The Gravitational Heat Exchanger

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The heat exchangers are present in many sectors of the economy. They are widely used in Refrigerators, Air-conditioners, Engines, Refineries, etc. Here we show a heat exchanger that works based on the gravity control. This type of heat exchanger can be much more economic than the conventional heat exchangers.

Key words: Heat Exchanger, Heat Transfer, Fluid Flow, Gravitation, Gravitational Mass.

1. Introduction

The energy transfer as heat occurs at the molecular level as a consequence of a temperature difference. When a temperature difference occurs, the Second Law of Thermodynamics shows that the natural flow of energy is from the hotter substance to the colder substance. Thus, temperature is a relative measure, which shows how hot or cold a substance is, and in this way, frequently is used to indicate the direction of heat transfer.

There are several modes of transferring heat: thermal conduction, thermal convection, thermal radiation, and transfer of energy by phase changes. A *heat exchanger* is a system for efficient heat transfer from one medium to another. The heat exchangers are present in many sectors of the economy [1]. They are widely used in Refrigerators, Air-conditioners, Engines, Refineries, etc. [2,3]. Here we show a very economic heat exchanger that works based on a gravity control device called *Gravity Control Cell* (GCC)*.

2. Theory

The quantization of gravity shows that the *gravitational mass* m_g and *inertial mass* m_i are not equivalents, but correlated by means of a factor χ, which, under certain circumstances can be strongly reduced, and till become *negative*. The correlation equation is [4]

$$m_g = \chi \; m_{i0} \qquad (1)$$

where m_{i0} is the *rest* inertial mass of the particle.

Also, it was shown that, if the *weight* of a particle in a side of a lamina is $\vec{P} = m_g \vec{g}$ ($\vec{g}$ perpendicular to the lamina) then the weight of the same particle, in the other side of the lamina is $\vec{P}' = \chi m_g \vec{g}$, where $\chi = m_g / m_{i0}$ (m_g and m_{i0} are respectively, the gravitational mass and the inertial mass of the lamina). Only when $\chi = 1$, the weight is equal in both sides of the lamina. The lamina works as a Gravitational Shielding. This is the *Gravitational Shielding* effect. Since $P' = \chi P = (\chi m_g) g = m_g (\chi g)$, we can consider that $m'_g = \chi m_g$ or that $g' = \chi g$.

If we take two parallel gravitational shieldings, with χ_1 and χ_2 respectively, then the gravitational masses become: $m_{g1} = \chi_1 m_g$, $m_{g2} = \chi_2 m_{g1} = \chi_1 \chi_2 m_g$, and the gravity will be given by $g_1 = \chi_1 g$, $g_2 = \chi_2 g_1 = \chi_1 \chi_2 g$. In the case of multiples gravitational shieldings, with $\chi_1, \chi_2, ..., \chi_n$, we can write that, after the n^{th} gravitational shielding the gravitational mass, m_{gn}, and the gravity, g_n, will be given by

$$m_{gn} = \chi_1 \chi_2 \chi_3 ... \chi_n m_g , \quad g_n = \chi_1 \chi_2 \chi_3 ... \chi_n g \qquad (2)$$

This means that, n superposed gravitational shieldings with different $\chi_1, \chi_2, \chi_3, \ldots, \chi_n$ are equivalent to a single gravitational shielding with $\chi = \chi_1 \chi_2 \chi_3 ... \chi_n$.

*The extension of the shielding effec*t, i.e., the distance at which the gravitational shielding effect reach, beyond the gravitational shielding, depends basically of the magnitude of the shielding's surface. Experiments show that, when the shielding's surface is large (a disk with *radius* a) the action of the gravitational shielding extends up to a distance $d \cong 20a$ [6].

Now, we will show how this gravitational technology can be used in order to develop a very

* The GCC is a device of gravity control based on a gravity control process patented on 2008 (BR Patent number: PI0805046-5, July 31, 2008[5]).

