FOR HYDRO ELECTRIC POWER DURING INFLOW FROM THE OCEAN

Kinetic Energy

- **For 165 meter drop** from top of the hill to the surface of the lake
  As we know surface of the lake is 70 meters below ocean level:
  Speed of the water at the surface of lake or at the turbine is 56.90 m/s

- Ek = ½ M x V²
  Ek = Kinetic Energy
  M = Mass
  V = velocity = = 13.9 m/s (this is the speed that we would pump water from the ocean thru the 48" diameter pipe). Reason for this speed: To compensate for the evaporation at the lake's surface using only 3 x 48" diameter pipes .

- M = 1.16 x 13.9 = 16.12416.124 x (994kg =weight of water at 100F) = 16,027 kg
  (This is our volume /mass of water per second).
  Ek = ½ M x V² = ½ x 16027 x (56.90 x 56.90)
  Ek = 8014 x 3237.6 = 25,946,206.5 Ws in period of one hour this is **25.94 MWh.**

PRELIMINARY ESTIMATE FOR HYDRO ELECTRIC POWER DURING INFLOW FROM THE OCEAN

Kinetic Energy (Continue)

- **Now we need to subtract:**

- **Efficiency factor** of around 0.85 we calculate 15% loss => 25.94 x 0.85 = 22.05 MWh
  Kinetic energy needed to transport water thru the pipe from the ocean and
  Energy needed to maintain Hydrostatic column of water for uphill side which in this option is 100 meters.

  Ek = ½ M x V^2 = ½ x 16027 x (13.92 x 13.92) = 1,552,747 Ws in an hour it is 1.55 MWh
  For efficiency 1.55 /0.80 = 1.93 MWh

- Energy used to maintain Hydrostatic column on uphill side is
  EP = M x g x h = 16027 x 9.81 x 100 = 15.73 MWs

- **Energy Net**
  22.05 MWh – 1.93 MWh – 15.73 MWh = 4.39 MWh in one hour 4.39 MWh

- Estimate is **4.39 MWh** per one 48" diameter pipe using this route. (~ 4.5 MWh)

- Four (4) pipelines could generate 18 MWh.

- If fifth pipeline is used for return brine into the Ocean for it might need 6.5 MWh.

- Bottom line is we still can have Hydro Electric Power Plant of **11.5 MWh.**

- In this calculation is not consider efficiency of my In-Line-Pump (Generator), which I believe would reduce loses.

ABOUT THE "SCIENTIFIC GEOTHERMAL TECHNOLOGY"

- **The proposal for the Restoration of the Salton Sea implements the Scientific Geothermal Technology, modified so to accommodates local conditions.**

- **The Scientific Geothermal Technology consists of:**
  - **The Self Contained In-Ground Geothermal Generator (SCI-GGG);**
  - **The Self Contained Heat Exchanger (SCI-GHE); and**
  - **The IN-LINE PUMP) ;**
  - **Apparatus for Drilling Faster, Deeper, and Wider Well Bore** with constant diameter;

- **Several designs and variations complementing each other and/or operating separately in many different energy sector applications.**

- **The In-Line Pump should be used for two way pipelines connecting the Salton Sea with Pacific Ocean and in process generate electricity because of 230 feet drop in elevation.**

- **As a first option for electricity generating unit, to be implemented, for this proposal is the (SCI-GHE) system**. It has less production capacity than the **(SCI-GGG) system**, but is less expensive to produce and to implement.. **Later on** when the (SCI-GHE) system starts generating revenue **it can be replaced with (SCI-GGG) system** which at this stage requires more investment and time for full development.

- **It is well known** that there is **an enormous source of energy** under our feet whether it is **a few miles underground** or on **the surface** in locations such as **Hawaii.** The question was, **until now,** how to harness it **expediently** and **efficiently?**

ABOUT THE "SCIENTIFIC GEOTHERMAL TECHNOLOGY"
- SUMMARY of the "Self Contained In-Ground Heat Exchanger" (SCI-GHE) system -

The function of the "Self Contained In-Ground Heat Exchanger" (SCI-GHE) system consists of several stages:

1. **Extracting heat** from prevalent geothermal sources;

2. **Transferring heat up** to the ground surface **through completely closed loop system** (no need for geothermal fluid to be pumped to the surface as is the case with conventional geothermal systems);

3. **Using extracted heat** from geothermal sources **for generation of electricity** for commercial and residential use; and

4. **Producing potable water** as a byproduct without spending additional energy for its production.

5. **Application for** harnessing heat from **Flare Stack;**

6. **Application for** harnessing heat from established **lava flow / lava tube / lava lake;**

ENERGY OVERVIEW IN GENERAL

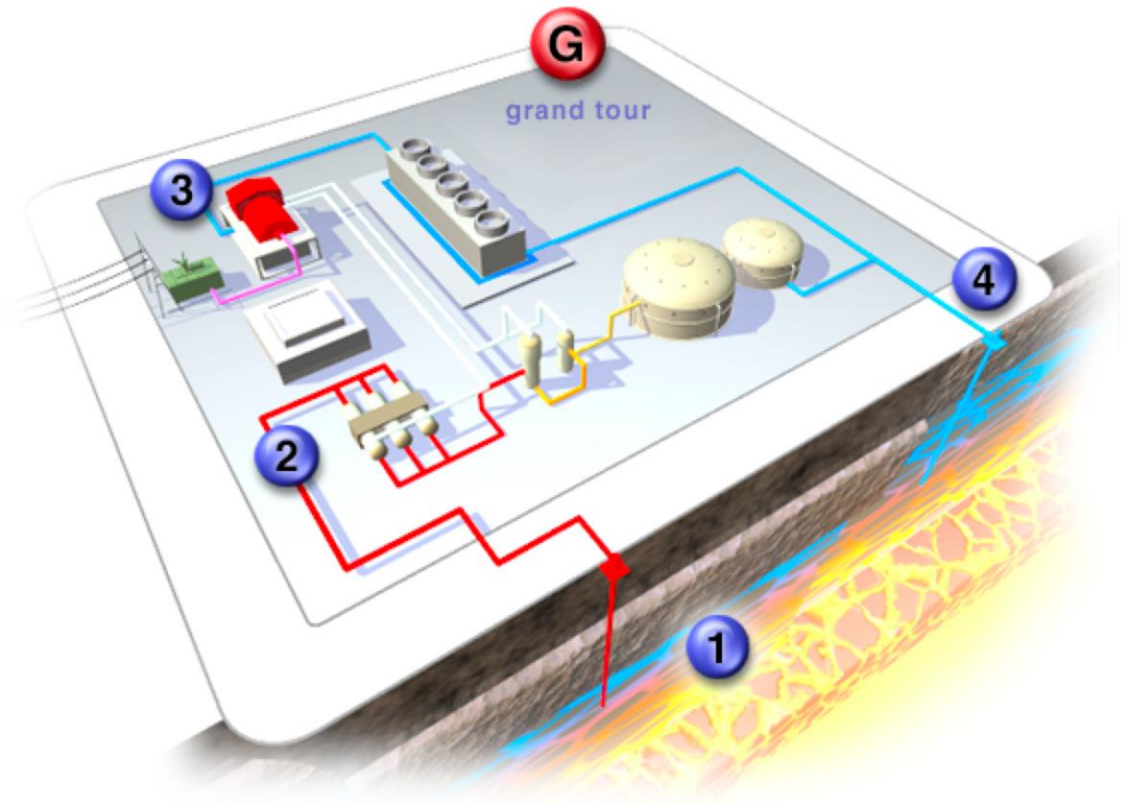
- **As population on our planet increases** there is constantly **increasing demand for electricity**.

- **Nuclear, Oil** and **Coal** burning Power Plants with their **waste material** are **pollutant** with **serious consequences** for our environment and our existence.

- Most of renewable energy technologies including **solar and wind** have serious **limitations** such as weather conditions.

- **In summary** – It is well know that **enormous energy** is under our feet – whether it is a few miles **underground** or on the **surface** in locations such as **Hawaii,** the **Erta Ale** volcano, the **East African Rift,** etc**.** The question was, until now, how to **harness it expediently and efficiently**?

Schematic View of an Conventional Geothermal Plant



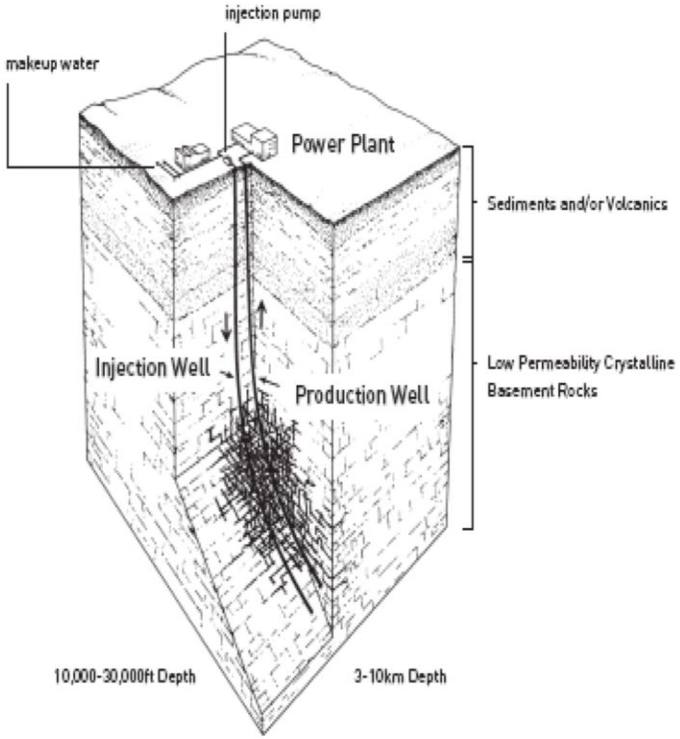
- **Location Limitations.**
- **Requires Hydrothermal reservoir.**
- **Maintenance issues with brine concentration, scaling and corrosion of equipment.**

Courtesy of CalEnergy – This illustration represents an existing geothermal power plant operation.

EXHIBIT "T "

GEOTHERMAL WORLDWIDE, INC.

Schematic View of an Enhanced Geothermal System (EGS)



Requires:

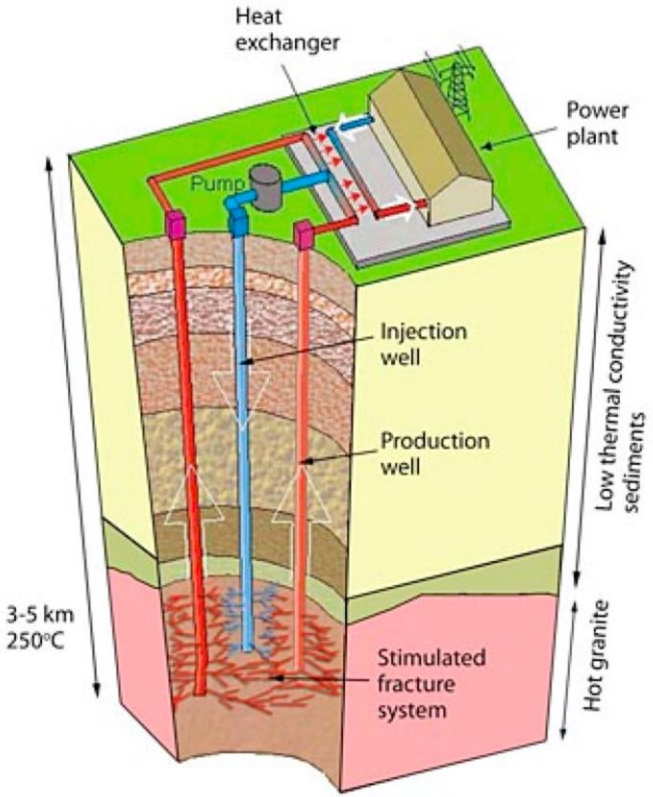
- **Permeability of hot rocks**
- **Horizontal rock formation**
- **Substantial amount of water to be injected and maintained**

This Illustration is a Schematic of a conceptual two-wells Enhanced Geothermal System in hot rock in a low permeability crystalline basement formation.
(Courtesy of: DOE - Energy Efficiency & Renewable Energy)

EXHIBIT " U "

GEOTHERMAL WORLDWIDE, INC.

Schematic View of an Enhanced Geothermal System (EGS)



Requires:

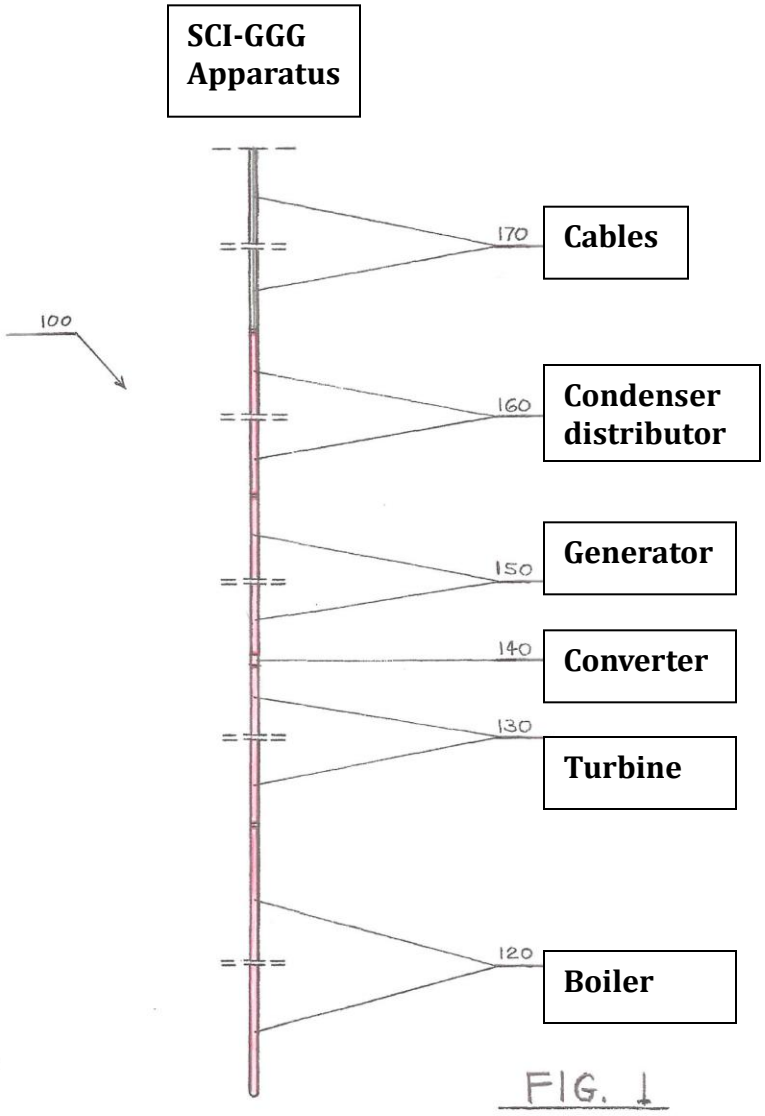
- **Permeability of hot rocks**
- **Horizontal rock formation**
- **Substantial amount of water to be injected and maintained**

This illustration is a schematic of another conceptual three-wells Enhanced Geothermal System in hot rock. 3D cutaway - diagram modified from ANU Hot Rock Energy website .
(Courtesy of: http://hotrock.anu.edu.au)

EXHIBIT " V "

GEOTHERMAL WORLDWIDE, INC.

