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# Study and analysis of the interaction of magnetic fields to generate unconventional mechanical movements

*Estudio y análisis de la interacción de los campos magnéticos para generar movimientos mecánicos no convencionales*

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This paper outlines the research on five patents related to devices employing the interaction of permanent magnets for motion generation. It also presents a physical study that exposes why the continuous operation of permanent magnet machines is not viable. In addition, simulations carried out through the COMSOL program on the patent developed by Muammer Yildiz are presented, as well as some results from Neo Teng Yi's thesis, which focuses its study on Howard Johnson's engine patent. It also shows a general analysis of the patents from a comparative table, which highlights aspects such as the way of construction, location of the magnets, among other features that are considered relevant to the understanding of the patents.

*Keywords*: Engine, magnetic fields, motion generation, permanent magnets

Este documento describe la investigación sobre cinco patentes relacionadas con dispositivos que emplean la interacción de imanes permanentes para la generación de movimiento. También presenta un estudio físico que expone por qué no es viable el funcionamiento continuo de las máquinas de imanes permanentes. Además, se presentan simulaciones realizadas a través del programa COMSOL sobre la patente desarrollada por Muammer Yildiz, así como algunos resultados de la tesis de Neo Teng Yi, que centra su estudio en la patente del motor de Howard Johnson. También muestra un análisis general de las patentes a partir de una tabla comparativa, en la que se destacan aspectos como la forma de construcción, la ubicación de los imanes, entre otras características que se consideran relevantes para la comprensión de las patentes.

*Palabras clave*: Campos magnéticos, generación de movimiento, imanes permanentes, motor

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## Introduction

Permanent magnetic fields have become the object of current study due to their uses in different areas, in which it has been possible to prove certain patterns of performance and usefulness (Cao et al., 2016; Kim, Choi, Koo, Shin, & Lee, 2016; Xu et al., 2017). Some of these results, and the applications they have shown, provide a starting point for the development of this research (Espinosa, Castañeda, & Martínez, 2015).

One of the documented fields of application is the construction of magnetic motors based on the principles of magnetic attraction and repulsion (Jin et al., 2014; Liang, Pei, Chai, Bi, & Cheng, 2016). A studied example can be seen in a patent granted in 1990 (Troy, 1990), in which a motoric device is presented that in its design has a great similarity with the motors of the automobiles, since it is supported also in a block with pistons, but with the difference that to generate the movement it is not necessary the use of fossil energies, but that it uses the interaction of magnetic forces (Alonso, Gil, & Martínez, 2015).

Another similar device that has been developed, documented and patented, is a generator of electricity through a system made up of an interaction between magnetic-generator motor (Wang, 1991). Another similar patent proposed by Bedini (Bedini, 2000. Patent.) uses a similar structure, but supported by electronic circuits, allowing some degree of storage of the energy generated, which is then used in the same system.

To make these motor mechanisms more efficient, some researchers have proposed a computational method called MEC (*Magnetic Equivalent Circuits*), that operates with three DOF (degrees of freedom) (Li, Li, & Li, 2011). This system has as principle to look for the way in which the magnetic field is used more efficiently, observing that to achieve this objective it is necessary to locate the magnets in a circular configuration.

In addition to the mentioned applications, another field that has been working is the replacement of the brushes or bearings, which are a fundamental part of some kinds of electromagnetic motors (Bai et al., 2015). The change is made by permanent field magnets that are located radially and axially (Fengxiang, Jiqiang, Zhiguo, & Fengee, 2004), which allow a rotor-stator interaction to occur in such a way that they behave like a magnetic levitation system, thus reducing friction losses. This type of system generates a mechanical structure with up to five DOF (Tezuka, Kurita, & Ishikawa, 2013), and are analyzed using computational models.

On the other hand, the adoption of the use of permanent field magnets is becoming an alternative to synchronous motors. This is due to the fact that thanks to them, power, efficiency and speed can be improved, and short-circuit faults in the stator are avoided (Abdallah, Devanneaux, Faucher, Dagues, & Randria, 2004; Shin, Kim, Hong, & Choi, 2017). This allows the application of this kind of engines to be carried out for example in railways, oil excavations, etc. (Saban, Bailey, Brun, & Lopez, 2009), and electricity generation, areas in which performance is significantly improved.

A model of magnetic motor is the one designed by Howard Jonhnson, which is composed by an external rotor in which three pairs of permanent magnets with oval form are located, whose distribution is symmetrical that is obtained with a mechanical union between them. The permanent magnets of the stator maintain a distance between them that is not constant, and varies along the circumference (Johnson, 1956). Similarly, Muammer Yildiz's patent develops a machine consisting of a rotating rotor and two stators, one internal and one external. Between the two stators is the rotor and they are also made up of permanent magnets (Yildiz, 2010).

Apart from these two designs, the work carried out at the Universidad Carlos III de Madrid Escuela Politécnica Superior was also an important input for this research, where a research was carried out by Francisco Prieto de Santos, aimed at carrying out an analysis of certain proposals circulating on the Internet, which are usually referred to as free energy machines or zero point energy. One of the points dealt with in this document are the permanent magnet machines (Prieto, 2013).