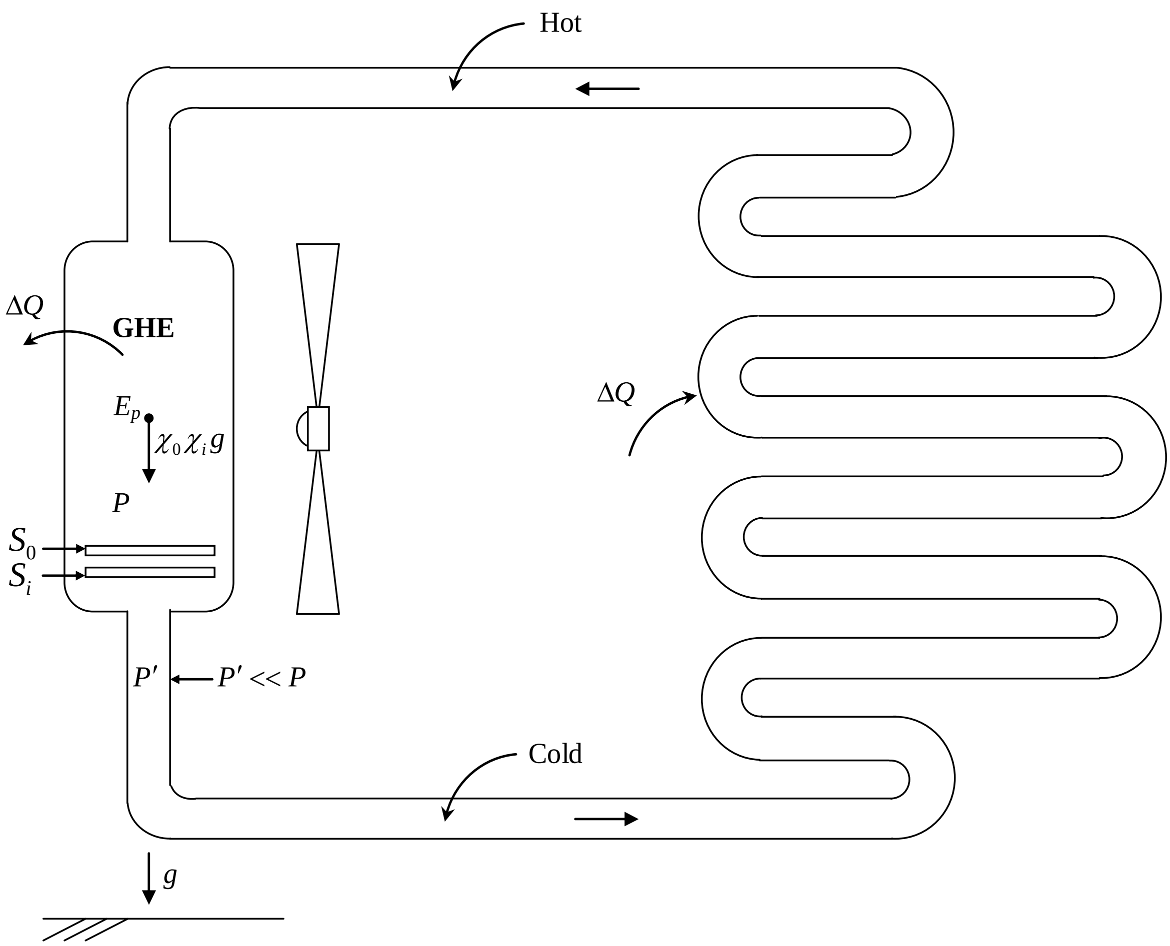

Fig. 1 – *The Gravitational Heat Exchanger* (GHE).

economic *heat exchanger*.

Consider two parallel *Gravitational Shieldings* (Gravity Control Cells (GCC)) S_o and S_i, inside a container filled with a fluid, as shown in Fig.1. The inertial mass of the fluid inside the GHE is m_{col}. The values of χ in each Gravitational Shielding are χ_0 and χ_i, respectively.

The gravitational potential energy of m_{col} with respect to the Earth's center, without the effects produced by the gravitational shieldings S_o and S_i is

$$E_{p0} = m_{col} hg \qquad (3)$$

where $h \cong r_{\oplus} = 6.371 \times 10^6 m$, is the distance of the center of mass of the column down to Earth's center; $g = 9.8 m/s^2$.

The gravitational potential energy related to m_{col}, with respect to the Earth's center, considering the effects produced by the gravitational shieldings S_o and S_i, is

$$E_p = m_{col} r_{\oplus} (\chi_o \chi_i g) \qquad (4)$$

Thus, the *decrease* in the gravitational potential energy is

$$\Delta E_p = E_0 - E_p = (1 - \chi_o \chi_i) m_{col} r_{\oplus} g \qquad (5)$$

The decrease, ΔE_p, in the gravitational potential energy *increases* the *kinetic energy* of the local at the same ratio, in such way that the mass m_{col} of the column *acquires* a kinetic energy $E_k = \Delta E_p$, which is converted into *heat*, raising the local temperature by ΔT, which value can be obtained from the following expression:

$$\left\langle \frac{E_k}{N} \right\rangle \cong k \Delta T \qquad (6)$$

where N is the number of atoms in the volume V of the substance considered; $k = 1.38 \times 10^{-23} J/K$ is the *Boltzmann constant*. Thus, we can write that

$$\Delta T \cong \frac{E_k}{Nk} = \frac{(1 - \chi_o \chi_i) m_{col} r_{\oplus} g}{(n V_{col}) k} \qquad (7)$$

Since $m_{col} \cong \rho V_{col}$, we get

$$\Delta T \cong \frac{(1 - \chi_o \chi_i)\ \rho\ r_{\oplus} g}{nk} \qquad (8)$$

where n is the number of molecules per cubic meter.