The "Self Contained In-Ground Geothermal Generator" (SCI-GGG) system



The SCI-GGG system uses several completely closed loop systems and generates electricity down at the heat source and transmits it up to the ground level by means of electrical cables.

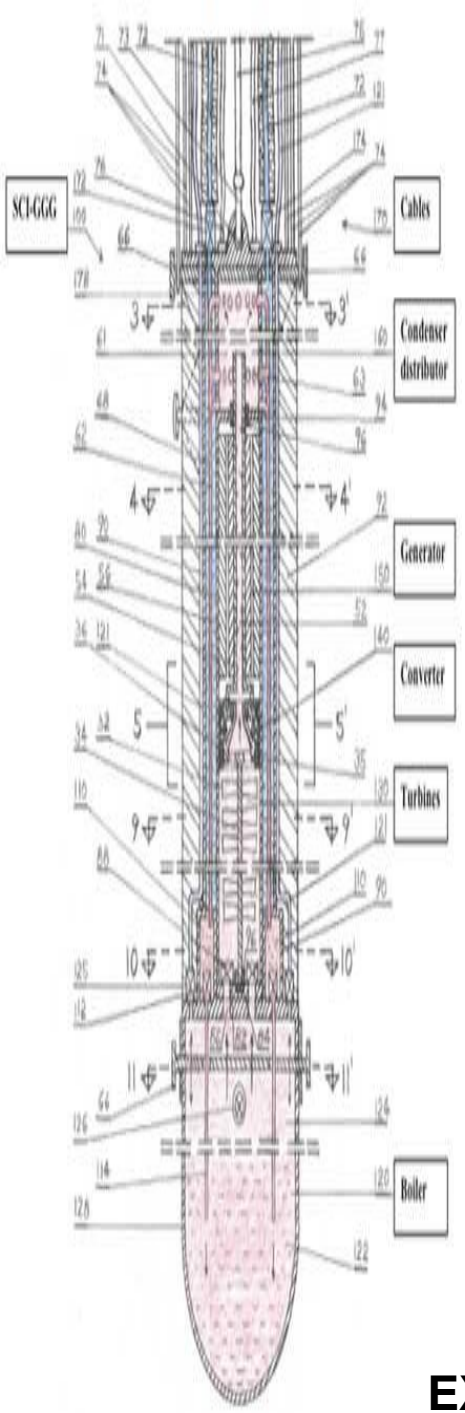
The SCI-GGG system consist of:

- **A BOILER;**
- **A TURBINE;**
- **A CONVERTER;**
- **A GENERATOR;**
- **A CONDENSER DISTRIBUTOR;**
- **CONDENSER** and COOLING system (not illustrated here); and
- **CABLES**

EXHIBIT " W "

GEOTHERMAL WORLDWIDE, INC.

SCI-GGG System



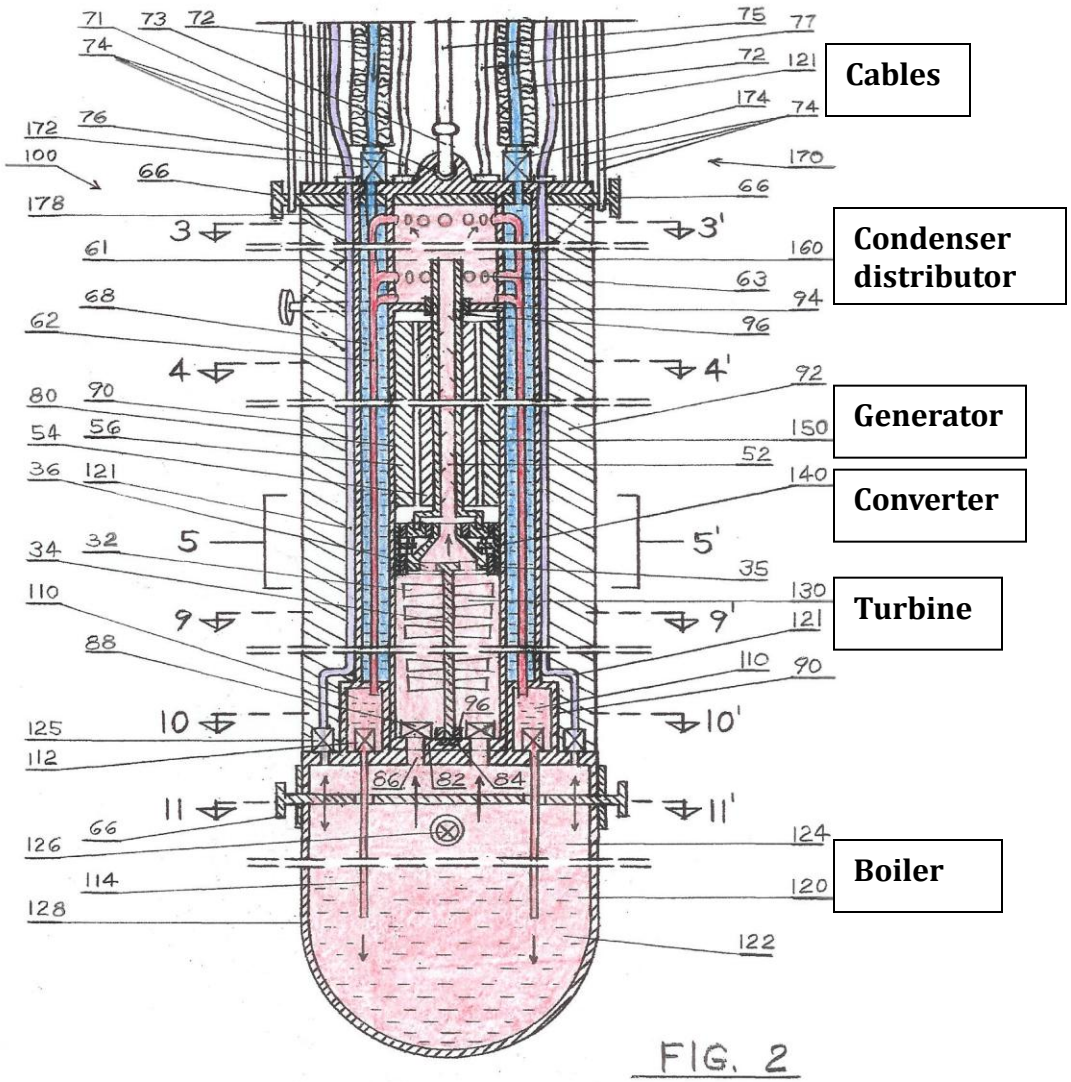


FIG. 2

EXHIBIT " X "

GEOTHERMAL WORLDWIDE, INC.

Self Contained In-Ground Geothermal Generator (SCI-GGG)

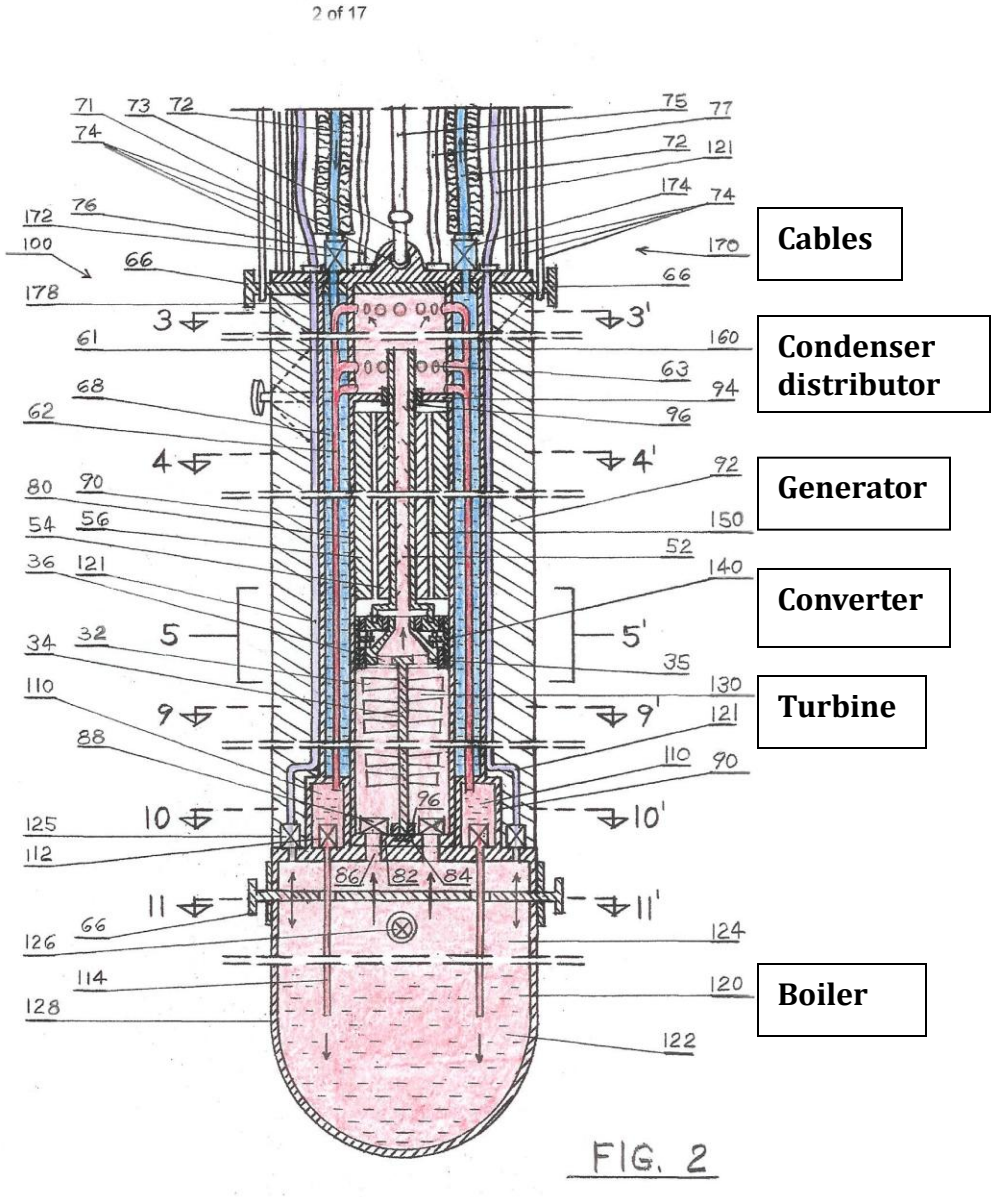


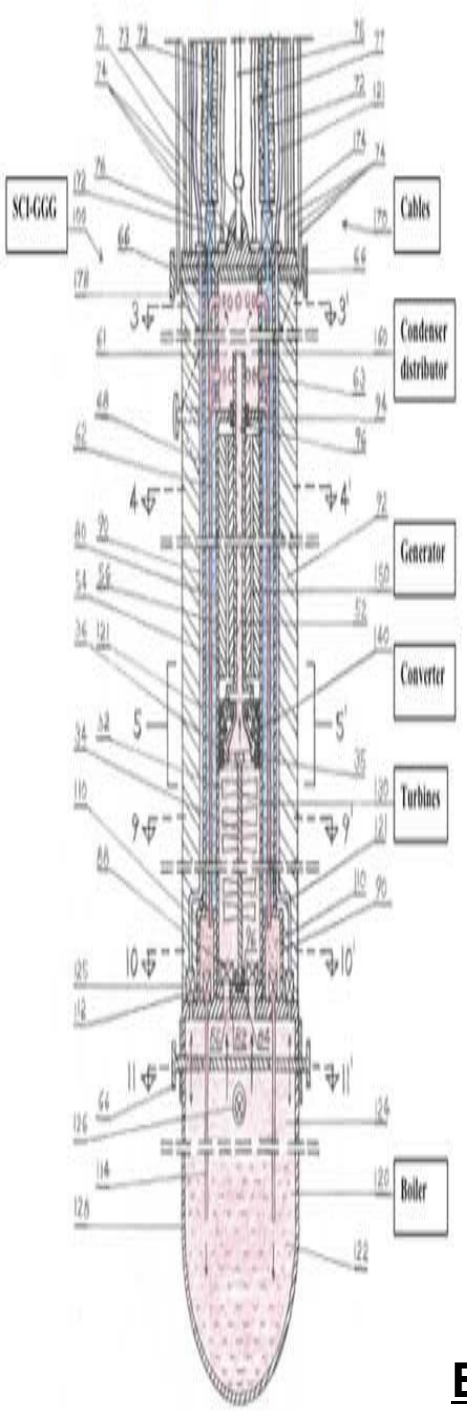
EXHIBIT " Y "

The (SCI-GGG) method for harnessing geothermal energy for production of electricity consists of:

- **Lowering a (SCI-GGG) apparatus into pre-drilled well bore at the source of heat;**
- **The (SCI-GGG) apparatus consists of: a boiler; a turbines; a converter; a generator; a condenser distributor; and a condenser that are arranged to function in confined spaces such as in a well bore.**
- **The SCI-GGGG absorbs heat from source of heat (hot rocks or reservoir) and generates electricity which is transmitted by cable to the ground surface to electrical grids for use in houses and industry.**
- **In the process of cooling the engine compartments with a separate closed loop system "Self Contained In-Ground Heat Exchanger" (SCI-GHE system), additional electricity is generated on the site.**

GEOTHERMAL WORLDWIDE, INC.

