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POTABLE FRESH WATER FROM SEA WATER

A practical approach to large scale sea-water conversion

by

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Recently, both the Atlantic and Pacific coastal cities were having fresh water troubles, notwithstanding that two great bodies of water was at their front doors. There are other places such as interior arid regions, oil fields and many islands throughout the world that also have fresh water problems.

Recognizing the need for fresh water from the sea, our Government, through Congress, passed a resolution to furnish funds to the Department of Interior for the purpose of Sea-Water Conversion Research.

The main problem in converting sea-water to fresh water is the removal from the sea-water of the many minerals from the earth's solid crust which are dissolved in the rivers and underground streams and eventually make their way into the ocean. Of more than thirty (30) principal minerals found in sea-water, sodium chloride (common salt), calcium carbonate (lime), magnesium, and potassium are the most common. Calcium carbonate (lime) is removed from the sea by marine life as coral, shell fish, diatoms, mollusks, oysters, clams, etc., and also supplies the element for bone structure of marine life.

The amount of sodium chloride (common salt) in the ocean increases since there is no way of getting rid of it, therefore there is more common salt than any other mineral in the ocean. Salt undergoes changes upon reaching the ocean, the solid crystals of salt are changed into molecules which are too small to be seen and are uniformily distributed throughout the ocean, later a further division of the salt molecules results in electrically charged "ions" one (1) positive and one (1) negative making the sea-water an electrical conductor, and also presents a serious conversion problem.

The potential of a practical system for converting sea-water into a potable fresh water in large quantities at a low cost would be of great value to mankind. Aside from producing fresh water for general use, there are many arid regions among the coastal plains, oil field areas, many islands, and other places that could be irrigated and turned into fertile garden spots.

Being aware of the need for sea-water conversion, early in World War II, as Chief Mechanical Engineer for an aircraft and ship-building company, one of the routine assignments was the design and construction of a sea-water conversion process for use on shipboard. By combining the functions of vaporization, vacuum, and condensation, powered with Diesel engines, sea-water conversion units in three sizes (25-50-100 GPM) were produced and installed on many ocean-going ships and vessels. However, this type of system as well as the multiple distillation process would be too expensive to operate for large scale sea-water conversion.

A later assignment, involved the design and construction of plant facilities for the production of a chemical stabilizer (used in ice-cream and drugs, etc.), manufactured from kelp (a sea weed). In processing this kelp through to a liquor, a thorough cleaning was necessary to remove the salt, this cleaning was accomplished by the process of leaching, coagulation, dissolved air, flotation, and filtration, leaving the kelp liquor free from impurities.

The results obtained by this process led to an idea for a system to convert sea-water into a potable fresh water. By using similar functions for the primary stage and adding other processes and electronics for the secondary stage, the combined processes should produce our objective. Many laboratory experiments have proven that fresh water can be secured in this manner with practical standard apparatus.

Now a complete system for the conversion of sea-water into a potable fresh water has been designed and consists of two stages in order to conserve the recoverable minerals. Coagulation, dissolved air, and flotation for the first stage and using the functions of expanded vapor, electronics, and condensation as the second stage, the sequence of the operation of the system are as follows:

The in-coming sea-water is pumped or conveyed through pipes from the ocean to traveling water screens, which removes the roughage such as (sea weeds, hydrads, barnacles, worms, byroza, trunicates etc.,) The water enters the settling basin traveling through a series of passageways, depositing some silt before reaching the sump. From this sump the water is pumped through heat exchangers, raising the temperature of the in-coming water from the heat of the out-going converted fresh water. The water now enters the conditioning unit where the coagulent and dissolved air are added. Turbine pumps mounted upon this unit serves as an agitator, and at the same time delivering the water with the form of an emulsion or froth, included through pipes of large size to accommodate the water with the emulsion or froth to the flotation cell. This emulsion or froth contains the lighter minerals and chemicals and arises or floats on the surface of the water upon entering the flotation cell, this froth is skimmed off and designated as the top sludge, the heavier minerals and solids sinking to the bottom where they are scraped into a trench and designated as the bottom sludge. This completes the first stage of the process, the sea-water is now partially clarified and reduced in weight; however, some salt and gas is still in the water.