## Some patents on the interaction of permanent magnetic fields

It is important to clarify that there has been great interest on the part of some researchers in the construction of perfect permanent magnetic motors. However, in most of these devices, the full working models have not been achieved. To make a permanent magnet motor operate, it is necessary to perform a switching function equivalent to that achieved in electric motors by brushes, alternating current switches, or other means. In permanent magnet motors, the magnetic leakage must be shielded in order to reduce energy losses due to Foucault effects. An adequate combination of materials, geometry, and magnetic concentration are required in order to be able to build a magnetic motor that can run continuously.

Below are the results of the research of the five (5) patents selected in this research, in which it is observed that the holders of said patents take as operating principle the interaction of magnetic fields generated by permanent magnets. It should be clarified that this part of the study focused only and exclusively on what the authors of the patents expose to the reader of how their machine operates and is built.

## Muammer Yildiz permanent magnet motor

The device developed by Muammer Yildiz was assigned the patent number EP2153515 A2 on February 12, 2009, by application of the inventor. It was identified by the name of *Dispositif avec un agencement d'aimants* (Device with a disposition of magnets), in Turkey (Fig. 1) (Yildiz, 2010).

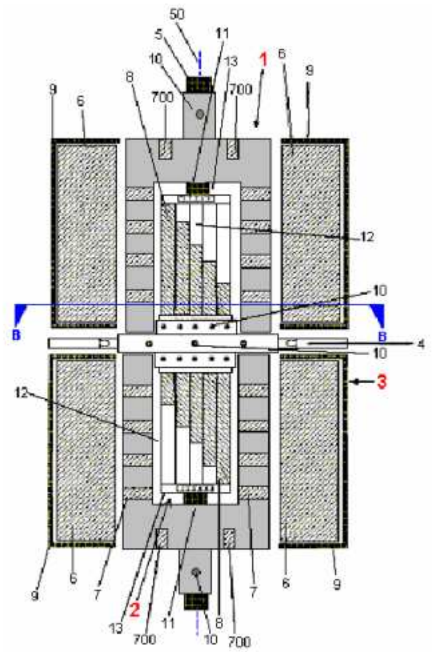

*Figure 1.* Motor top view (Yildiz, 2010).

The device described in the patent refers to a magnetic motor made up solely of permanent magnets located in two stators and a rotor. When mentioning the stators, it refers to the fact that the motor is made up of an internal stator and an external stator, which have a cylindrical shape and inside which is the rotor, which is also cylindrical, and to which is coupled a shaft that rotates at the same speed as the rotor. The rotor is separated from the stators by two small air spaces which in conventional motors is known as air gap.

The field produced by the interaction of the stators and the rotor is alternating and stationary as it usually happens in DC motors that do not use the so-called brushes or bearings or also in applications of systems known as magnetic levitation.

The effect produced by the stators on the rotor is of floating type, that is to say that the rotor is immersed and being affected by the fields generated by the magnets that are located in each one of the stators and that are also spaced and oriented in the system in a way that they interact with the magnets that are in the rotor. This interaction is known as an alternating field that allows the rotor to rotate in an effect that Muammer calls a magnetic bearing and which, according to him, generates few losses.

An important aspect that the inventor highlights of the device is the configuration of the stators and the rotor in terms of the location of the magnets, since for him the most appropriate way to locate the stator magnets is a rectangular or trapezoidal shape, while in the case of the rotor magnets is a circular location. Moreover, the structural shape of all the magnets, i.e. stators and rotor, are practically the same, since in this way the interaction between the fields is more efficient.

Regarding the magnetic orientation of the magnets of the two stators with the rotor, this is of repulsion, which is why it is recommended that they are located as follows: The inner stator magnets may have their North poles facing outwards and in this case, the magnets on the rotor will have their North poles facing inwards, towards the inner stator. Similarly, the outer stator magnets would then have their South poles facing inwards in order to repel the South pole of the rotor magnets, which face outwards.

## Troy G. Reed permanent magnet motor

The device developed by Troy G. Reed was assigned the patent number WO1990010337 A1, on September 7, 1990, by the application of the inventor, was identified with the name of *Moteur Magnetique* (magnetic motor), in the United States of America (Fig. 2) (Troy, 1990).

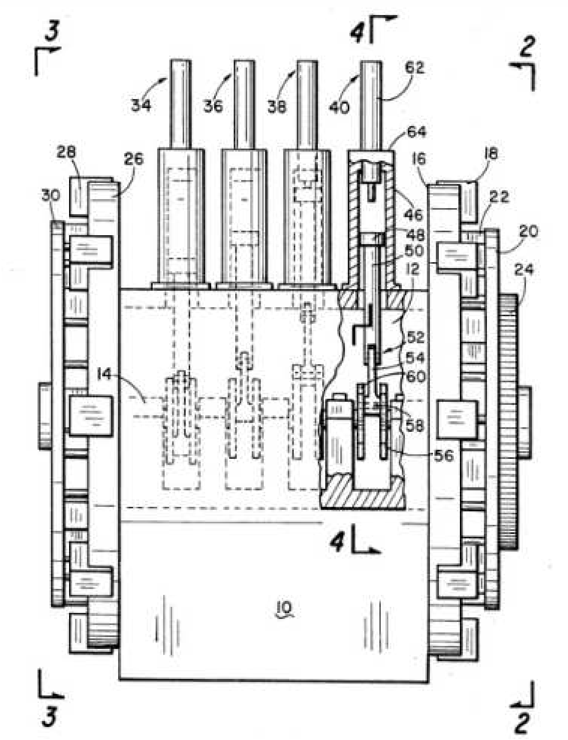

*Figure 2.* Motor side view (Troy, 1990).