Cross-sectional views of the SCI-GGG System - Figs. 3 & 4



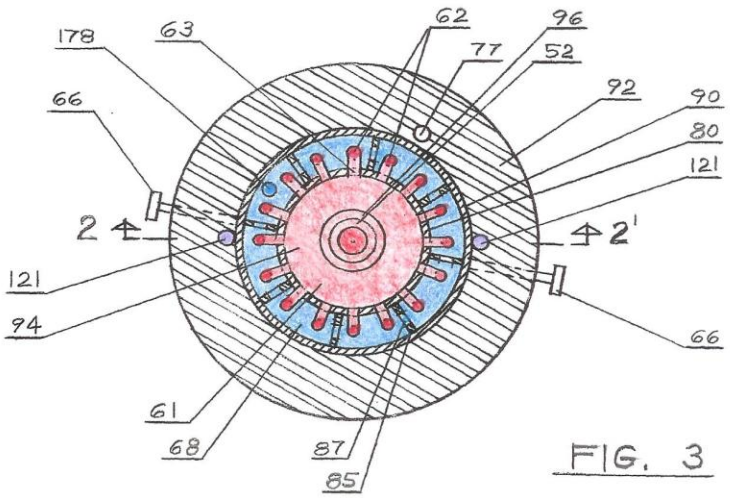


FIG. 3

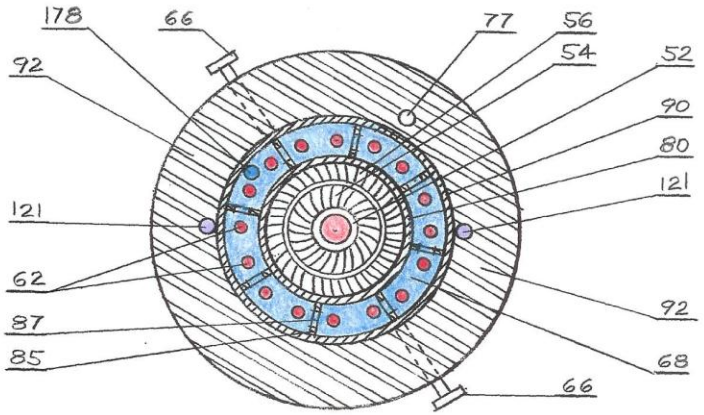


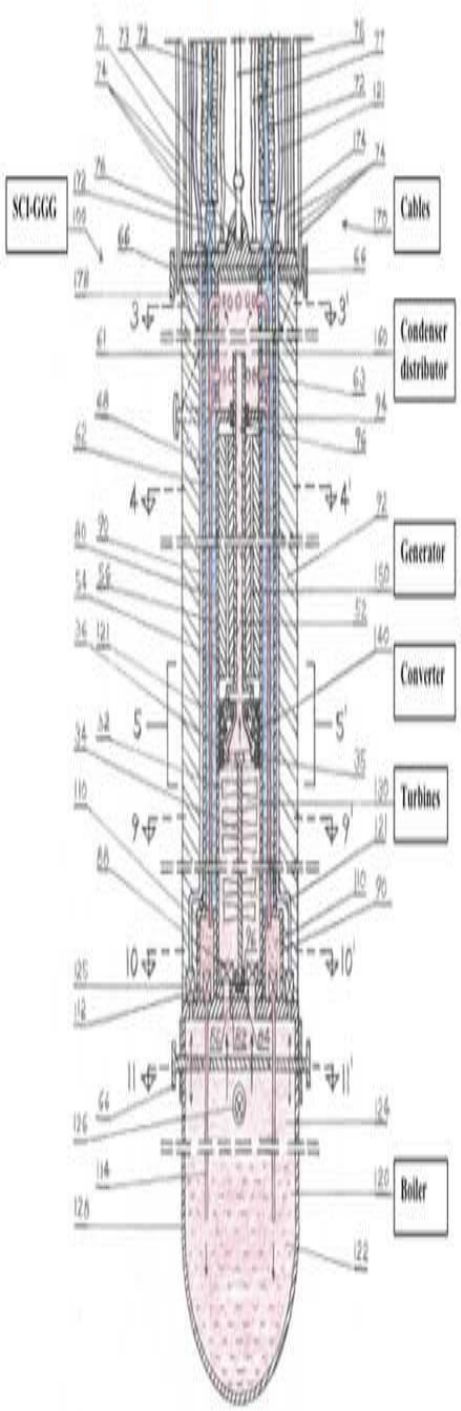
FIG. 4

- **Cross-sectional view of the SCI-GGG apparatus taken along line 3-3' of the FIG. 2 through Condenser Distributor**
- **Cross-sectional view of the SCI-GGG apparatus taken along line 4-4' of the FIG. 2 through Generator**

EXHIBIT " Z "

GEOTHERMAL WORLDWIDE, INC.

Cross-sectional views of the SCI-GGG System - Fig. 5



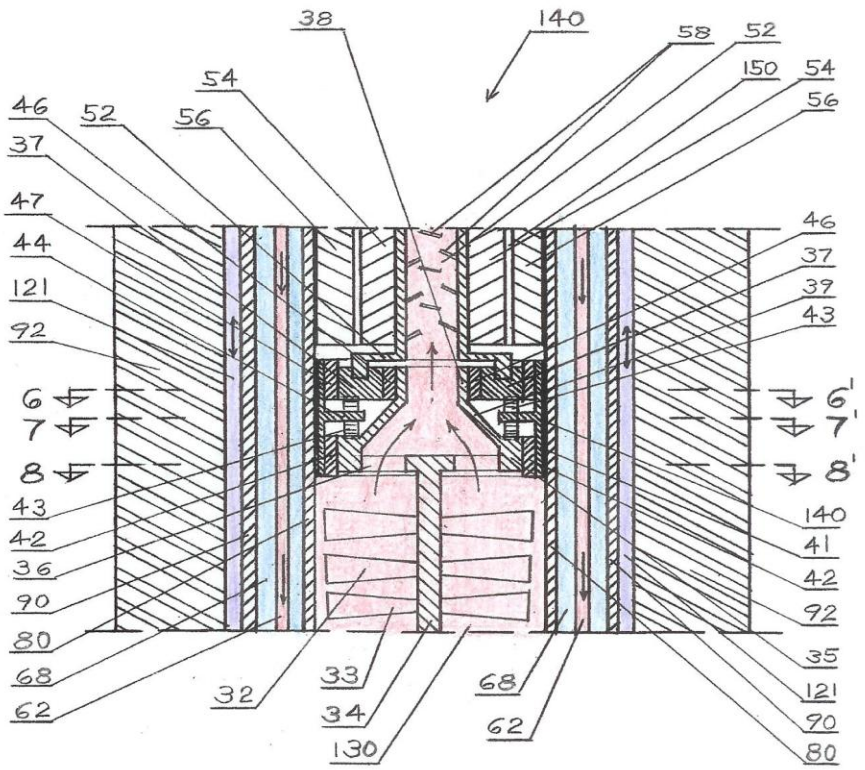


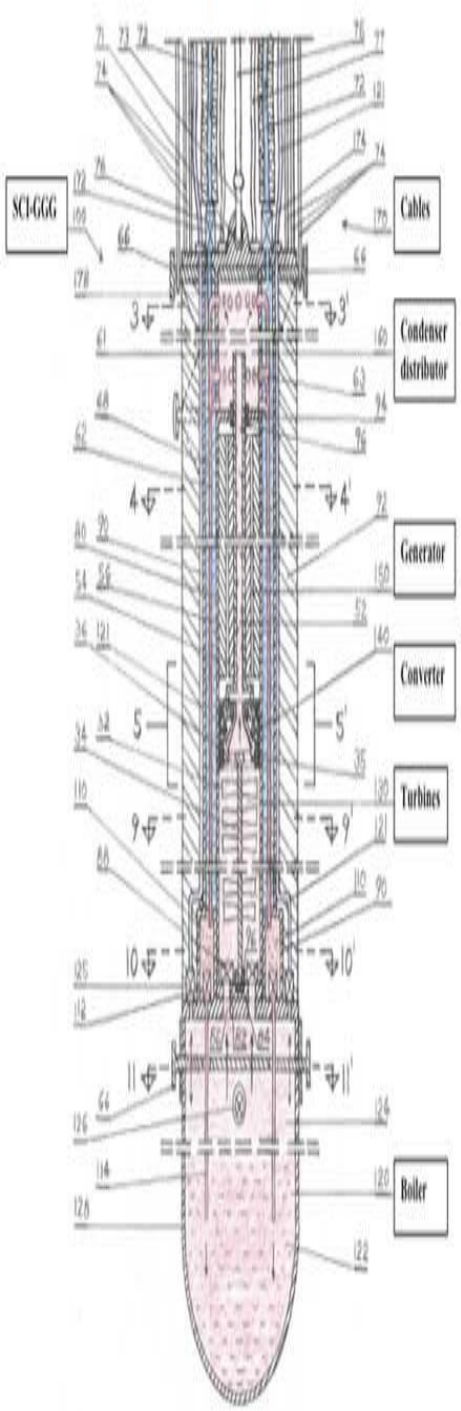
FIG. 5

- **Cross-sectional view of the SCI-GGG apparatus taken along line 5-5' of the FIG. 2 through Converter.**
- **Converts rotation of the generator in opposite direction from rotation of the turbines to equalize momentum.**

EXHIBIT " AA "

GEOTHERMAL WORLDWIDE, INC.

Cross-sectional views of the SCI-GGG System - Figs. 6 & 7



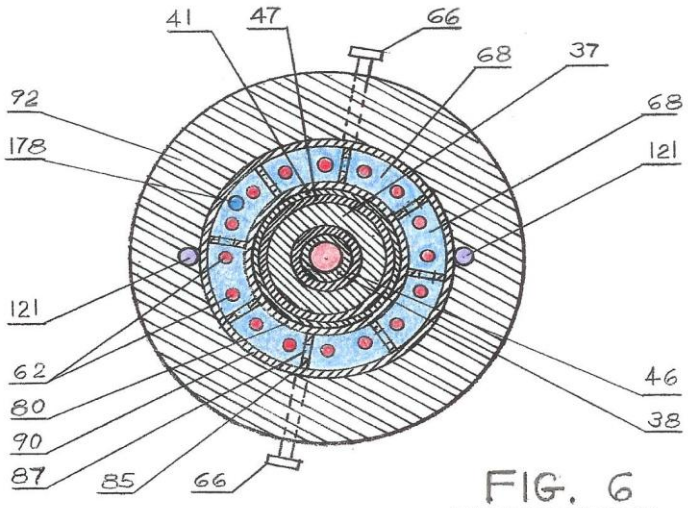


FIG. 6

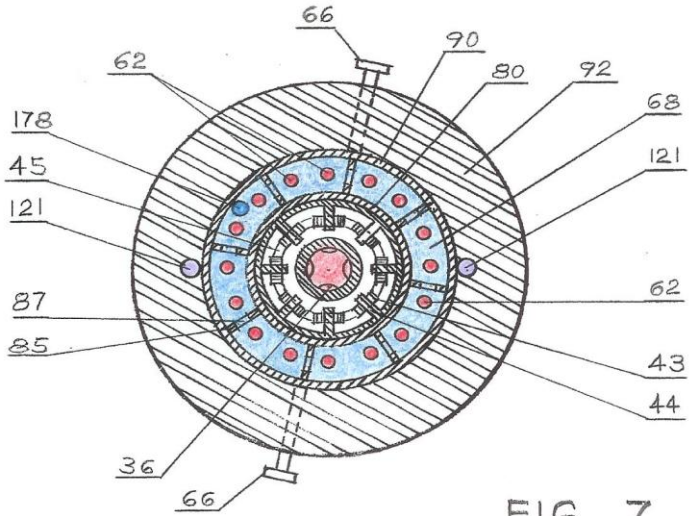


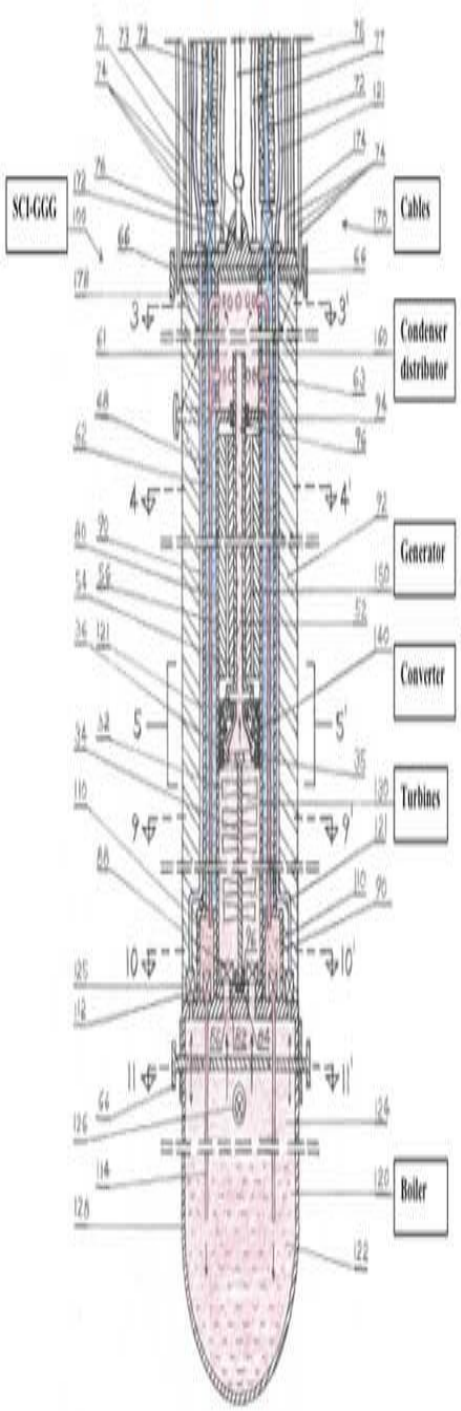
FIG. 7

- **Cross-Section through Converter**
- **Cross-Section through Converter**

EXHIBIT " BB "

GEOTHERMAL WORLDWIDE, INC.