The partially clarified sea-water now entering the second stage is pumped to a chamber where it is vaporized or fogged, by delivering the water through fogging nozzles ihto heated free air, forming a fog or saturated vapor, which upon being released in the chamber expands while traveling through a series of passageways, releasing more of the minerals and gases. The fog, before leaving the chamber, will be subjected to an electronic bombardment for the final separation of the salt from the water. The fog is now delivered to the precipitator by blowers where the water is de-aerated and the entrained water condensed and precipitated to the bottom of the vessel, the air being returned to the air heaters.

From the precipitator the de-salted water is pumped through heat exchangers to the spray pond and re-conditioning unit where the water is prepared to the specifications required, (note the processed water was deficient in oxygen and other minerals); for use it is then pumped to covered storage tanks for distribution. (This water is almost comparable to spring water.)

The above described sea-water conversion system is entirely automatic in operation. Each unit comprised of the tandem arrangement is complete with control panel and sampling bench, the operator being in control of the process at all times, providing also for easy adjustments, inspection and maintenance.

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This system is now protected with and by existing patents and patent applications.

Diesel engines in conjunction with waste heat boilers furnish the power and heat for operation of the system, the economy provides for the production of 7,000 gallons of potable fresh water from the combustion of one (1) gallon of petroleum fuel with a specification of 138,500 btu's per gallon. When available Solar or Atomic Energy may be substituted.

The production cost for operating this system at present price level for labor and material with the usual fixed charges, ranges from fifteen cents (15¢) to five cents (5¢) per thousand (1000) gallons of fresh water produced, governed by the quantity.

A very important feature of this sea-water conversion system is the commercial value of the minerals and chemicals that can be recovered from the sludge; however, this recovery and reduction process for minerals and chemicals would require an additional investment. Each acre foot of sea-water contains approximately thirty-four (34) tons of minerals and chemicals, eighteen (18) tons of which can be recovered and marketed. Magnesium and bromide, (now taken from the sea) aluminum and potassium salts are in ready demand. The sale of these products would produce a revenue of approximately $323.00 from each acre foot of sea-water processed, exclusive of the common salt.

A suitable demonstration unit, of thirty (30) acre feet or the equivalent of ten (10) million gallons per day processed sea-water, would gross a revenue from the sale of the water and recovered minerals, of over $10,000.00 per day. The net profits over and above the cost of administration and operation, would amortize the investment in less than three (3) years.

The field is unlimited and much less risky than prospecting for oil or ore.