The device described in the patent refers to a motor that converts magnetic force into rotary motion, this from the interaction of permanent magnets. The magnets are fixed around two rotating discs, so they are known as rolling magnets and distributed in such a way that they add up to eight (8), that is, sixteen (16) between the two wheels. The discs are located at both ends of a crank-shaped shaft joined together by two bearings. In addition to the magnets located on the wheels, near the discs there are another sixteen (16) fixed magnets that are distributed in such a way that they are with the same pole with which the rolling magnets were fixed, this with the objective of exerting a repulsive force between them.

The crankshaft is coupled to a system similar to that used in internal combustion engines, but with the difference that it does not operate under a principle of propulsion due to the burning of fossil fuel, but is a propulsion system caused by the interaction of fixed and rolling magnets. These have a support system that meets the objective that the movement generated operates continuously. This system fulfills the function of re-using the force exerted by a spring that is located in the injector and that is caused by a connecting rod when hitting with it, this force drives it downwards, until the crankshaft when turning returns and initiates the cycle.

The above system consists of four injection pins located at the top of the engine base. Coupled to it is the spring in charge of the rebound force. The system that hits and bounces on each of the pins is known as a connecting rod, which is inserted into an arrangement of parts similar to that found inside the retractable pens. This is attached to a pivot which in turn is attached to a crank arm and this, in turn, is attached to the crankshaft which, depending on its position, raises or lowers the connecting rod that hits and receives the force of the spring.

### Victor Diduck's permanent magnet motor

To the device developed by Victor Diduck was assigned the patent identified with the number US20070296284 A1, on December 27, 2007, at the request of the inventor, was identified with the name of *Magnetic Motor*, in the United States of America (Fig. 3) (Diduck, 2007).

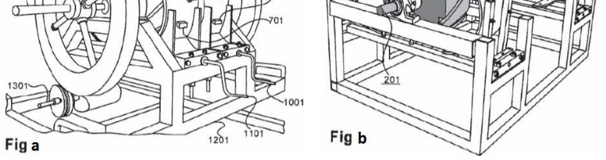

*Figure 3*. Parts distribution (Diduck, 2007).

The patent refers to a permanent magnet motor consisting of two rotating wheels or rotors which are attached to an axle and which the author calls *slave wheels*. A large number of slave magnets are located in these wheels and distributed along parallel grooves; each groove has a diagonal placement of approximately 35 degrees to the horizontal.

Parallel to the slave wheels, there are two non-magnetic casings with a small flow of air or between-iron that can be adjusted through two cranks located in the lower part of the engine and that are adjusted in a *threadable* way. As with slave wheels, permanent magnets are also distributed on the housings, which are located with the same polarity with which the magnets of the slave wheels were fixed. This is done with the aim of exerting a force of repulsion between the fields of the same pole, such interaction takes place in the between-iron.

As an optional part, the author places two flywheels at the ends of the motor axle, with the aim of having the option of locating a generator or other device that is responsible for converting the mechanical energy generated into electrical energy or more mechanical energy.

### Howard Johnson motor

Howard Johnson's permanent magnet motor received patent approval US4151431 A on April 24, 1979, when it demonstrated the performance of its motor, which is based solely on the use of the energy contained in the permanent magnets (Fig. 4) (Johnson, 1956).

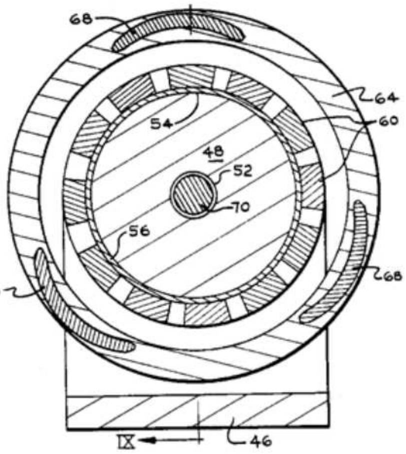

*Figure 4*. Motor front view (Johnson, 1956).

This device, like conventional electric motors, consists of a rotor and a stator. On the rotor side there are three pairs of stepped permanent magnets, which are connected by a non-magnetic core, the length of the armature magnets is defined by the poles of opposite polarity, but more specifically these magnets become longer than the lengths of two stator magnets plus the gap between them, the length that Howard Johnson indicates is 3.125 inches.

The stator magnets are mounted on a support plate of high magnetic permeability that helps to concentrate the force fields but the separation between them is not constant, the magnets of both the armature and the stator are located so that the poles of the same polarity are facing each other, this will also indicate the direction of displacement. The best gap between the armature magnet end poles and the stator magnets appears to be about 3/8 inch.

Displacement is created as the north pole of the armor passes over a magnet, which is repelled by the north pole of the stator; and there is an attraction when the north pole is passing along a space between the stator magnets. Quite the contrary, it is true with respect to the South Pole armor. It is attracted by passing over a stator magnet, repelled by passing over a space.

The interaction between the stator magnets and the armature will produce a continuous force, which will allow a displacement of the armature magnet, this is due to the ratio of the length of the armature magnet and the dimension of the stator magnets and the space between them.