Cross-sectional views of the SCI-GGG System - Figs. 8 & 9



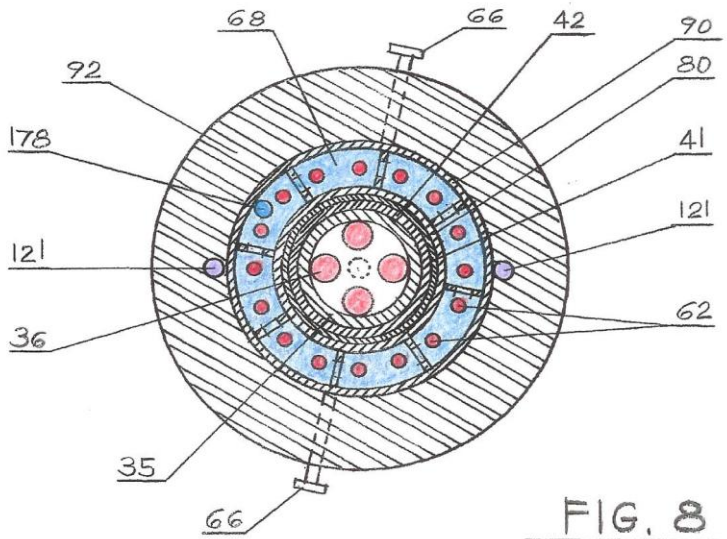


FIG. 8

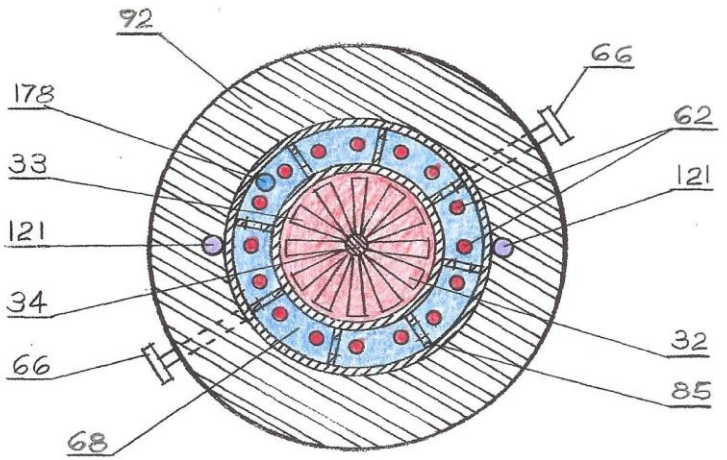


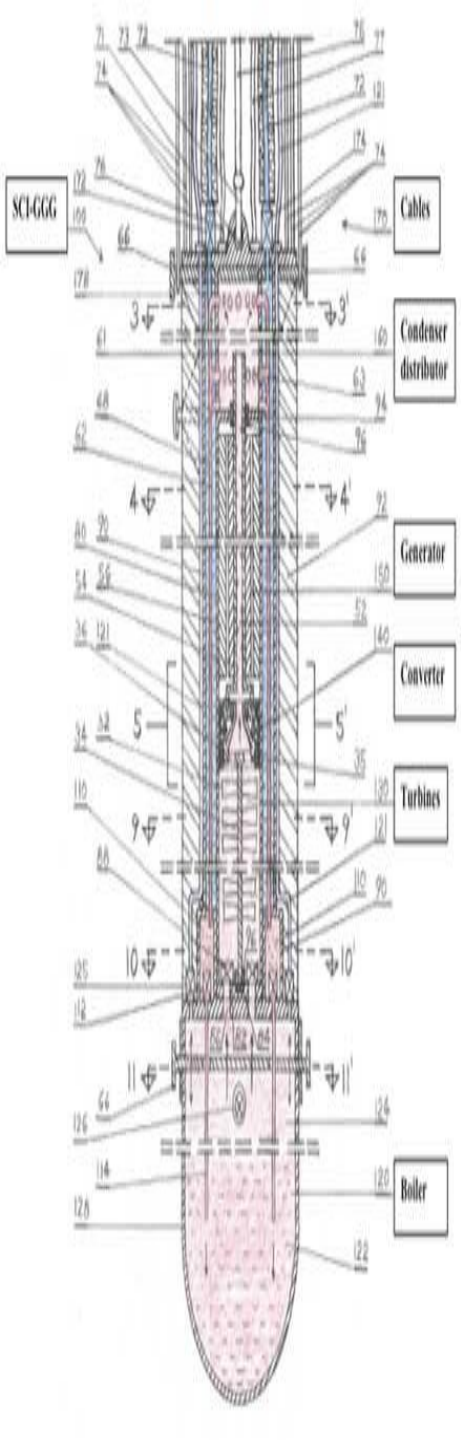
FIG. 9

- **Cross-Section through Converter**
- **Cross-Section Through Turbine**

EXHIBIT "CC"

GEOTHERMAL WORLDWIDE, INC.

Cross-sectional views of the SCI-GGG System - Figs. 3 & 4



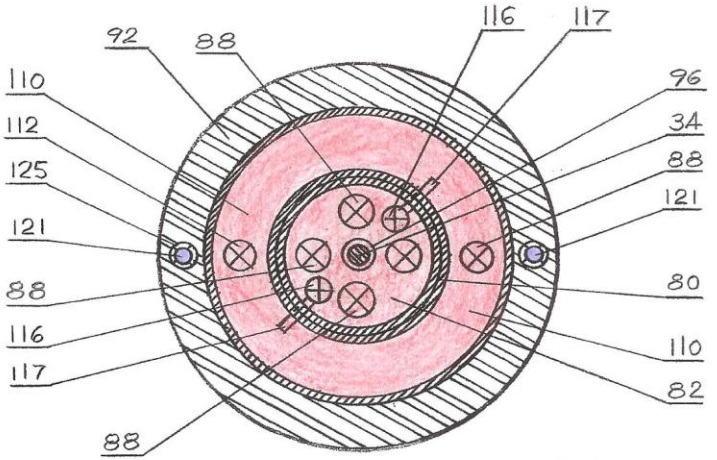


FIG. 10

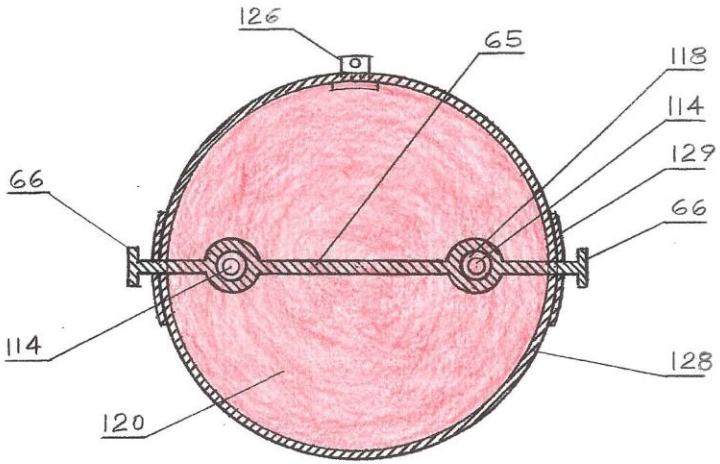


FIG. 11

- **Cross-Section 10-10’**
- **Cross-Section through Boiler**

EXHIBIT “DD“

GEOTHERMAL WORLDWIDE, INC.

Self Contained In-Ground Geothermal Generator (SCI-GGG system)

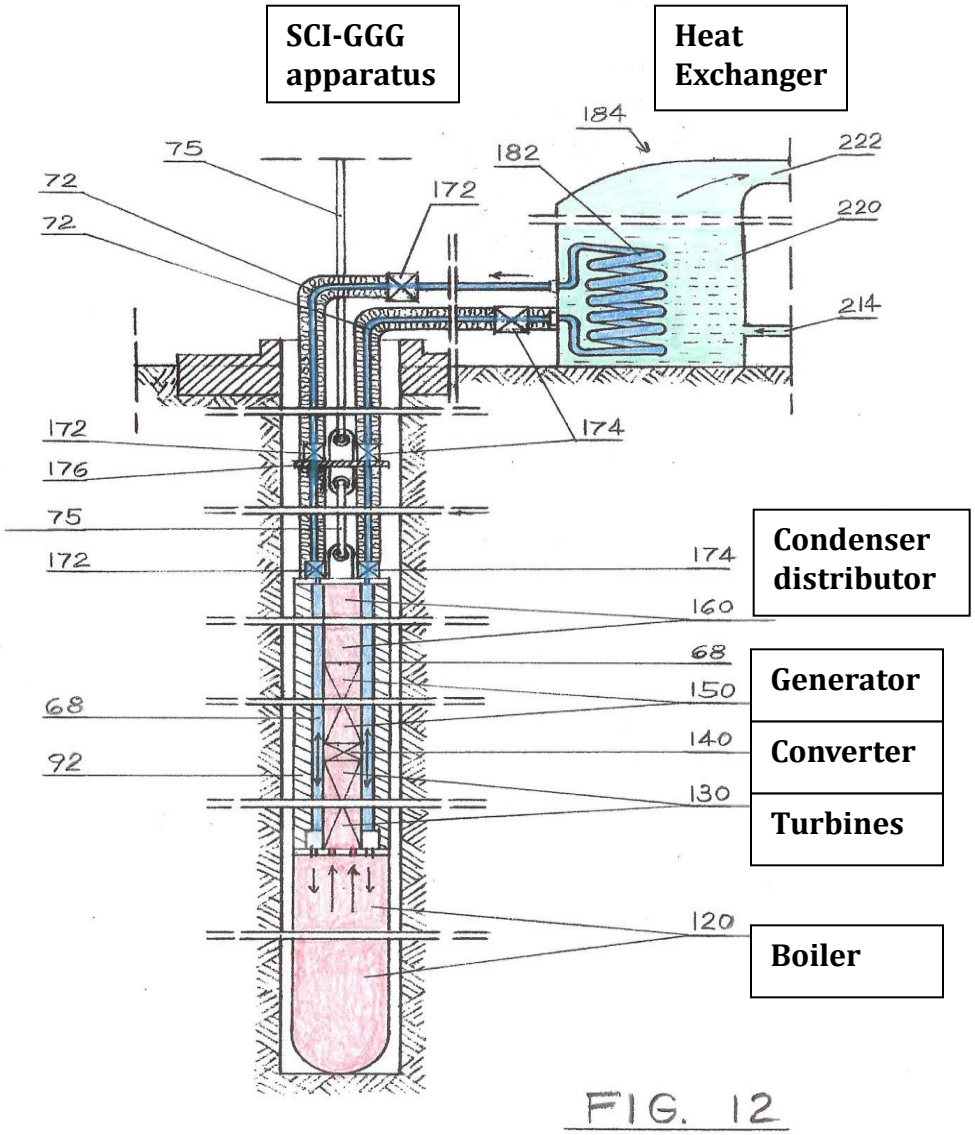


FIG. 12

- The SCI-GGG apparatus uses three (3) closed loop systems:
- A first closed loop systems (rosy color) circulates working fluid through a Boiler, Turbine, Generator, Condenser, and back through Boiler.
- A second closed loop systems (blue color) "the Self Contained In-Ground Heat Exchanger (SCI-GHE system)" circulates fluid through the condenser; thermally insulated hoses; and a Heat Exchanger coupled to the binary power unit on the ground surface.
- The "Self Contained In-Ground Heat Exchange" (SCI-GHE system) is an integral part of the SCI-GGG system and can be used separately as an independent Heat Exchanger.
- A third closed loop systems (greenish color) circulates working fluid through a binary power unit on the ground surface and generates additional electricity.

EXHIBIT "EE "

GEOTHERMAL WORLDWIDE, INC.

The "Self Contained In-Ground Heat Exchanger" (SCI-GHE system)

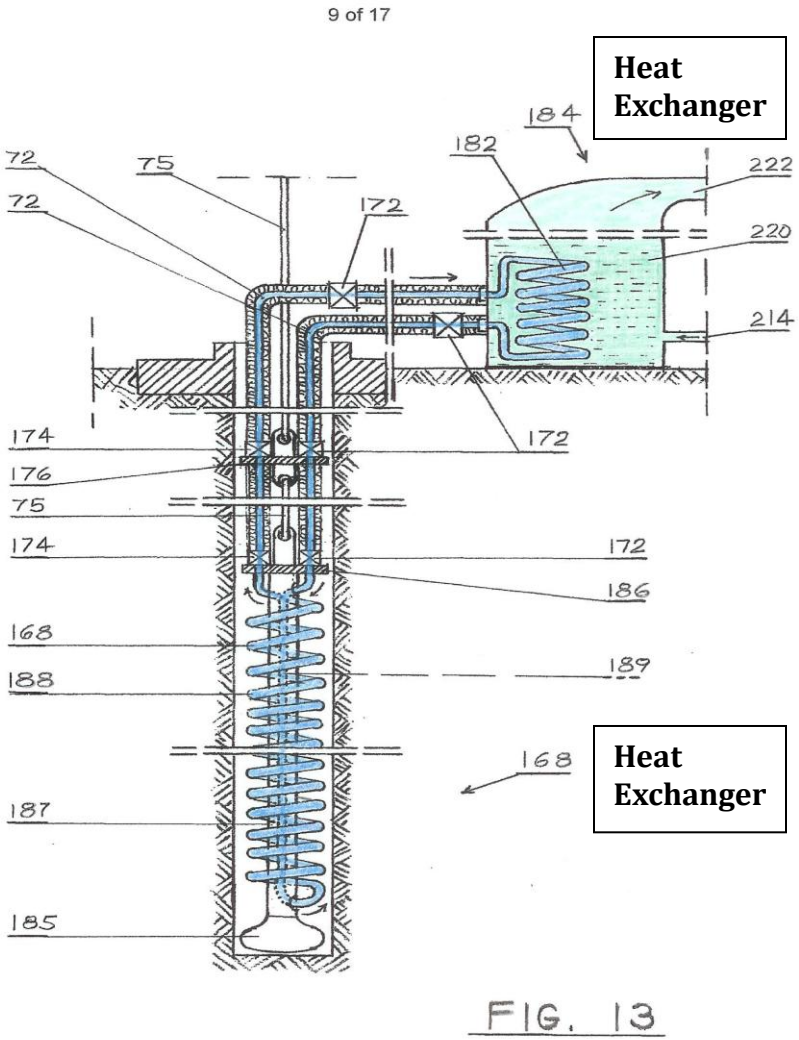
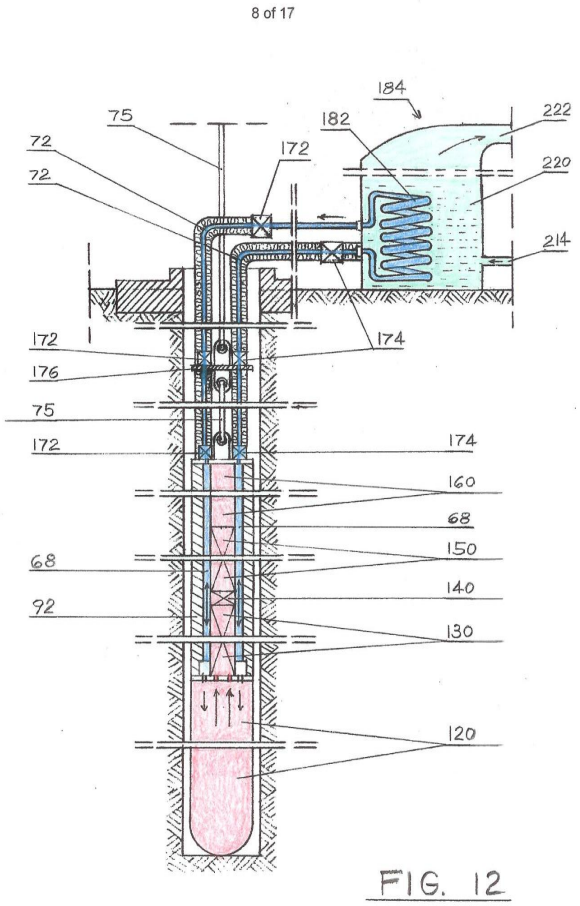


FIG. 13

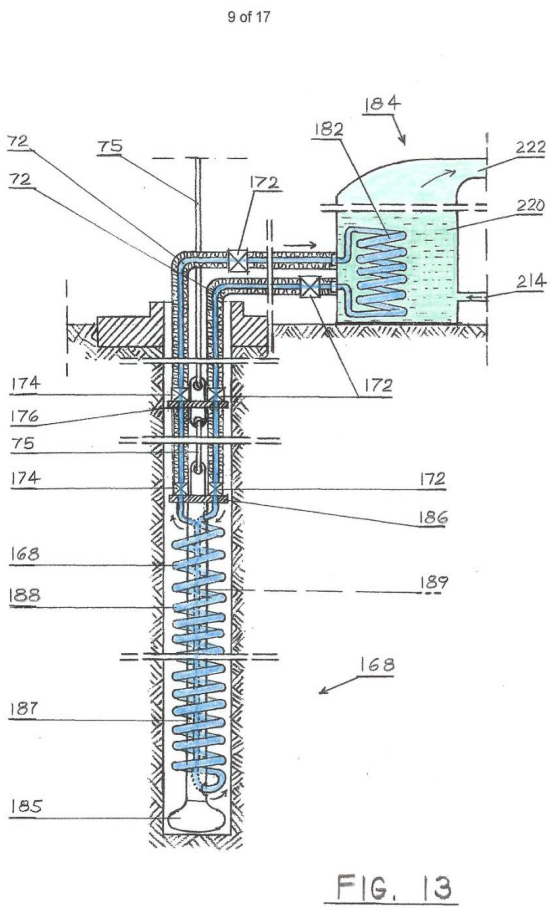
EXHIBIT "FF"

- The (SCI-GHE) apparatus is an integral part of the "Self Contained In-Ground Geothermal Generator" (SCI-GGG system) and is used separately as an independent Heat Exchanger apparatus.
- The (SCI-GHE) apparatus consist of: two coils (Heat Exchangers); a closed loop of thermally insulated pipes/hoses 72; at least one In-Line Pump 172; and a Binary Power Unit 184.
- The first coil (Heat Exchanger) 168 of the first closed loop systems is located at heat source and the second coil (Heat Exchanger) 182 is coupled into boiler of the Binary Power Unit on the ground surface which operates as a second closed loop system - the Organic Rankine Cycle (ORC) – which generates electricity.
- Alternatively, the (SCI-GHE) and/or (SCI-GHE) apparatus can be scaled to be used for extracting heat from abandon and marginal wells.
- The first coil (HE) at the bottom of well bore has vertical pipe and is structurally sound to support its weight.

