Method and Apparatus for The Purification of Swimming Pool Water

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Background of the Invention

Swimming pools comprise tens of thousands of gallons of water which normally reside in a deep concrete lined reservoir. This water was originally supplied through pipes from the local potable water supply. Over time, this water becomes contaminated with high levels of bacteria, and even viruses. It is not unknown for the water to even become populated with amoeba. Great effort is made by pool owners to reduce the populations of these living pollutants to safe levels. Normally, this is accomplished by the constant injection of chlorine which is quite deleterious to the health of such entities. Unfortunately, not all of these entities are affected by chlorine. Further, the purpose of the chlorine application is to make the swimming pool safe for human use. Should the chlorine levels exceed certain known levels, the chemical can be quite harmful to the intended occupant.

To date, the primary trend in the art has been to prevent the chlorine from becoming itself a hazard and then to prevent the microorganisms to be a hazard through the delicate balancing of chlorine levels versus contaminant levels. All of this is expensive in time and money and remains as a substantial risk to all those who venture in to the pool.

The use of ozone instead of chlorine is a standard alternative.

While ozone injection is an extremely powerful and useful alternative, most ozone generators require access to high voltages from the home line supply as well as modifications to the existing swimming pool pump, plumbing and or filter.

Description of the Invention

The present invention is a device which generates sufficient quantities of ozone to obviate the need for chlorine and which does not depend upon attachment to the home's AC power or to the swimming pool's plumbing, pump or filter.

With reference to Figure 1, a disk shaped device floats upon the surface of the pool. Another similar but heavily weighted disk is attached to the first by a tube / tether and this second disk rests at the bottom of the pool.

The tube / tether is somewhat rigid in its longitudinal axis and resists all torsional strain.

The tube / tether is ribbed along its entire length.

The tube / tether fits through a hole in the center of the floating disk.

There is a sliding clamp which will stop the rotation of the tube / tether vis a vis
the floating disk but still allow the tube / tether to extend and contract.

The floating disk is equipped with a compass.

The floating disk is covered with a set of front surface mirrors. These mirrors use titanium and or zirconium as their reflective surface.

The mirrors are set on the upper surface of the disk in a semi circle. This semicircle of mirrors reflects solar energy sent from the sun and concentrates that energy on a secondary mirror at the center of the disk..

The secondary mirror sends the solar energy in its highly concentrated form downwards at the center of the disk and onto a cluster of solar cells.

These solar cells are of a specialized type called “concentrator solar cells” and are designed to accept 100, 200, 300, even 500 times the normal energy of sunlight that falls on earth.

To survive that concentrated energy these cells normally must be water cooled.

In the present invention the rear cooling fins of those cells rest in the water of the swimming pool itself.

Beneath the floating disk are two raised cup-like areas. Both cups have carbon rings at their circumferences.

One cup’s ring is attached to the PLUS lead of the array of solar cells through a resistor.

The other cup’s ring is attached to the MINUS lead of the array of solar cells.

The apex of the cup with the MINUS ring is provided with a vent hole and which is then open to the air.

The apex of the cup with the PLUS ring is equipped with an automobile spark plug.

The cup with the PLUS ring is also equipped with a small tube which is attached from the underside and which falls downwards three feet into the depths of the pool.

The floating disk is equipped with a high voltage power supply which can provide 5,000 volts or more.
The floating disk is also equipped with a microprocessor computational engine / controller. This controller includes an accurate clock. The year, day of the year and time of day are all computed and stored within the controller.

The clock is equipped with a rechargeable battery.

There is a map of the surface of the earth on the surface of the floating disk. There is a button and a piezo beeper adjacent to this map.

Through manipulation of the single button and following the beeps from the piezo beeper, the year, day, hour and general longitude and latitude of the swimming pool in which the device is to be used can be input into the controller.