A simpler way of understanding how the armature and rotor magnets interact will be described from Fig. 5 where continuous lines represent attraction forces, dashed lines represent repulsion forces, and double lines in each case indicate the most dominant forces.

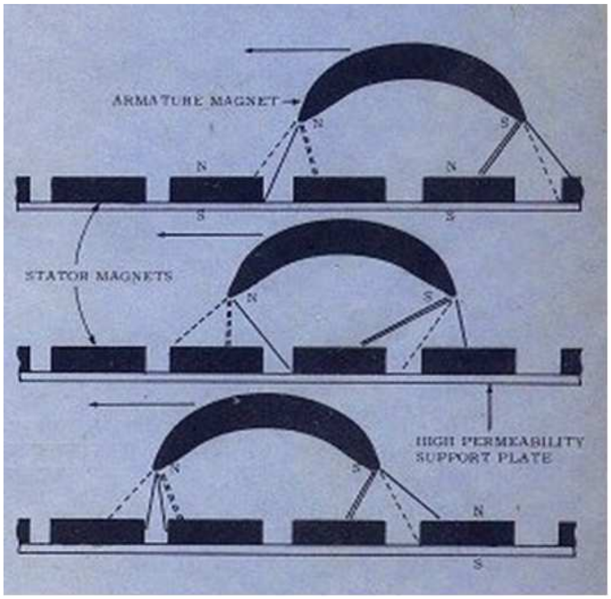

*Figure 5*. Diagram of assembly of magnets of the Howard Johnson motor (Johnson, 1956).

In Fig. 5 is shown that the opposing poles are north, it is observed that the displacement is directed to the left due to the interaction of forces of attraction and repulsion that occur between the magnet of the armor and adjacent magnets, more exactly in the north pole of the magnet of the armor there are three forces of attraction and two of repulsion, it should be noted that these two forces of repulsion worked against each other but it is greater that tends to move the armor to the left (double line discontinuous). This movement to the left is reinforced by the force of attraction between the north pole of the armature and the south pole of the stator at the bottom of the space between the stator magnets. Also in the southern part of the stator magnet, the same thing happens but the forces are opposite. In other words, there are two forces of attraction and one of repulsion, in whose confrontation of forces the result also tends to displace the armor to the left.

## Wang Shenhe permanent magnet motor

Wang Shenhe's permanent magnet motor received patent approval CN1218329 A on June 2, 1999. A power machine based on universal gravitation that features the use of a special structure to collect energy and the use of high-intensity magnets, whose unused surface has been shielded to limit speed, which combine to generate physical movement. Its advantages are a new style, simple structure, energy saving, no pollution, smooth rotation, long service time, low noise and low-cost (Wang, 1991).

This machine consists of eight magnets evenly distributed along the surface of a metal cylindrical structure, oriented towards the inside. The outer magnets have an angle of inclination with respect to the radial direction. In the center, on a fluid that reduces friction, rotates the rotor consisting of two parts. One whose profile is a circular section that houses a fluid, and a permanent magnet. The other part has the shape of a complete disc, which contains permanent magnets again inside. The machine is completed with a cover in which the rotor shaft comes out (Prieto, 2013).

It is not easy to configure permanent magnets in a pattern that can provide a continuous force in a single direction, as there is often a point where the forces of attraction and repulsion are balanced, thus generating a position where the rotor brakes and remains stationary. There are several ways to prevent this from happening. It is possible to modify the magnetic field by diverting it by means of a soft iron component (Wang, 1991). For the side cutting of the motor in Fig. 6:

1. A cup containing a magnetic fluid used as a bearing to minimize friction. When this cup of liquid is placed in the magnetic field, the metallic powder will move, generating circular motion.
2. A four-legged device to act like an unbalanced wheel.
3. An unbalanced wheel with liquid vibration damper and a permanent magnet. The unbalanced wheel has the appearance of an automatic watch. Instead of the oscillation, it rotates. There is a permanent magnet inside, which is the main source of the Impulse Force.
4. Inner rotating shaft (rotor) with a disc containing permanent magnets. The unbalanced swivel wheel causes the inner shaft to rotate with pulses.
5. External cylinder with fixed permanent magnets (stator). External disc with permanent magnets.

6. Magnetic shielding material: used for rotation in one direction.

7. Control of on and off through magnetic field interruption using shielding material.

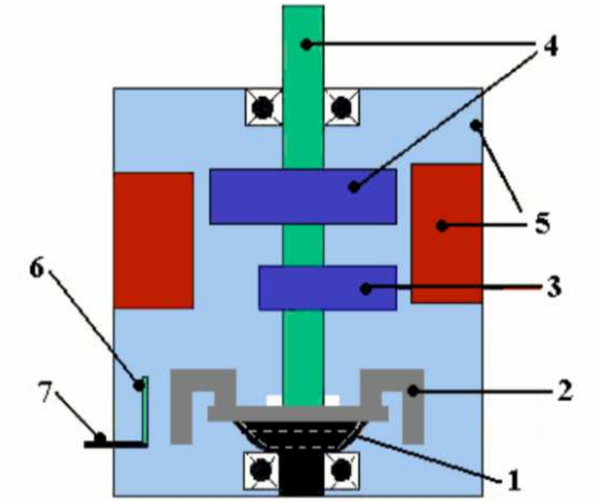

*Figure 6*. Motor side cut (Wang, 1991).