Scientific Geothermal Technology
SCI-GGG and SCI-GHE systems - side by side



SCI-GGG system



SCI-GHE system

- **The SCIG-GGG system generates electricity down at the heat source and transmits it up to the ground level by means of electrical cables.**
- **The SCIG-GGG system generate additional electricity on the ground surface.**
- **The (SCI-GHE) system is an integral part of the (SCI-GGG) system and can be used separately as an independent Heat Exchange Apparatus.**
- **The (SCI-GHE) system has, the less production capacity than (SCI-GGG) system but it is easier to build and maintain.**
- **Alternatively, the (SCI-GHE) and/or (SCI-GHE) apparatus can be scaled for extracting heat from abandon and marginal wells.**
- **The Scientific Geothermal Technology doesn't require hydrothermal reservoirs, although is not limited to dry hot rocks.**

EXHIBIT " GG "

GEOTHERMAL WORLDWIDE, INC.

Schematic Plain view of the Power Plant with the "Scientific Geothermal Technology" - (SCI-GGG) and/or (SCI-GHE) system.

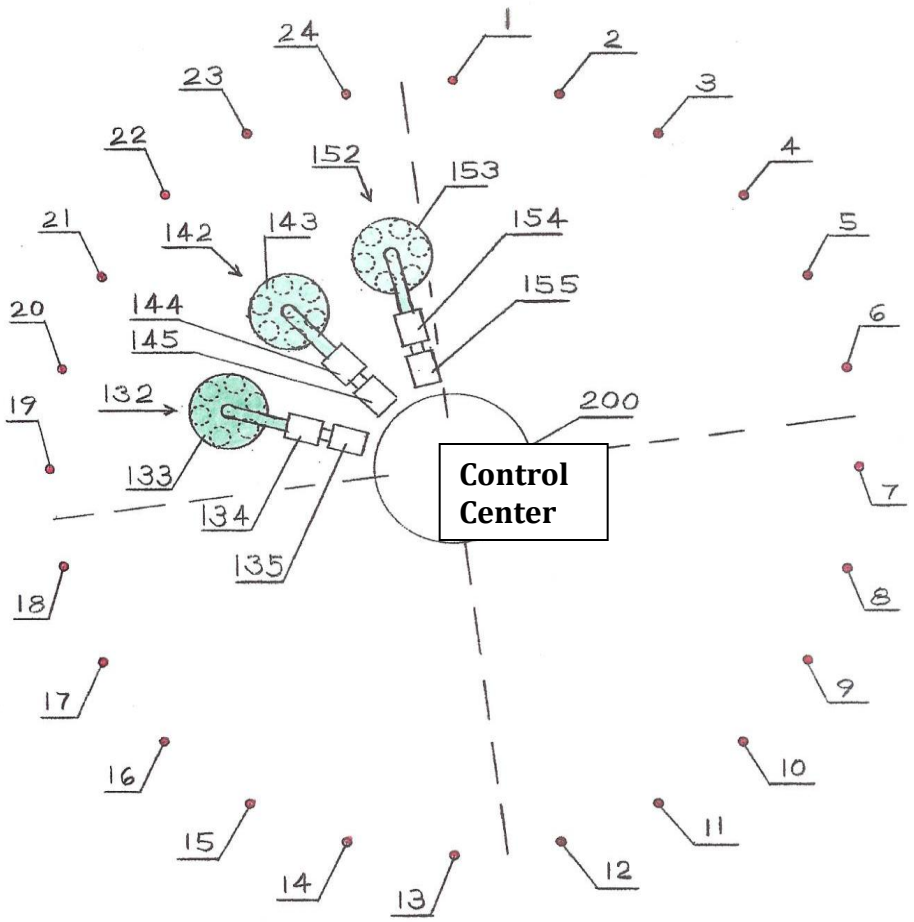


FIG. 16

EXHIBIT "HH"

- **Power Plant with 24 wellbores and Control Center.**
- **Cooling system with three (3) Binary Power Units (BPU) with different working fluids produces additional electricity. (BPU are Illustrated only at one typical quarter).**
- **Modular implementation of the SCI-GGG or SCI-GHE systems creates immediate revenues and allows continuation of buildups of additional modular units.**

GEOTHERMAL WORLDWIDE, INC.

Diagram of the Cooling System of one typical quarter of the Power Plant

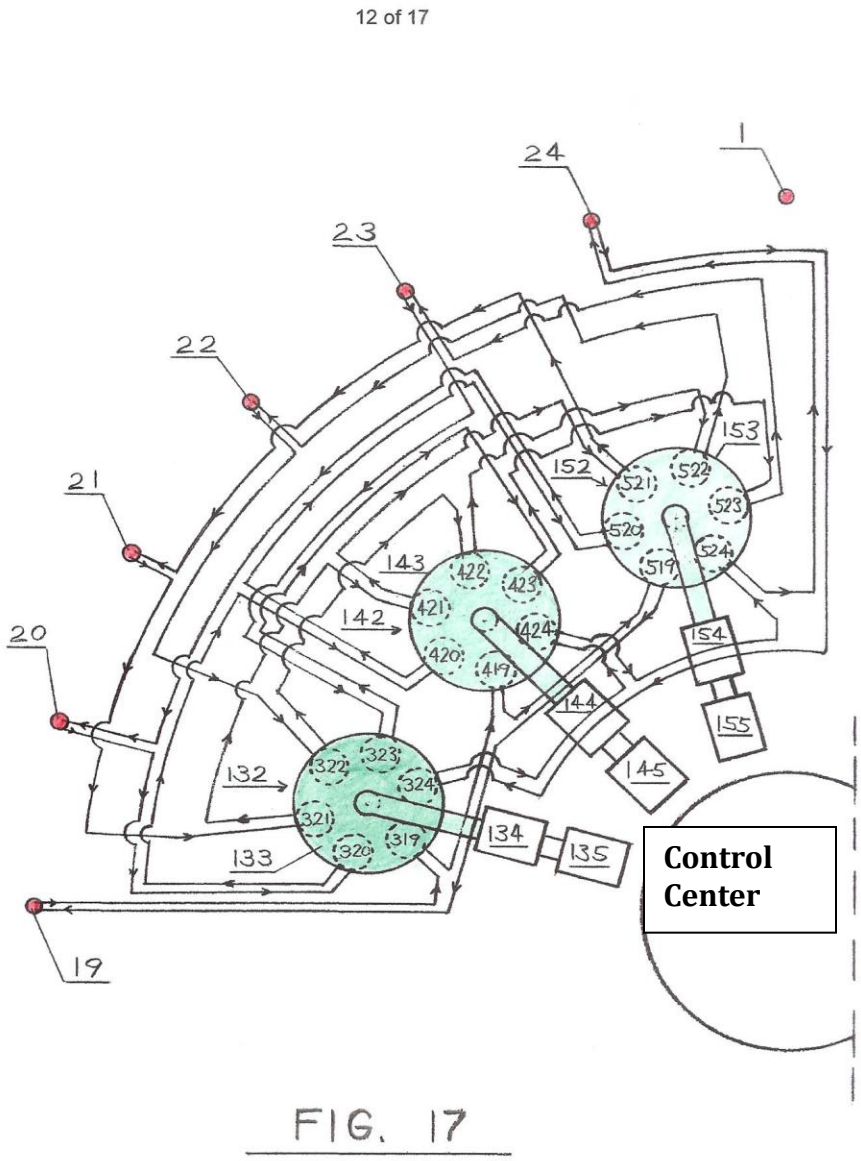


FIG. 17

- **Three boilers (evaporators) operates with different working fluids each with different boiling points.**
- **Three boilers of these three Binary Power Units are coupled with six heat exchangers of six apparatuses in six wellbores and generates electricity on the ground surface.**

EXHIBIT " II "

GEOTHERMAL WORLDWIDE, INC.

Cross-sectional views of the Boiler of the Power Unit on ground surface

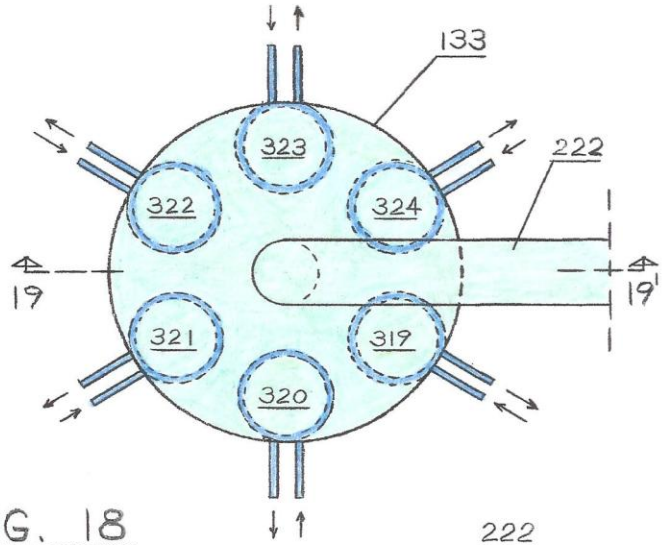


FIG. 18

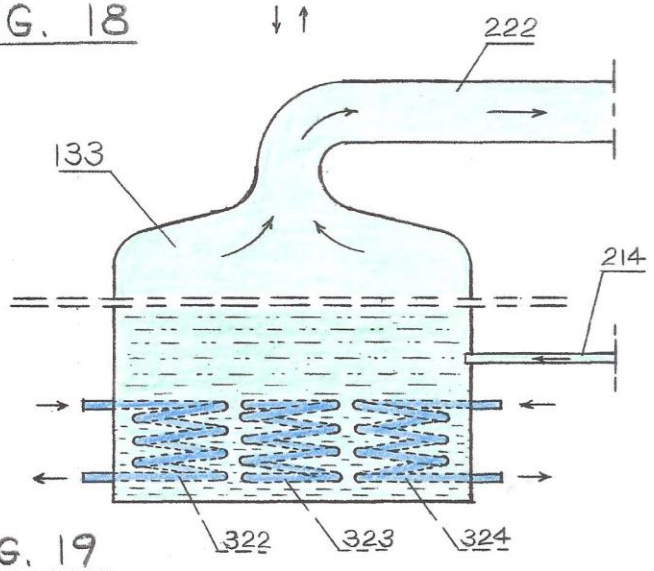


FIG. 19

- **Plain view of one of the boiler of the Binary Power Unit coupled with six heat exchangers of the six apparatuses.**

- **Cross sectional view of the boiler.**

EXHIBIT "JJ "

Cross-sectional view of the “In-Line-Pump” taken along line 22-22’ of FIG. 23

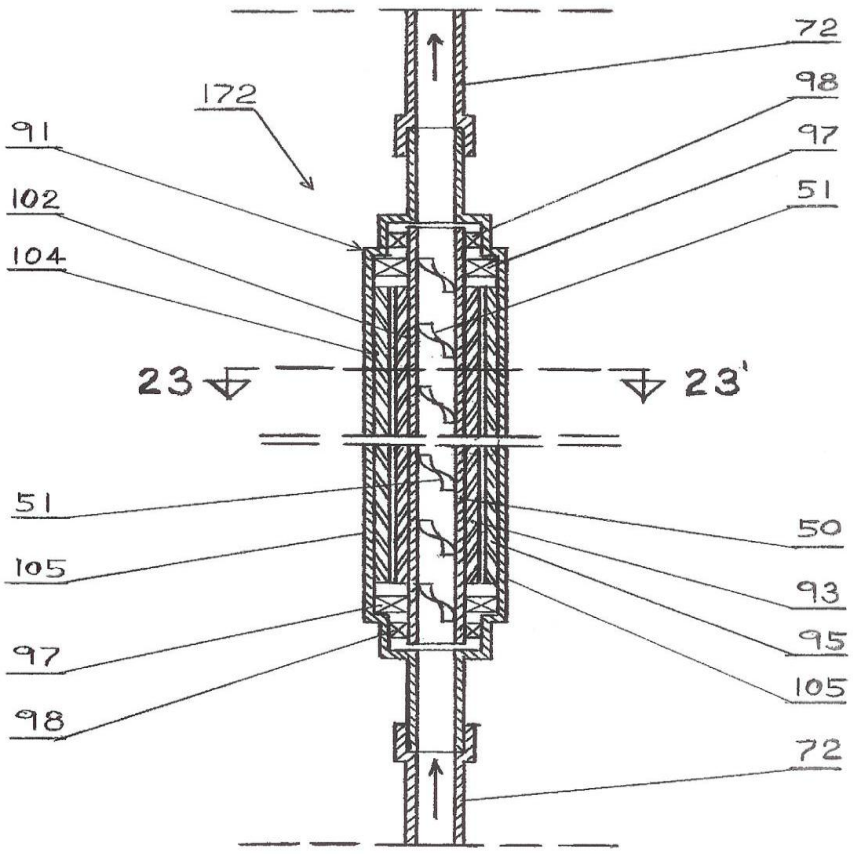


FIG. 22

- **The In-Line-Pump 172 is an integral part of both SCI-GGG and SCI-GHE systems, circulating fluids through closed loop systems.**
- **The In-Line-Pump 172 is an electromotor cylindrical shape and is inserted as a repetitive segment in pipeline.**
- **It has a hollow cylinder shaft of the rotor with spiral blades inside hollow shaft.**
- **Yields maximum flow rate with limited diameter.**

EXHIBIT “ KK “

Cross-sectional view of the In-Line-Pump taken along line 23-23' of FIG. 22

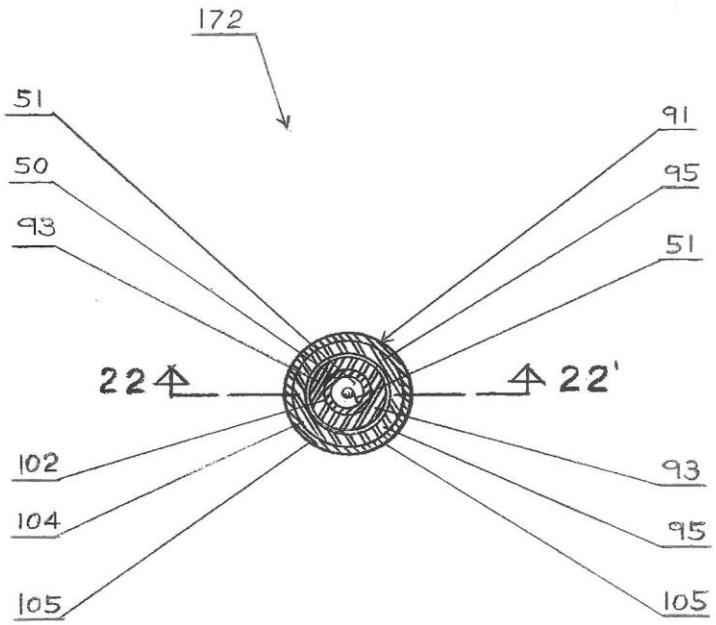


FIG. 23

- **Alternatively, the In-Line-Pump 172 can be inserted as a repetitive segment of a raiser pipe for pumping fluids up to the ground surface from reservoirs in which geo-pressure is low.**
- **Also, the In-Line-Pump 172 can be used in cross-country pipeline for oil, gas, water, etc., as a repetitive segment.**
- **In downhill route it function as a generator and generates electricity, which can be used to supplement In-Line-Pumps 172 in horizontal and uphill route.**

EXHIBIT " LL "

GEOTHERMAL WORLDWIDE, INC.