This information is used to compute the position of the sun using the following general set of instructions:

```
'**********************************************************
'   This program autonomously tracks the position of the Sun
'   using a low precision celestial method.
'
'    The method is good to 0.01 degrees -- acceptable for a floating
solar powered ozone generator
'
'
'
'
DEFDBL A-Z
pr1$ = "\        \#####.##"
pr2$ = "\        \#####.#####"
pr3$ = "\        \#####.###"
pi = 4 * ATN(1)
tpi = 2 * pi
twopi = tpi
degs = 180 / pi
rads = pi / 180
'
'   Get the days to J2000
'   h is UT in decimal hours
'
'
DEF FNday (Y, M, D, h) = 367 * Y - 7 * (Y + (M + 9) \ 12) \ 4 + 275
* M \ 9 + D - 730531.5
+ h / 24
'
'   define some arc cos and arc sin functions and a modified inverse
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'   tangent function
'
DEF FNacos (x)
   s = SQR(1 - x * x)
   FNacos = ATN(s / x)
END DEF
DEF FNasin (x)
   c = SQR(1 - x * x)
   FNasin = ATN(x / c)
END DEF
'
'   the atn2 function below returns an angle in the range 0 to two pi
'   depending on the signs of x and y.
'
DEF FNatn2 (Y, x)
   a = ATN(Y / x)
   IF x < 0 THEN a = a + pi
   IF (Y < 0) AND (x > 0) THEN a = a + tpi
   FNatn2 = a
END DEF
'
'   the function below returns the true integer part,
'   even for negative numbers
'
DEF FNipart (x) = SGN(x) * INT(ABS(x))
'
'   the function below returns an angle in the range
'   0 to two pi
'
DEF FNrange (x)
   b = x / tpi
```

```
   a = tpi * (b - FNipart(b))
   IF a < 0 THEN a = tpi + a
   FNrange = a
END DEF
'
'   Find the ecliptic longitude of the Sun
'
DEF FNsun (D)
'
'   mean longitude of the Sun
'
L = FNrange(280.461 * rads + .9856474# * rads * D)
'
'   mean anomaly of the Sun
'
g = FNrange(357.528 * rads + .9856003# * rads * D)
'
'   Ecliptic longitude of the Sun
'
FNsun = FNrange(L + 1.915 * rads * SIN(g) + .02 * rads * SIN(2 * g))
'
'   Ecliptic latitude is assumed to be zero by definition
'
END DEF
'
'
'
CLS
'
'    get the date and time
'
```

```
INPUT "  year  : ", Y
INPUT "  month : ", M
INPUT "  day   : ", day
INPUT "hour UT : ", h
INPUT " minute : ", mins
INPUT "    lat : ", glat
INPUT "   long : ", glong
glat = glat * rads
glong = glong * rads
h = h + mins / 60
D = FNday(Y, M, day, h)
'
'   Use FNsun to find the ecliptic longitude of the
'   Sun
'
lambda = FNsun(D)
'
'   Obliquity of the ecliptic
'
obliq = 23.439 * rads - .0000004# * rads * D
'
'   Find the RA and DEC of the Sun
'
alpha = FNatn2(COS(obliq) * SIN(lambda), COS(lambda))
delta = FNasin(SIN(obliq) * SIN(lambda))
'
'   Find the Earth - Sun distance
'
r = 1.00014 - .01671 * COS(g) - .00014 * COS(2 * g)
'
'   Find the Equation of Time
```

```
'
equation = (L - alpha) * degs * 4
'
'   find the Alt and Az of the Sun for a given position
'   on Earth
'
'   hour angle of Sun
LMST = FNrange((280.46061837# + 360.98564736629# * D) * rads
+ glong)
hasun = FNrange(LMST - alpha)
'
'   conversion from hour angle and dec to Alt Az
sinalt = SIN(delta) * SIN(glat) + COS(delta) * COS(glat) * COS(hasun)
altsun = FNasin(sinalt)
Y = -COS(delta) * COS(glat) * SIN(hasun)
x = SIN(delta) - SIN(glat) * sinalt
azsun = FNatn2(Y, x)
'
'   print results in decimal form
'
PRINT
PRINT "Position of Sun"
PRINT "==============="
PRINT
PRINT USING pr2$; "     days : "; D
PRINT USING pr1$; "longitude : "; lambda * degs
PRINT USING pr3$; "       RA : "; alpha * degs / 15
PRINT USING pr1$; "      DEC : "; delta * degs
PRINT USING pr2$; " distance : "; r
PRINT USING pr1$; "  eq time : "; equation
PRINT USING pr1$; "      LST : "; FNrange(LMST) * degs
```

```
PRINT USING pr1$; "  azimuth : "; azsun * degs
PRINT USING pr1$; " altitude : "; altsun * degs
END
'*********************************************************
```

The set of mirrors which are mounted on the top surface of the floating disk are moveable under controller command. The mirrors can be moved vertically approximately 60 degrees.

The floating disk itself can be rotated under controller command by rotating the tube / tether clamp. The disk itself can be rotated 120 degrees about the centrally mounted tether.

Because the tether does not rotate, orientation of the floating disk to the tether is fixed.

The user orients the floating disk to north and then clamps the disk in place so that it cannot rotate around the tube / tether.

The floating disk can be blown by the wind in X and in Y and as the level of the pool varies from filling and evaporation in Z to the moderate limits of the tube / tether.

Through the use of the year, day, time, longitude and latitude the controller determines the position of the sun in the sky and sets the mirrors so that they can reflect the sun – at whatever vertical height it may be in the sky – onto the secondary mirror. Using the same information the controller rotates the disk so as to allow the mirrors to capture the sunlight from the sun.

Once the sunlight illuminates the solar cells they begin maintaining a charge in the controller's battery. Simultaneously, the electricity is directed to the two carbon rings mounted on the inverted cups on the bottom of the floating disk. Simultaneously, the electricity is directed to a semiconductor driven high voltage supply.

A capacitor within the high voltage supply is charged by the electricity flow.

When the capacitor reaches more than 80% of full charge the current from the capacitor is released into the high voltage output side of the generator and an output of over 5,000 volts is created.

This high voltage is then directed to the leads on the automotive spark plug on the PLUS oriented inverted cup.

As low voltage electricity flows into the PLUS and the MINUS carbon rings, water is deconstructed through the process of electrolysis into hydrogen and oxygen.

The hydrogen is released at the MINUS carbon ring and is vented through the small vent tube at the top of the inverted cup. This gas is thus harmlessly exhausted directly into the atmosphere.

The oxygen is released at the PLUS carbon ring and remains generally in the cup.

The constant filling of the PLUS cup with oxygen eventually fills the entire cup with oxygen.

This oxygen is then slowly pressurizing the vent tube along its entire length and three feet below the surface of the pool.

The oxygen vents out the tip of the vent tube three feet below the surface of the pool.

The periodic sparking of the automobile spark plug converts substantial portions of the oxygen -- O2 -- into oxygen -- O3 -- which is ozone.

This system thus uses sunlight to create ozone.