## Analysis and observations

Considering the little information that the authors present on their patents and that they do not theoretically demonstrate the operation of these devices, which does not guarantee that these devices really work, this leads us to make a general physical study on the information that there is about permanent magnet motors. The main thing that was found was, that such devices are not possible since they would be violating the laws of thermodynamics.

To understand this we will first explain the laws of thermodynamics and also the types of perpetual motion mobiles, where the permanent magnet motors would be located. The first law of thermodynamics consists of (Eq. 1):

$$Q = \Delta U + W \tag{1}$$

The amount of energy supplied to any insulated system in the form of heat $Q$ is equal to the work $W$ performed by the system, plus the change in $\Delta U$ internal system energy.

The first law of thermodynamics is the application of the principle of energy conservation, which is valid for all isolated systems. The thermal efficiency $e$ of the thermal motor is defined as (Eq. 2):

$$e = \frac{work\ performed\ during\ a\ cycle}{heat\ added\ during\ a\ cycle} = \frac{W}{Q_h} \tag{2}$$

The net amount of heat $Q$, which is absorbed by the substance, is the amount of heat it receives from the high-temperature heat source $Q_h$ minus the low-temperature heat that dissipates $Q_c$ (Tsaousis, 2008). The work produced by the gas equals the net amount of heat it absorbs (Eq. 3):

$$Q = Q_h - |Q_c| \tag{3}$$

Replacing Eq. 3 in Eq. 2 we have (Eq. 4):

$$e = \frac{Q_h - |Q_c|}{Q_h}\ o\ e = 1 - \frac{|Q_c|}{Q_h} \tag{4}$$

Efficiency can be thought of as the ratio of what you get (mechanical work) to what you pay for (energy). This result shows that a thermal machine has an efficiency of 100% ($e = 1$) only if $Q_c = 0$, i.e. if no heat is released to the cold source. In other words, a perfectly efficient thermal machine must convert all the absorbed heat energy $Q_h$ into mechanical work.

The first law does not produce any restrictions on the types of energy conversions that can occur. In addition, it makes no distinction between work and heat. According to the first law, the internal energy of a system can be increased either by adding heat or by working on the system. But there is a very important difference between work and heat that is not evident from the first law. For example, it is possible to completely convert work into heat, but in practice, it is impossible to completely convert heat into work without modifying the surroundings. The second law of thermodynamics establishes which processes of nature can occur or not. Of all the processes allowed by the first law, only certain types of energy conversion can occur.

The second law of thermodynamics indicates that it is impossible to build a thermal machine that, operating in one cycle, has no other effect than to absorb the thermal energy from a source and perform the same amount of work.

This gives us to understand that it is impossible to build a second class perpetual motion machine, that is, a machine that could violate the second law of thermodynamics (a first-class perpetual motion machine is one that can violate the first law of thermodynamics, energy conservation, it is also impossible to build such a machine) (Inzunza, 2007).

Carnot's theorem exposes that no thermal machine operating in cycles between two given thermal focuses has a higher efficiency than a reversible machine (of Carnot) operating between the same two focuses; the Carnot Cycle consists of four processes, in which two are isothermal and the other two are adiabatic (Fig. 7) (García, Mendoza, & Camacho, 2010).

- Isothermal expansion (a-b): the gas absorbs a quantity of heat Q2 and remains at the temperature of the hot source T2.
- Adiabatic expansion (b-c): the gas is cooled without loss of heat up to the temperature of the cold source T1.
- Isothermal compression (c-d): the gas transfers the heat Q1 to the cold source, without varying the temperature.

- Adiabatic compression (d-a): the gas is heated to the temperature of the hot source T2, closing the cycle.

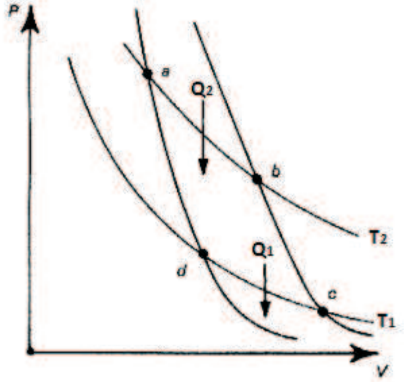

*Figure 7*. Carnot Cycle (García et al., 2010).

### Simulation by Neo Teng Yi of Howard Jonhson's motor

Below is a part of the research carried out by Neo Teng Yi, which focused on the study of Howard Johnson's motor and other experiments that use permanent magnets to generate movement. His main tool of analysis were the simulations which were performed with the software FEMM 4.2. FEMM is known as a set of programs that can be used to solve low-frequency magnetic or electromagnetic problems in two-dimensional flat and asymmetric domains. But before performing the simulation, Neo made a schematic drawing in a 2D plane, whose design and production was carried out in Solidworks 2011. After this, he designed the model in 2D and then imported it into FEMM 4.2 for further processing and simulation. Fig. 3.32 of Neo Teng Yi's document on page 60 shows the 2D design layout of the geometry of the Howard Johnson engine model.