Schematic Cross-Sectional Diagram of an Universal Heat Exchange System 210

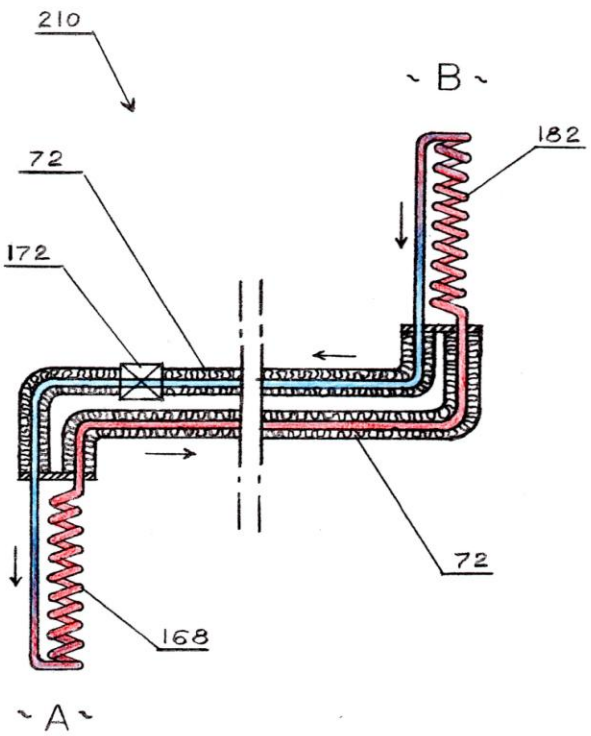


FIG. 24

EXHIBIT "MM"

FIG. 24 illustrate an schematic cross sectional diagram of an universal heat exchange system 210 with main segments including:

- **A thermally insulated close loop line 72 with an in-line pump 172;**
- **A first heat exchanger 168 positioned in heat source environment "A"; and**
- **A second heat exchanger 182 positioned in preferred environment "B";**
- **Heat is extracted from heat source through the first heat exchanger 168 and transferred through thermally insulated line 72 to the second heat exchanger 182 for external use including production of electricity.**
- **The universal heat exchange system 210 is a portable unite and can be used in many applications.**

A Proposal for Temporary Cooling Dysfunctional Reactor at Fucushima Daiichi Nuclear Power Complex by using SCI-GHE System

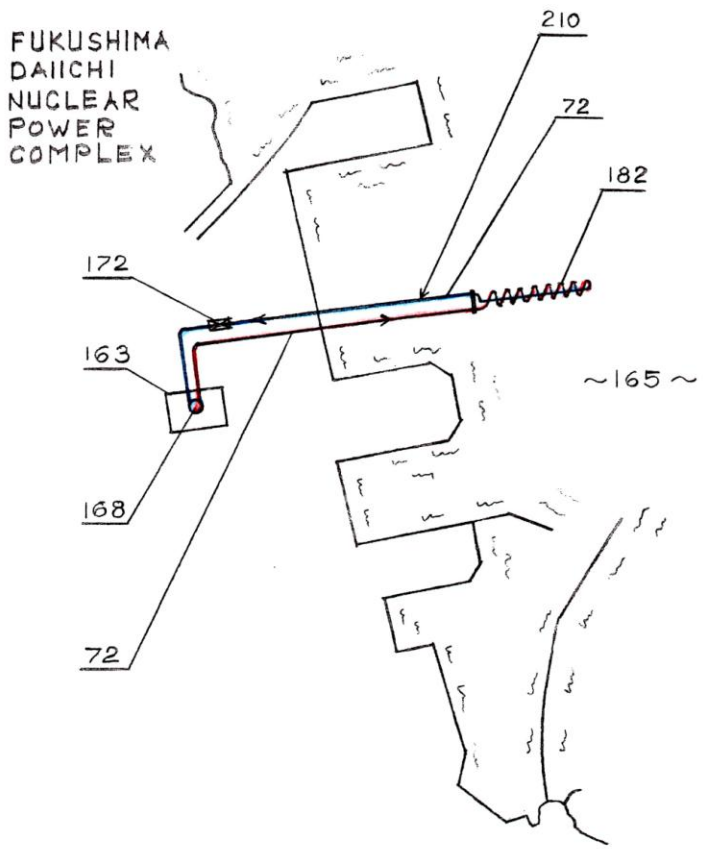


FIG. 25

- **FIG. 25 illustrate dysfunctional nuclear reactor 163, Ocean 165 and universal closed loop heat exchanger system 210.**
- **The first heat exchanger 168 is lowered into dysfunctional nuclear reactor 163 and the second heat exchanger 182 is submerged into nearby Ocean 165.**
- **Heat is extracted from dysfunctional overheating nuclear reactor 163 through the first heat exchanger 168 and transferred through closed loop line 72, to the second heat exchanger 182, and dispersed safely into the Ocean 165.**
- **Heat exchange fluid in closed loop system 210 is not in direct contact with radioactive material in dysfunctional nuclear reactor 163 or the Ocean 165.**
- **Multiple units of the closed loop system 210 can be deployed.**
- **Although a temporally solution, if needed, Portable Binary Power Unit, can be inserted into closed loop system 210.**

EXHIBIT "NN "

Schematic Plan View of a Power Plant for Production of Electricity in locations such as Hawaii by using SCI-GHE System

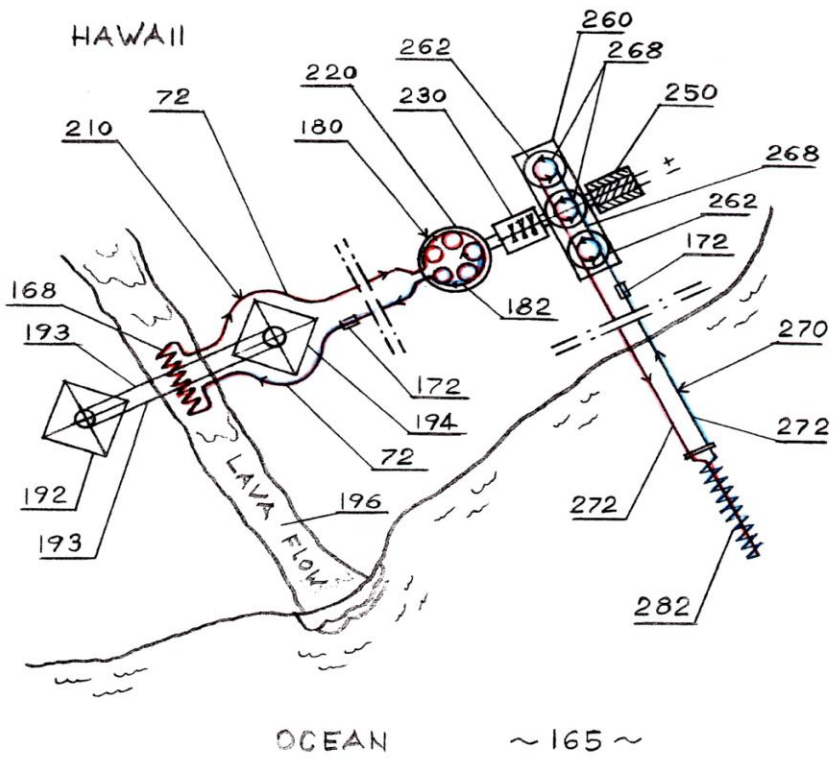


FIG. 26

- **Two posts/towers 192 and 194 erected on either side of established lava flow/tube 196 with cable 193 suspended between them.**
- **The first heat exchanger 168 is lowered at safe distance, close to lava flow 196, and the second heat exchanger 182 is coupled into boiler/evaporator 220 of the binary power unit 180.**
- **Heat exchangers 168 and 182 are connected with thermally insulated closed loop system 210.**
- **Power unit 180 consist of a boiler 220 a turbine 230, a generator 250, and a condenser 260.**
- **Cooling system for the condenser 260 consisting of additional closed loop system 270 with heat exchanger 282 submerged into Ocean 165.**

EXHIBIT "OO"

Cross-sectional view of a Power Plant for Production of Electricity from heat source such as Oil Well Flare Stacks by using SCI-GHE System

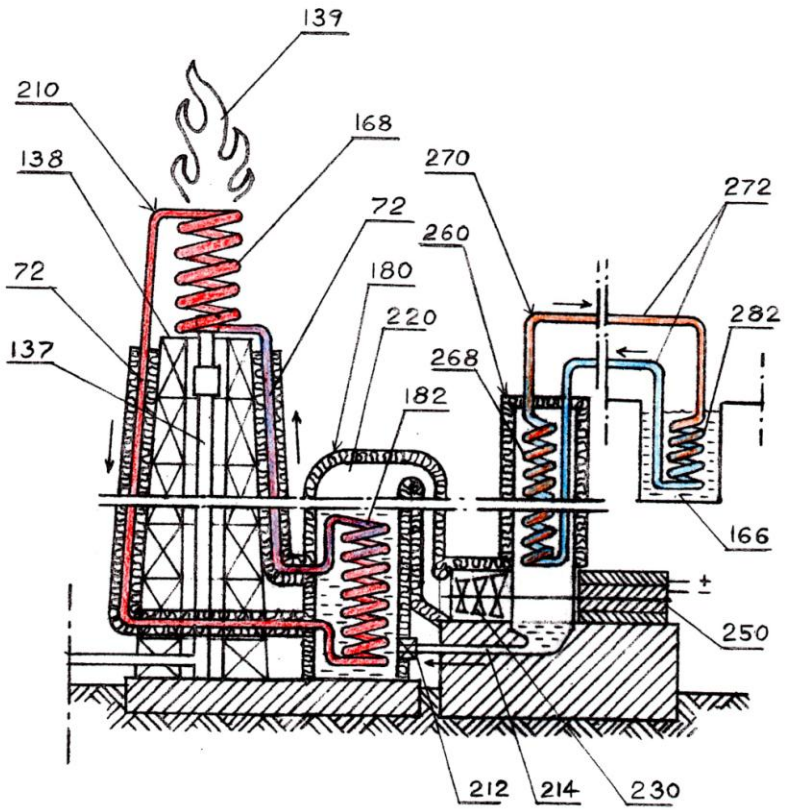


FIG. 27

- **Flare stack 137 has support structure 138.**
- **The heat exchange system 210 with the first heat exchanger 168 positioned on top of the supporting structure 138 and the second heat exchanger 182 coupled into boiler/evaporator 220 of the binary power unit 180.**
- **Heat from flame 139 is extracted through the first heat exchanger 168 and transferred through thermally insulated line 72 to the second heat exchanger 182.**
- **Binary power unit 180, has a boiler 220, turbines 230, a generator 250, and condenser 260.**
- **Condenser 260 is cooled with additional closed loop system 270 consisting of the first heat exchanger 268, closed loop line 272 and the second heat exchanger 282 which can be submerged into nearby source of cold water.**

EXHIBIT " PP "

Cross-sectional view of an alternative Power Plant for Production of Electricity from heat source such as Oil Well Flare Stacks by using SCI-GHE System

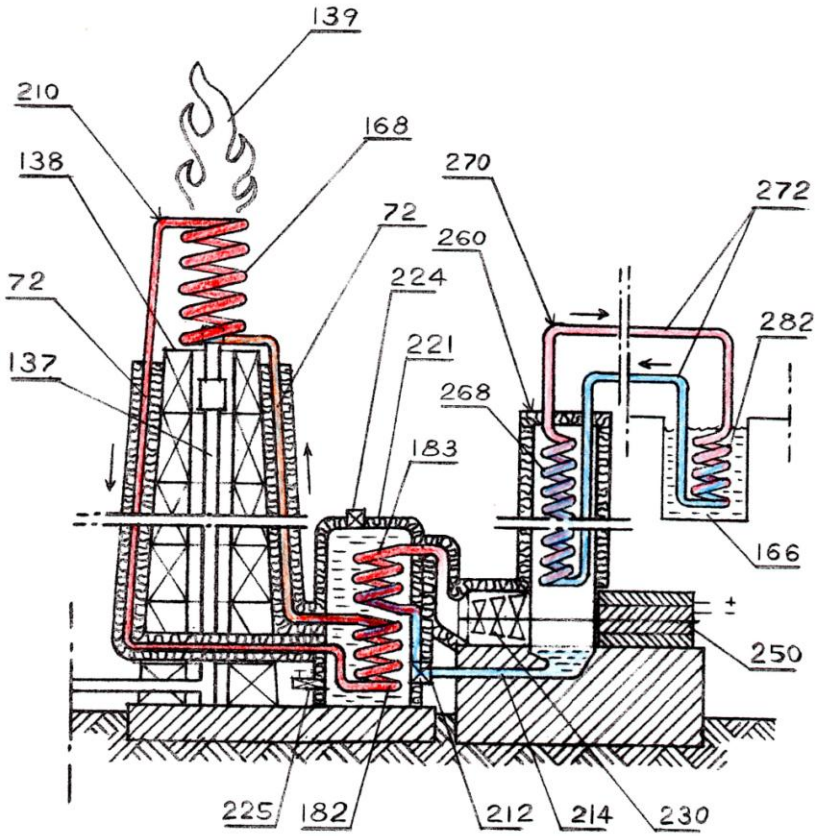
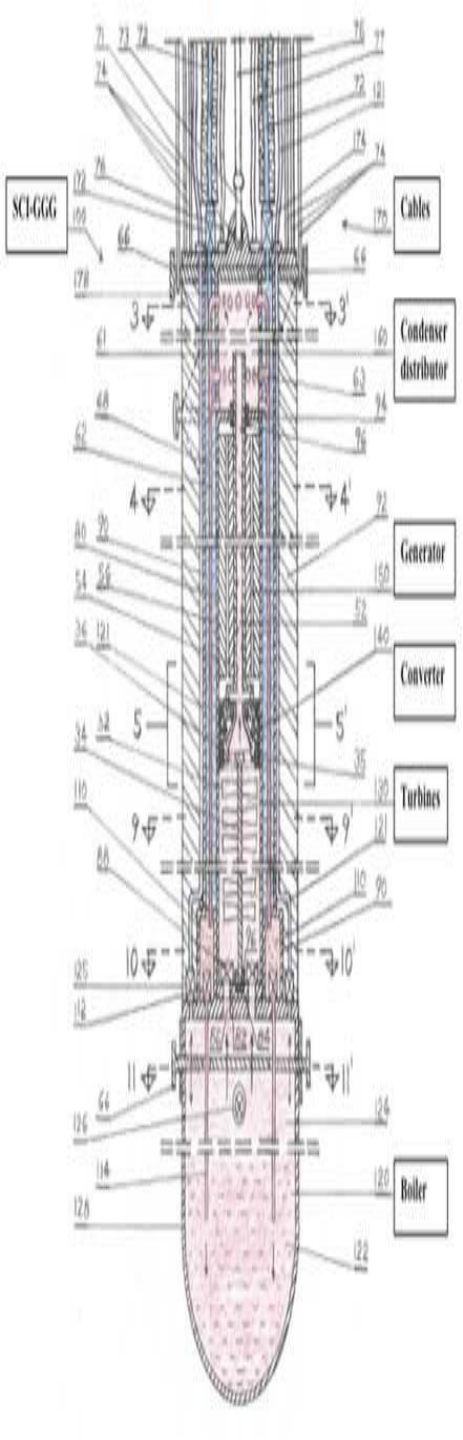