Note that, if $\chi_o \chi_i > 1$ the value of ΔT becomes *negative*, which means that *the column loses an amount of heat*, ΔQ, decreasing its temperature by ΔT.

Since the number of molecules per cubic meter is usually expressed by the following equation

$$n = N_0 \rho / M_0 \qquad (9)$$

where M_0 is the molecular mass ($kg.mol^{-1}$); $N_0 = 6.02 \times 10^{23} molecules.mol^{-1}$ (Avogadro's number); ρ is the matter density of the column (in kg/m^3). Thus, Eq. (8) can be rewritten as follows

$$\Delta T \cong \frac{(1 - \chi_o \chi_i)\ M_0 r_{\oplus} g}{N_0 k} \qquad (10)$$

If the fluid is *Helium gas* ($M_0 = 0.004 kg.mol^{-1}$), then Eq. (10) gives

$$\Delta T \cong 3.009 \times 10^4 (1 - \chi_o \chi_i) \qquad (11)$$

For example, if $\chi_0 = -1.9587$ and $\chi_i = -0.5110$, Eq. (11) gives

$$\Delta T \cong -27K \qquad (12)$$

Thus, if the initial temperature of the Helium is about $300K$, then it will be reduced to

$$T \cong 273K \cong 0°C \qquad (13)$$

It is important to note that if, for example, $\chi_0 = -1.959$ and $\chi_i = -0.510$, then the result is $\Delta T \cong +27K$. Note that there is now an *increase* of temperature of about $27K$. This shows the fundamental importance of the *precision of the values of* χ_0 and χ_i. In a previous paper [7] it was shown the need of to use *very accurate voltage source*, for apply accurate voltages to the gravitational shielding, in order to obtain high-precision values of χ.

Now considering equations (6) and (9), and the *Equation of State*: $\rho = PM_0/ZRT$, where P and T are respectively the pressure and the temperature of the gas; $Z \cong 1$ is the *compressibility factor*; $R = 8.314 joule mol^{-1}.K^{-1}$ is the *gases universal constant*, then we can write that

$$E_k = Nk\Delta T = nV_{col}k\Delta T \cong V_{col}\Delta T(P/T) \quad (14)$$

Therefore, *the* GHE *loses an amount of heat*, $\Delta Q = E_k$. By substitution of ΔT and T given respectively by Eq. (12) and Eq. (13) into Eq. (14), we get

$$\Delta Q \cong 0.10 V_{col} P \qquad (15)$$

The gravitational compression produced by the gravitational shieldings inside the GHE can reach several hundreds atmospheres [8]). Thus, for example, if the GHE is designed to work with a compression of $P = 400\,atm \cong 4.052 \times 10^7 N.m^{-2}$ and $V_{col} = (400/1)V_0 \cong 2.7m^3$, ($V_0$ is the volume of the chamber (GHE) and V_{col} is the volume of the Helium compressed into the camber.), then Eq. (14) gives

$$\Delta Q \cong 1.094 \times 10^7 \; joules \cong 10{,}000\,BTU \quad (16)$$

Now, if the pressure is reduced down to $P = 100atm$, and the volume V_0 of the GHE is *increased* up to $1m^3$, then $V_{col} = (100/1)V_0 \cong 100m^3$, and the value of ΔQ becomes

$$\Delta Q \cong 1.013 \times 10^8 \; joules \cong 96{,}000\,BTU \quad (17)$$

Note that the electric power required for the Gravitational Heat Exchanger is only the necessary to activate the two gravitational shielding (some watts)†.

Thus, the Gravitational Heat Exchanger shown in Fig .1 can work as an efficient and very economic heat exchanger. Another vantage of this system is the fact that it does not use CFCs gases, which are very dangerous for mankind‡.

Finally, note that, if $\chi_o \chi_i < 1$ then the GHE can be used as a *heater* (See Eq. (5) and (6)).

† The conventional heat exchangers require *hundreds* of watts.

‡ The use of these gases is prohibited in several countries [9].

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