The design for the geometry model was defined as shown in Fig. 3.32 and 3.33 which can be seen on page 61 of Neo Teng Yi's document. The magnets that were implemented in the simulation were neodymium magnets, whose grade is NdFeB 40 MGOe. The North pole of the magnets was configured upwards and the South pole was mounted in a high permeability material that is Mu-metal type. The rotor was then designed to have a curvature shape with a sharp edge and consisted of three magnets that have 120 degrees of separation. The green direction lines indicate the direction of magnetization of the magnets in the direction pointing the arrow is the North Pole. The direction of magnetization of the curvature magnets is tangential to the rotation movement of the rotor.

After the simulation pre-processing was carried out, the problem was solved and analyzed and the simulation data were extracted from the magnetic post-processing stage. A program (Lua Scripting) was performed in order to extract the rotor torque ($T$) values for each 1° of rotation pitch angle. The rotor was programmed to turn left with an angle of 360° and the torque values were extracted at all pitch angles to 1°. In succession, the torque values would be used to calculate the work done ($J$) on the rotor for a full rotation of 360°. Fig. 3.34 on page 63 of Neo Teng Yi's paper shows the visualization of the magnetic field distribution and flux density of the Howard Johnson motor geometric model.

### Simulation of magnetic unbalance forces

The constant imbalance of the magnetic force is the principle that feeds Howard Johnson's motor. The Magnetic Unbalance Forces had been simulated using FEMM 4.2 software to study and analyze the magnetic unbalance characteristics that occurred in Howard Johnson's motor. Fig. 3.35 on page 63 of Neo Teng Yi's paper shows the geometry of the 2D simulation model.

The simulation is carried out by studying the actuator which is made up of curvature magnets in three different places above the stator magnets. Fig. 3.36 on page 64 of Neo Teng Yi's paper shows the three positions of the magnets that were performed throughout this simulation. The magnetization directions of the magnets were defined as green arrows.

The rotor was programmed to complete a revolution of 360° and the rotor torque was extracted from the work performed. It was calculated and represented in a graph shown in Fig. 4.2. The comparison of torque and work performed is illustrated in Fig. 4.3 which were taken from page 76 of the Neo Ten Yi document.

Based on the graphical result, the work done has a net loss of approximately -2.3 Joules after completing a revolution, which did not reach the objective expected of the simulation. Obviously, the rotor was doing a negative job where external forces are needed to apply to the rotor in order to achieve a full rotation of 60°. Based on Fig. 4.3, the distribution of torque values is more in the negative region than the positive region. Therefore, it will result in a negative value and net loss of work performed.

The reasons that cause the net loss of work done in the simulation is probably the stator air space and the curvature of the actuator magnets, which has not been configured correctly during the simulation. Since the motor patent does not mention the exact dimensions of the motor design, the geometrical dimension of the model was designed based on a rough estimate. Therefore, it has become one of the reasons that cause the negative expectation of the simulation result. In addition to that, the configuration of the stator magnets, the air gap, and the rotor curvature magnets is very difficult to perform, which is another reason for the net loss of work.

The most important issue to obtain a continuous motor rotation is that the North Pole flow density of the rotor curvature magnets must always be lower than the South Pole flow density.

At the end of the document, Neo Teng Yi concluded that the existence of a free energy magnet motor is still an uncertain fact. He conducted a great deal of research and simulations with the aim of indicating the viability of free energy, however, the results of research did not provide firm evidence in demonstrating the movement of the motor, as they only offer some theories and basic hypotheses (Neo, 2011).

## Muammer Yildiz motor simulations

For the elaboration of the simulations of Muammer Yildiz's patent, we use the COMSOL Multiphysics software which is a physical analysis program, which analyzes phenomena such as thermodynamics, electromagnetism, acoustics, among others. In the same way, it was necessary the support of the program Autocad, this one like a tool of construction of the graphical part that describes the model.

It is important to note that the simulation was performed in a two-dimensional (2D) space and we take as analysis the physical principle *Rotary Machines, magnetic part* that is part of the simulation software. It was also taken into account that the magnets of both the internal and external stators and the rotor were made of neodymium material with neodymium alloys, iron, and boron $Nd_2Fe_{14}B$, since it has a magnetic energy density of 10000 Gauss (1T) and also has a force of attraction and repulsion of ±15 [Kg] (Herrera, Alarcón, & Rivas, 2013); likewise air was used as a material in between-iron with the aim of having the model closest to that described by the inventor. We also made use of the information provided in terms of distances and number of magnets.

The results obtained were achieved from the study of stationary state in the simulator and produced the results shown in Fig. 8.

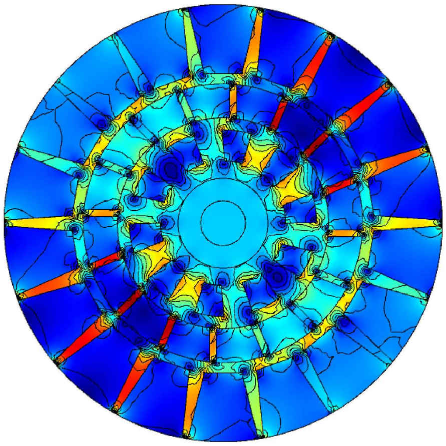

*Figure 8*. Magnetic field lines.

In Fig. 8 as a result of the simulation it is possible to observe the shape and direction of the magnetic field lines in both the stators and the rotor. In addition it can be observed that the lines generated by the internal stator are those that interact more with those of the rotor, whereas those of external stator do it to a great extent in the corners, which we believe that happens by the location of the magnets, since a good number are located to the sides of the blocks in the form of trapeze.