FIG. 28

- **The assembly illustrated in FIG. 28 is essentially the same as assembly illustrated in FIG. 27;**
- **Only difference is that instead of boiler 220 in FIG. 27 there is heat exchanger unit 221 which contains two heat exchangers 182 and 183.**
- **The heat exchanger unit 221 is filled with heat exchange medium fluid.**
- **Alternatively, condenser 260 can be modified and replaced with condenser 360 illustrated in FIG. 45.**

EXHIBIT "QQ"



Maintenance of the SCI-GGG system

- **Basic maintenance of the apparatus – monitoring temperature, managing levels of fluids and lubrication, can be managed from the ground surface through service lines.**

- **Extensive maintenance – such as replacement of bearings, turbine, generator or fixing leak(s) – requires removal of apparatus, refurbishment or replacement and then reinsertion into the wellbore.**

Advantages of the "Scientific Geothermal Technology“ the (SCI-GGG) & (SCI-GHE) systems (I):

1. **Generates electricity constantly 24 hours per** day regardless of weather condition on the ground surface.

2. **Needs a single well** bore to function and doesn’t need a hydrothermal reservoir although it is not limited to dry hot rocks.

3. **The (SCI-GHE) and/or (SCI-GHE) apparatus** can be **scaled** to be used for **extracting heat from abandon** and marginal **wells.**

4. Uses **several closed loop systems** and at no time is there any contact with the environment by the working fluid or the heat exchange fluid therefore it **doesn’t pollute the environment.**

5. **Eliminates** any concern of **”fracking”** (Hydraulic Fracturing).

6. **Eliminates** the issues of injection water.

7. **Eliminates** the issues of concentration of brine, **filtration, separation,** equipment **corrosion, scaling,** and ground **water pollution.**

Advantages of the "Scientific Geothermal Technology“ the (SCI-GGG) & (SCI-GHE) systems (II):

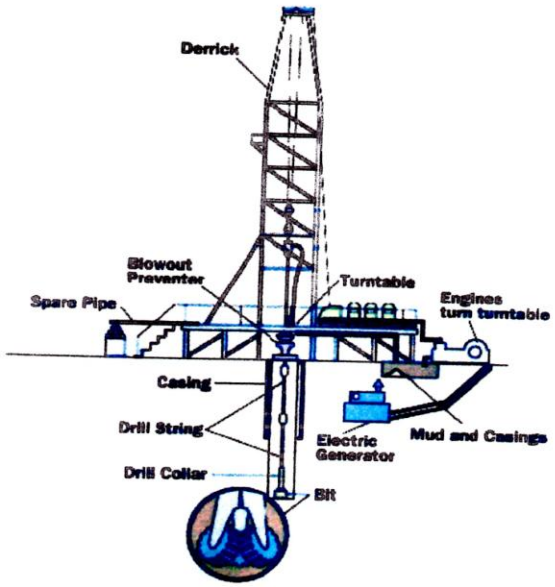
8. **Modular implementation** of the **"Scientific Geothermal Technology"** systems create immediate revenues and allowed continuation of buildups of additional modular units.

9. When eventually cooling of the rocks happen then **additional drilling** could be performed, **periodically** or **at once,** until **equilibrium** of heat absorption and heat replenishment is **achieved** rather than start drilling at a new location nearby. The **extended depth** will result **in hotter rock** formations and **higher heat flux.** Eventually, a point will be reached where heat extraction and heat replenishment will be in **balance - equilibrium.**

10. Necessary heat can be reached and used from any location and **every country has the potential** to access that limitless heat source and **produce electricity** by implementing the **"Scientific Geothermal Technology"** systems.

11. By implementing **"Scientific Geothermal Technology “** systems, we can **stop polluting** our planet with nuclear, coal and oil burning power plants and their toxic waste **and start producing electricity** from abundant **self sustaining geothermal source** for energy needs for our **current** and **future generations.**

Schematic view of an Contemporary Oil Rig Drilling System



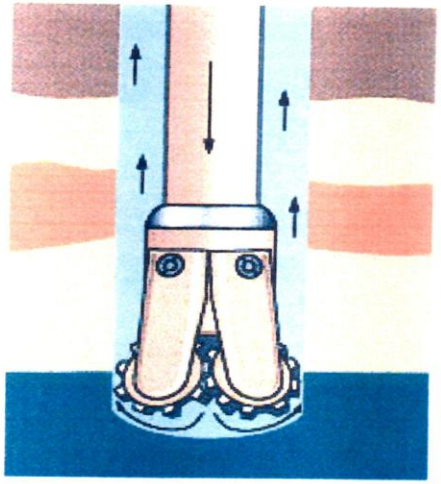
Here are illustrated major systems of a land oil rig:

- **Power System** – Large diesel engines
- **Mechanical system** – driven by electric motors; hosting system; turntable;
- **Rotating equipment** – Swivel; kelly; turntable or rotary table; Drill string; drill bit(s);
- **Casing;**
- **Circulation system;**
- **Derrick;**
- **Blow Out Preventer;**

(Photo courtesy of the Energy Institute.)

EXHIBIT "QQ"

Schematic view of an Contemporary Oil Rig Drilling System



Here is illustrated a drill bit:

- **Mad circulation system;**
- **Mad is injected through pipe and through several orifices at drill bit circulates up between pipe and wall of the well bore providing necessary stream for cutting to be excavated;**
- **By increasing size of the drill bit (well bore) and / or by increasing dept of the well bore it requires tremendous increase of pressure inside pipe and corresponding stream up;**
- **Contemporary drilling system have limitations how wide and deep wellbore can be drilled;**

EXHIBIT "RR "

(Photo courtesy of the Energy Institute).

Schematic view of an Apparatus for Drilling Faster, Deeper, and Wider Well Bore

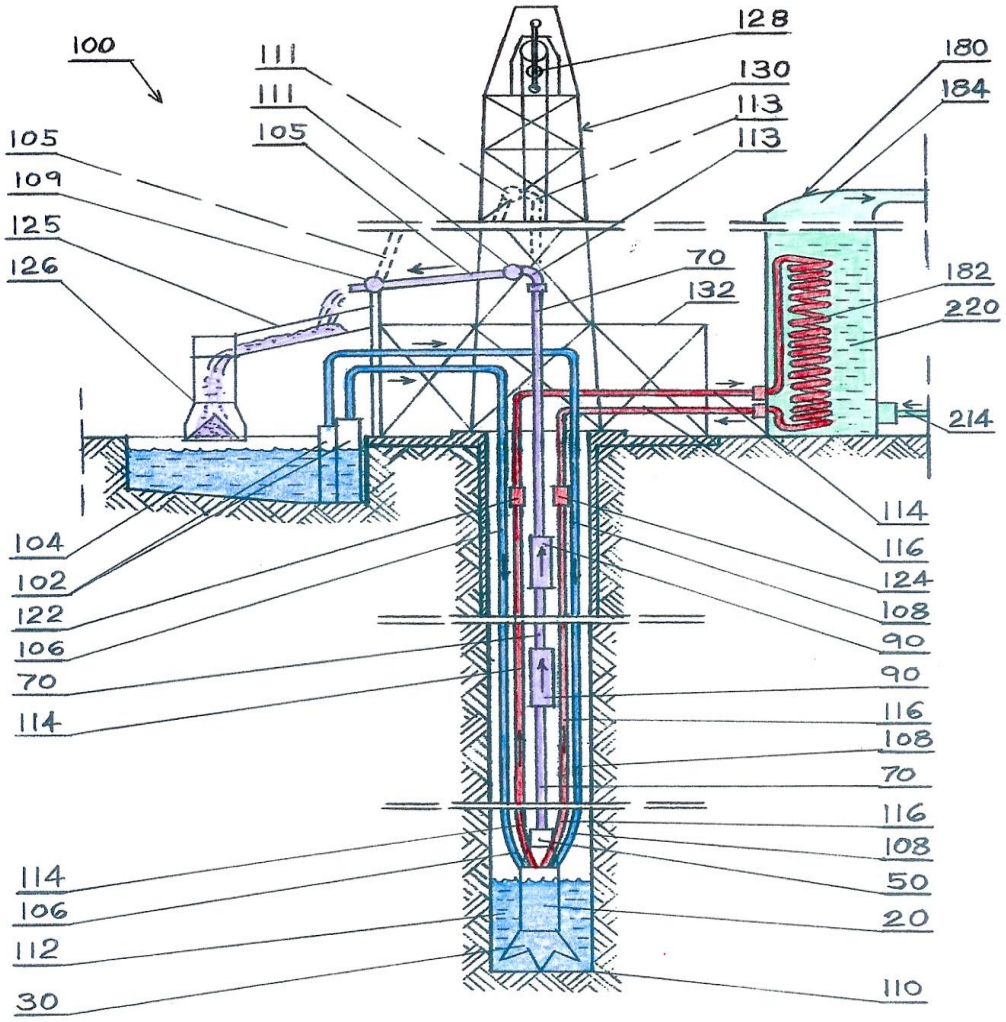


FIG. 1

EXHIBIT "SS"

The apparatus and method for drilling deeper and wider well bores consist of:

- **A Motorized Drill Head for cutting and shredding ground material;**
- **A separate excavation line;**
- **A separate fluid delivery line;**
- **A separate close loop engine cooling line;**
- **The excavation line consists of multiple connected stationary segments of the main excavation pipe with periodical segments of an In-Line excavation pump;**
- **Optionally, whole excavation pipeline can consist of multiple segments of an In-Line excavation pump;**

GEOTHERMAL WORLDWIDE, INC.

Schematic view of an Binary Power Unit on the ground engaged with the Apparatus for Drilling Faster, Deeper, and Wider Well Bore

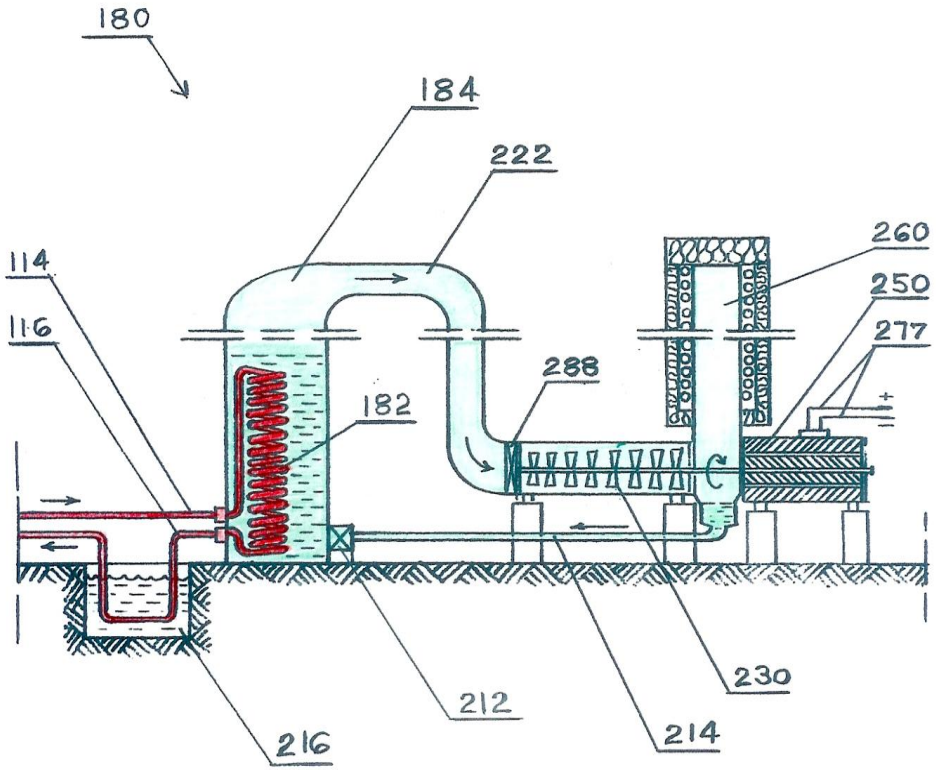


FIG. 2

EXHIBIT "TT "

Binary Power Unit on the ground surface consist of:

- **A Boiler;**
- **A Turbine;**
- **A Condenser; and**
- **A Generator**
- **The boiler is coupled with coil (Heat Exchanger) from a separate close loop engine cooling line circulating fluid from motorized drill head.**
- **A Generator of the Binary Unit generates electricity to supplement power for the motorized drill head.**

Schematic view of an Motorized Drill Head of an Apparatus for Drilling Faster, Deeper, and Wider Well Bore