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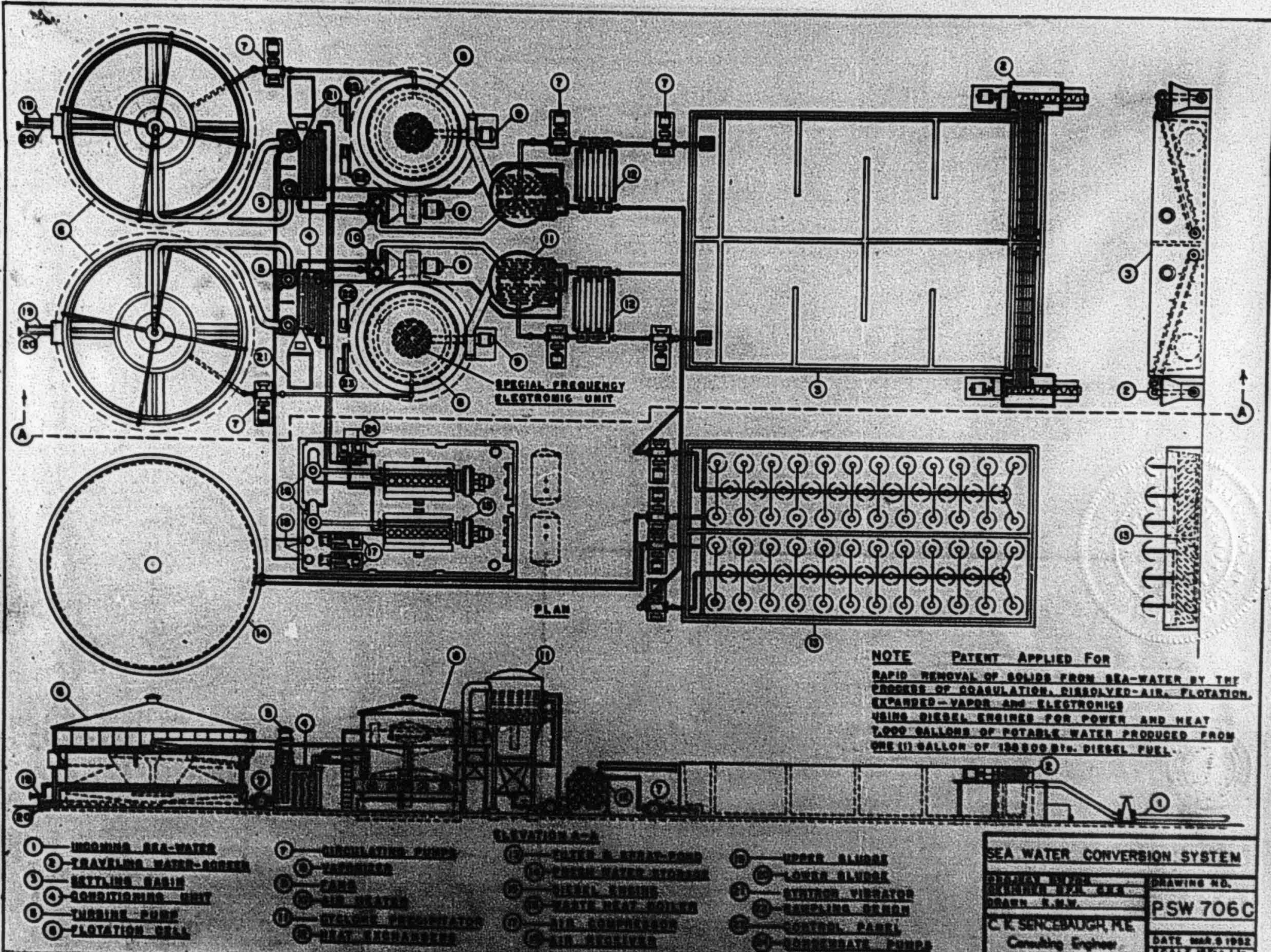
SPECIAL FREQUENCY
ELECTRONIC UNIT
PLAN
ELEVATION A-A
NOTE PATENT APPLIED FOR
RAPID REMOVAL OF SOLIDS FROM SEA-WATER BY THE
PROCESS OF COAGULATION, DISSOLVED-AIR, FLOTATION,
EXPANDED-VAPOR AND ELECTRONICS
USING DIESEL ENGINES FOR POWER AND HEAT
7,000 GALLONS OF POTABLE WATER PRODUCED FROM
ONE (1) GALLON OF 138,800 Btu. DIESEL FUEL.
1 INCOMING SEA-WATER
2 TRAVELING WATER-SCREEN
3 SETTLING BASIN
4 CONDITIONING UNIT
5 TURBINE PUMP
6 FLOTATION CELL
7 CIRCULATING PUMPS
8 VAPORIZER
9 FANS
10 AIR HEATER
11 CYCLONE PRECIPITATOR
12 HEAT EXCHANGERS
13 FILTER & SPRAY-POND
14 FRESH WATER STORAGE
15 DIESEL ENGINE
16 WASTE HEAT BOILER
17 AIR COMPRESSOR
18 AIR RECEIVER
19 UPPER SLUDGE
20 LOWER SLUDGE
21 SYNTRON VIBRATOR
23 CONTROL PANEL
24 CONDENSATE PUMPS
SEA WATER CONVERSION SYSTEM
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DRAWING NO.
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