In Fig. 9 It can be seen from the speed line on the right side of the magnet graphics that the speed reached by the device in the stationary state is zero and the same in the temporal state by applying a minimum torque that can generate the human being of 5.296 [Kgf] (Barbosa & Henríquez, 2004) it was obtained that the speed reached was zero as can be seen in Fig. 10.

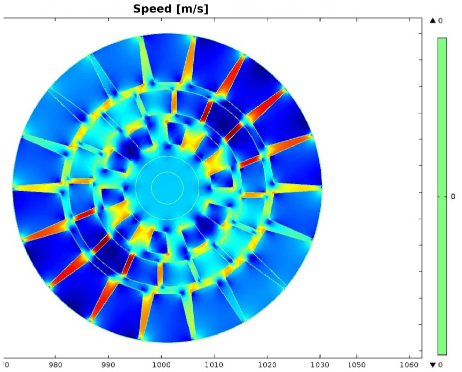

*Figure 9*. Speed reached in steady state.

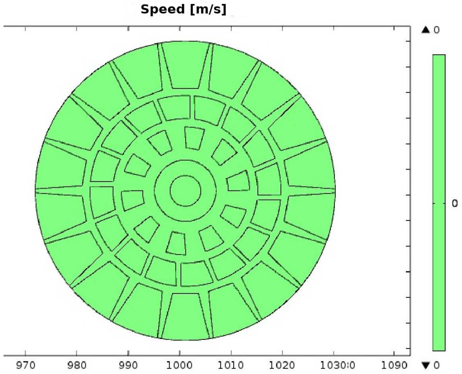

*Figure 10*. Speed reached in transient state.

Next in Fig. 11 is presented the graph of speed against torque in which it can be observed that in a stationary state the speed reached by the motor is zero. Subsequently, in a transient state, a torque is applied which causes the speed to increase, vary for an instant and then fall back to zero.

Similarly from the simulations can be seen how the forces exerted by the magnets on the objects that make up the motor are distributed as shown in Fig. 12.

It should be made clear that these forces do not represent the total forces exerted by the stators on the rotor, but

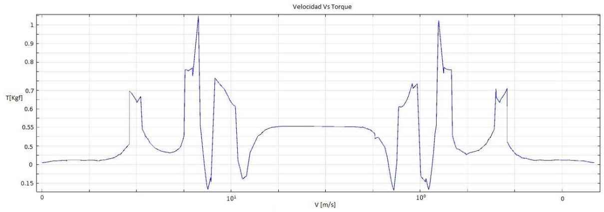

*Figure 11*. Variation of the speed with respect to the torque.

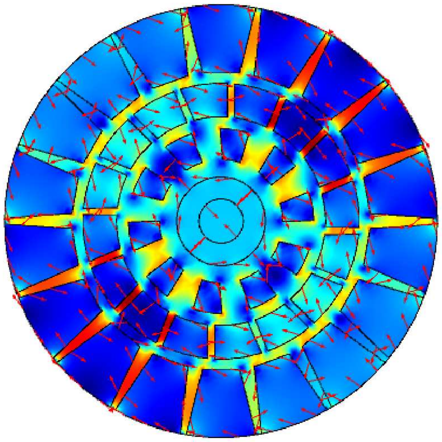

*Figure 12*. Speed reached in transient state.

simply represent the forces exerted by the magnets on the elements that make up the motor. From these vectors of forces represented in the image, it can be observed that the force generated by the magnets is not used in its great majority in the attainment of movement, which may be one of the reasons why the motor does not generate some kind of movement.

On the other hand, in Fig. 13 we observe the forces to which the rotor is being subjected by the stators. In the same way of this image, we observe that finally the forces are annulled, which can also be another cause that the motor does not acquire a speed.

Fig. 14 shows the vectors where the exchange of forces between stators and rotor occurs. Again, the interaction between the internal stator and the rotor, and between the external stator and the rotor can be observed.

Finally in Fig. 15 we can see how the magnetic field moves in the whole engine giving a better idea of how the interaction between each of the elements that make up the engine developed by Muammer Yildiz.

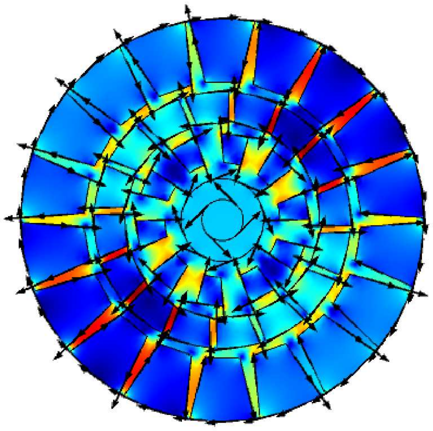

*Figure 13*. Stator forces on the rotor.

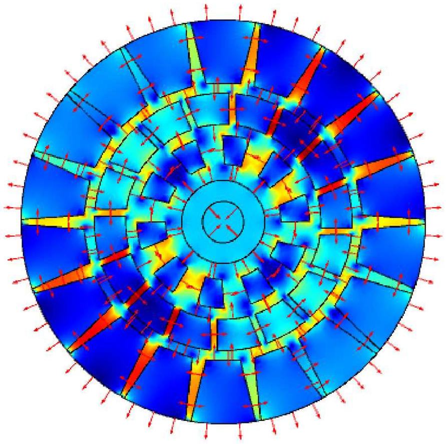

*Figure 14*. Lateral forces.