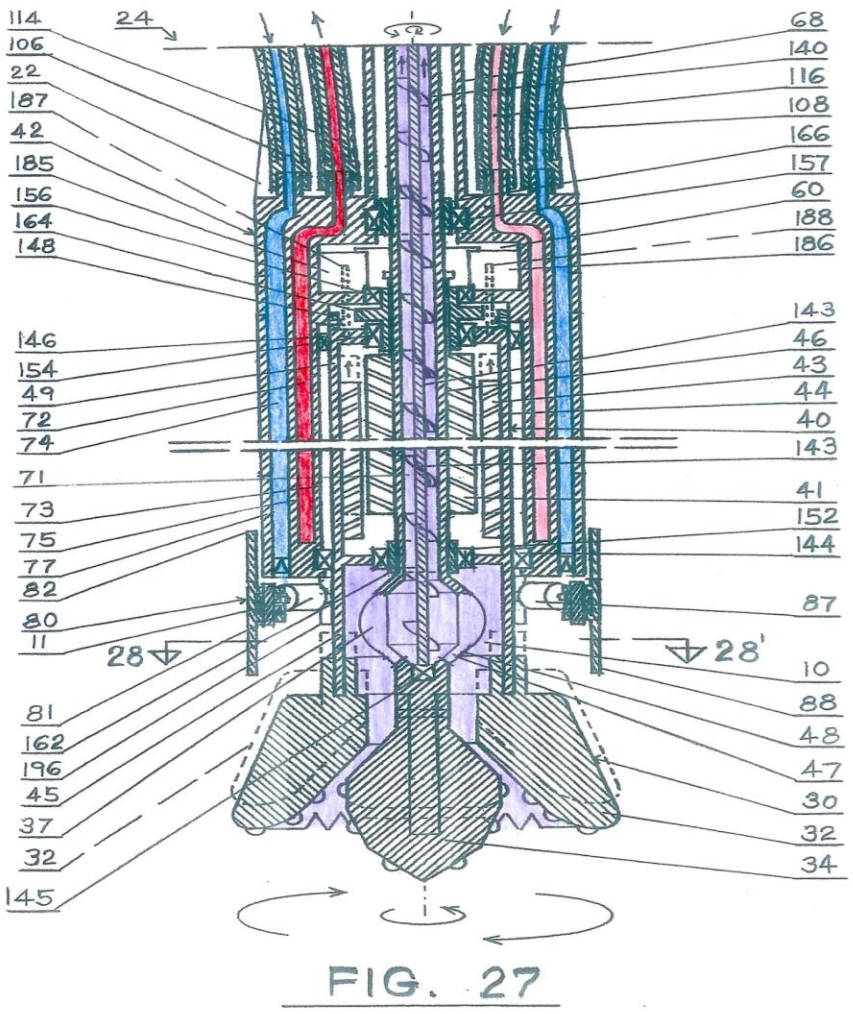


FIG. 27

- **The diameter of the excavation line and rate of flow of mud and cuttings through it and the diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only limited fluid column at the bottom of the well bore.**
- **Fluid column may exist through whole well bore to sustain it during drilling process, but not for excavation reasons.**
- **The excavation process continues regardless of the diameter of the drill head (wellbore);**
- **Therefore this method eliminates well known drilling limitations relative to the depth and diameter of the wellbore.**

EXHIBIT "UU"

GEOTHERMAL WORLDWIDE, INC.

MISSION STATEMENT:

Our corporate mission at Geothermal Worldwide, Inc., include the following:

- **Licensing our unique "Scientific Geothermal Technology“:**
  1. "Self Contained In-Ground Geothermal Generator" **(SCI–GGG)** system;
  2. "Self Contained In-Ground Heat Exchanger" **(SCI–GHE)** systems;
  3. **"In-Line Pump",** and more, to interested and capable parties worldwide;
  4. “**Apparatus for Drilling Faster, Deeper, and Wider Well Bore** with constant diameter; and

- **Promoting** implementation of our methods commonly called the **"Scientific Geothermal Technology"** for generating electricity by efficiently **harnessing the limitless source of geothermal energy** without polluting the environment and in the process preserving our environment from further degradation;

CONSTRAINS OR REQUIREMENTS OF PROJERCT

Constrains are:

- **The size of the project consisting of several phases incorporating several new, although proven, patented technologies and its implementation;**
- **No legal platform dealing with big companies with means such as ORMAT, MITSUBISHI, FUJI, FLUOR, SIEMENS, ABB, etc.**
- **At this time no budget for exploratory projects;**

CONSTRAINS OR REQUIREMENTS OF PROJERCT

Solutions are:

- **Now that we have project of a great value and of a great importance for our economy and our environment and for our future generations, with help of this committee and local authorities, we should be able to:**

- **Form a necessary exploratory budget;**

- **Form a team of necessary expert;**

- **Work with potential contractors and companies with means towards final selection of corridor and final production design of the patented technologies involved in the project and its implementation.**

- **Work with state and federal politicians on the grant or long term loan for the project.**

US007849690B1

(12) **United States Patent**
Lakic

(10) **Patent No.: US 7,849,690 B1**
(45) **Date of Patent: Dec. 14, 2010**

(54) **SELF CONTAINED IN-GROUND GEOTHERMAL GENERATOR**

(76) Inventor: **Nikola Lakic**, 45-191 Elm St., Indio, CA (US) 92201

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 818 days.

(21) Appl. No.: **11/770,543**

(22) Filed: **Jun. 28, 2007**

Related U.S. Application Data

(60) Provisional application No. 60/922,440, filed on Apr. 7, 2007, provisional application No. 60/927,336, filed on May 2, 2007.

(51) **Int. Cl.**
F03G 7/00 (2006.01)

(52) **U.S. Cl.** ..... **60/641.2**; 290/1 A; 290/2

(58) **Field of Classification Search** ..... 60/641.2, 641.4; 290/1 A, 2

See application file for complete search history.

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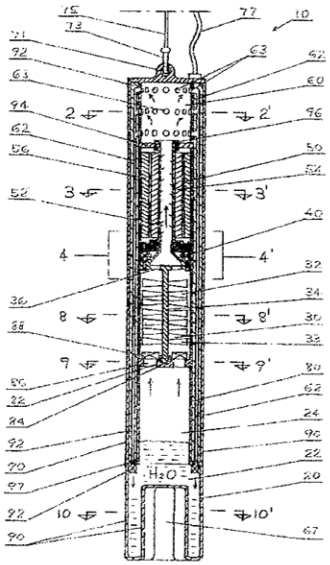
Primary Examiner—Hoang M Nguyen
(74) *Attorney, Agent, or Firm* Schmeiser, Olsen & Watts LLP

(57) **ABSTRACT**

A method of using geothermal energy to produce electricity by lowering a geothermal generator deep into pre-drilled holes below the Earth's surface. A geothermal generator includes a boiler, a turbine compartment, an electric generator, a condenser and an electric cable. The geothermal generator also includes an internal cylinder, an external cylinder and a plurality of tubes disposed between the internal cylinder and the external cylinder. The plurality of tubes is part of the condenser. In a method of using the geothermal generator, water contained within the boiler is converted to high-pressure, super heated steam due to heat contained within a pre-drilled well below the earth's surface. The steam is used to produce electric energy, which is transported to the ground surface by the electric cable.

22 Claims, 14 Drawing Sheets



- **US Patent Issued on: December 14, 2010;**
- **Title: Self Contained In-Ground Geothermal Generator;**

GEOTHERMAL WORLDWIDE, INC.

US008281591B2

(12) **United States Patent**
Lakic

(10) **Patent No.: US 8,281,591 B2**
(45) **Date of Patent: Oct. 9, 2012**

(54) **SELF CONTAINED IN-GROUND GEOTHERMAL GENERATOR**

(76) Inventor: **Nikola Lakic**, Indio, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1035 days.

(21) Appl. No.: **12/197,073**

(22) Filed: **Aug. 22, 2008**

(65) **Prior Publication Data**

US 2011/0169274 A1 Jul. 14, 2011

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/770,543, filed on Jun. 28, 2007, now Pat. No. 7,849,690.

(51) **Int. Cl.**
F01K 27/00 (2006.01)
F03G 7/00 (2006.01)

(52) **U.S. Cl.** **60/641.2**; 60/641.1; 60/641.4

(58) **Field of Classification Search** 60/641.1–641.5
See application file for complete search history.

(56) **References Cited**

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Lakic, Self Contained In-Ground Geothermal Generator, U.S. Appl. No. 11/770,543, filed Jun. 28, 2007, Amendment, dated Sep. 8, 2010.
Lakic, Self Contained In-Ground Geothermal Generator, International Application No. PCT/US2009/054656, Priority date Aug. 22, 2008, Written Opinion of the International Searching Authority, dated Oct. 8, 2009.

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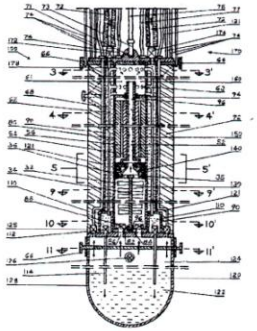
Primary Examiner — Thomas Denion
Assistant Examiner — Christopher Jetton
(74) *Attorney, Agent, or Firm* — Schmeiser, Olsen & Watts LLP

(57) **ABSTRACT**

A self contained geothermal generator includes a boiler, a turbine compartment, an electricity generator, a condenser and an electric cable. The condenser includes a distributor chamber, a peripheral chamber and plurality of tubes disposed between the chambers. The peripheral chamber of the condenser surrounds and cools turbine, elective generator and selector of the condenser departments. The condenser cools and converts exhausted steam back in liquid state and returns it back into boiler for reheating. In a method of using the geothermal generator, water contained within the boiler is converted to high-pressure, super heated steam due to heat from hot rocks contained within a pre-drilled well below the Earth's surface. The steam is used to produce electric energy which is transported up to the ground surface by the electric cable. A plurality of geothermal generators may be used in a "binary" power plant through system of several heat exchangers.

13 Claims, 15 Drawing Sheets



- **US Patent Issued on: October. 9, 2012**
- **Title: Self Contained In-Ground Geothermal Generator**
- **Several Patent Pending Applications**

GEOTHERMAL WORLDWIDE, INC

US008713940B2

(12) **United States Patent**
Lakic

(10) **Patent No.: US 8,713,940 B2**
(45) **Date of Patent: May 6, 2014**

(54) **SELF-CONTAINED IN-GROUND GEOTHERMAL GENERATOR**

(76) Inventor: **Nikola Lakic**, Indio, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 262 days.

(21) Appl. No.: **13/053,029**

(22) Filed: **Mar. 21, 2011**

(65) **Prior Publication Data**

US 2011/0167819 A1 Jul. 14, 2011

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/197,073, filed on Aug. 22, 2008, now Pat. No. 8,281,591, and a continuation-in-part of application No. 11/770,543, filed on Jun. 28, 2007, now Pat. No. 7,849,690.

(51) **Int. Cl.**
F03G 7/00 (2006.01)

(52) **U.S. Cl.**
USPC **60/641.2**; 60/641.1; 60/641.4

(58) **Field of Classification Search**
USPC 60/641.1–641.5
See application file for complete search history.

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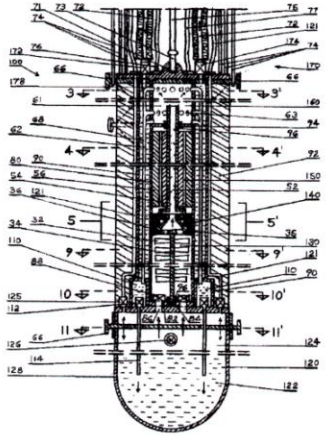
(74) *Attorney, Agent, or Firm* — Schmeiser, Olsen & Watts LLP

(57) **ABSTRACT**

A method of using geothermal energy to produce electricity by lowering a geothermal generator deep into a pre-drilled well bore below the Earth's surface. A self contained geothermal generator includes a boiler, a turbine compartment, an electricity generator, a condenser and an electric cable. The condenser includes a distributor chamber, a peripheral chamber and plurality of tubes disposed within the peripheral chamber. The peripheral chamber of the condenser surrounds the turbine, electric generator and distributor chamber departments and is cooled with a separate closed loop system. The condenser cools and converts exhausted steam back in liquid state and returns it back into the boiler for reheating. Water contained within the boiler is converted to high-pressure, super heated steam due to heat from hot rocks contained within a pre-drilled well bore. The steam is used to produce electric energy which is transported up to the ground surface by the electric cable.

7 Claims, 17 Drawing Sheets



- **US Patent Issued on: May 6, 2014;**
- **Title: Self Contained In-Ground Geothermal Generator;**
- **Several Patent Pending Applications;**

GEOTHERMAL WORLDWIDE, INC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(12) **United States Patent**
Lakic

(10) **Patent No.: US 9,206,650 B2**
(45) **Date of Patent: Dec. 8, 2015**

(54) **APPARATUS FOR DRILLING FASTER, DEEPER AND WIDER WELL BORE**

(76) Inventor: **Nikola Lakic**, Indio, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 779 days.

(21) Appl. No.: **13/424,184**

(22) Filed: **Mar. 19, 2012**

(65) **Prior Publication Data**

US 2012/0292112 A1 Nov. 22, 2012

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/US2010/049532, filed on Sep. 20, 2010.

(60) Provisional application No. 61/276,967, filed on Sep. 19, 2009, provisional application No. 61/395,235, filed on May 10, 2010, provisional application No. 61/397,109, filed on Jun. 7, 2010.

(51) **Int. Cl.**

E21B 4/00	(2006.01)
E21B 7/00	(2006.01)
E21B 10/26	(2006.01)
E21B 17/18	(2006.01)
E21B 21/01	(2006.01)
E21B 21/12	(2006.01)

(52) **U.S. Cl.**

CPC ***E21B 10/26*** (2013.01); ***E21B 7/002*** (2013.01); ***E21B 7/005*** (2013.01); ***E21B 17/18*** (2013.01); ***E21B 21/01*** (2013.01); ***E21B 21/12*** (2013.01)

(58) **Field of Classification Search**

CPC E21B 21/08; E21B 21/12; E21B 21/00; E21B 17/18; E21B 10/18; E21B 10/38; E21B 17/203; E21B 4/02; E21B 7/068; B08B 9/035

USPC 175/215, 25, 339, 320, 102, 324

See application file for complete search history.

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(Continued)

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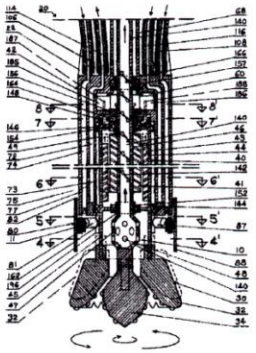
(74) *Attorney, Agent, or Firm* — Schmeiser, Olsen & Watts LLP

(57) **ABSTRACT**

An apparatus and method for drilling deeper and wider well bores is provided. The apparatus includes a motorized drill head for cutting and shredding ground material; a separate excavation line; a separate fluid delivery line; and a separate close loop engine cooling line. The excavation line consists of multiple connected stationary segments of the main pipe with periodical segments of an in-line excavation pump. Alternatively, in another embodiment, excavation line consists of multiple connected segments of the main stationary pipe with rotating continues screw inside. The close loop cooling line consists of one heat exchanger in the motorized drill head and one on the ground surface in the binary unit where fluid is cooled and in process electricity produced which can be used as a supplement for powering drill head, pumps, equipment, etc.

29 Claims, 39 Drawing Sheets



- **US Patent Issued on: December 8, 2015;**
- **Title: APPAEATUS FOR DRILLING FASTER, DEEPER AND WIDER WELL BORE;**
- **Several Patent Pending Applications;**

GEOTHERMAL WORLDWIDE, INC

RELEVANT QUOTES

- **"We cannot solve our problems with the same thinking we used when we created them".**

  ~ Albert Einstein (1879-1955) ~

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- **"All truth passes through three stages:**
  - **First, it is ridiculed;**
  - **Second, it is violently opposed; and**
  - **Third, it is accepted as self-evident".**

  ~ Arthur Schopenhauer (1788-1860) ~