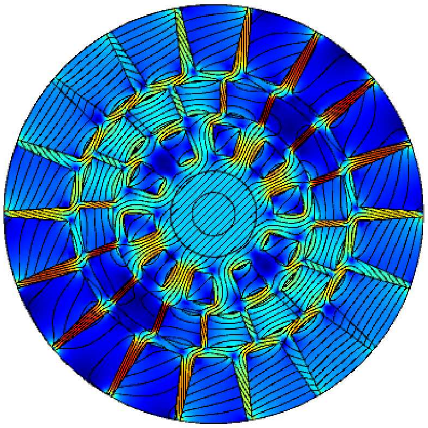

*Figure 15*. General field.

After having exposed all the development of simulation and the results obtained it is convenient to clarify that this study does not have the last word since for the elaboration of the same one did not take into account all the for minors that perhaps if it had in consideration the designer. This is due to the little physical and construction information that the author transmits to us in his patent and also because the physics that we know today limits us in aspects such as thermodynamics. For all this, although the results suggest that the engine can not rotate continuously if it is applying a torque, we can not rule out the possibility that the engine operates normally.

## Comparative study of patents

The following is a comparative table of the patents studied, which highlights some of the characteristics that we consider to be the most important for each device (Table 1).

## Conclusions

Based on the research carried out, we could deduce that by means of the physical principles of thermodynamics, permanent magnet motors that generate perpetual motion are not possible, since these can be grouped in first-class perpetual motion mobiles. In the patents analyzed, motor designs were found that use a very ingenious form of design and construction, which could be used in the research and development of electromagnetic motors that generate great reliability and efficiency. According to the simulations of Muammer Yildiz's motor, and those already documented of Howard Johnson's motor and also in different simulation programs, the same relationship was found that the motors are not functional, whether or not an initial torque is applied to them. Due to the lack of information provided in the patents and in addition to the little documentation that is found about permanent magnet motors, it is difficult for us to give an exact answer that indicates that truly magnetic motors are not functional. A patented machine or device does not always indicate that it is working correctly or that it is viable, as is the case with patents supplied to devices that involve the generation of motion from permanent magnets. Given the results obtained in both Howard Johnson's and Muammer Yildiz's engine simulations and based on these results, it would be advisable not to discard the proposed models but to try to implement them through the use of external sources. Bearing in mind that these can be very useful in some applications such as the motor of electric cars. It would be very interesting to go deeper into the investigation of the devices investigated in this document by constructing one of these mechanisms mentioned in order to have a much more general idea of the way of functioning and also to corroborate how accurate are the results of simulations.

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Table 1
*Comparative table of studied patents.*

| Patente | Nombre y número de la Patente | Autor de la Patente | Ubicación de los imanes | Forma de construcción del motor | Aspectos a destacar | Factibilidad de Fabricación | Factibilidad de Funcionamiento |
|---|---|---|---|---|---|---|---|
| 1 | "Dispositivo con una Disposición de Imanes" N° EP2153515 A2 | Muammer Yildiz | Se encuentran ubicados en dos estatores y un rotor, en los cuales se distribuyen de tal forma que haya una separación equidistante y la cual ejerza una fuerza repulsiva, es decir se enfrentando los polos con igual polaridad. | Esta conformado por dos estatores, uno interior y otro exterior, y en medio de ellos se ubica el rotor el cual se encuentra acoplado al eje a través de dos rodamientos de baja fricción. La forma del estator interno es de forma cilíndrica, mientras que el externo esta formado por unos bloques en forma de trapezio, y el rotor tiene la misma forma que el extator interno es decir en forma de cilindro. | Que posee dos estatores y en medio de ellos se encuentra el rotor. Es decir que el rotor esta sufriendo dos fuerzas de repulsión. | Factible pero con alta dificultad en la construcción. | Debido a que ninguna patente demuestra su funcionamiento a partir de principios físicos, y además teniendo en cuenta los resultados obtenidos en el desarrollo de este proyecto. Podemos afirmar que ninguno de estos dispositivos funciona tal como lo indican sus creadores. Lo cual nos lleva a concluir que estos dispositivos no son factibles en su funcionamiento. |
| 2 | "Motor Magnético" N° WO1990010337 A1 | Troy Reed | Se encuentran ubicados en dos ruedas giratorias por lo que se les conoce como imanes giratorios. También se encuentran fijos cerca de las ruedas ejerciendo una fuerza de repulsión por la disposición de polaridades iguales. | Tiene una construcción similar a la de los motores de combustión interna, ya que el eje tiene forma de cigüeñal y a él se encuentran acoplados una serie de elementos que facilitan a los imanes el movimiento. En la parte externa se encuentran dos discos fijados a los extremos del cigueñal y en los cuales se encuentran ubicados los imanes de al interactuar con los imanes fijos generan el movimiento. | Se puede destacar que no tiene una forma de construcción convencional, ya que en la parte interna posee un eje en forma de cigüeñal al cual van acoplados una serie de mecanismos que ayudan a que el movimiento que se genera por los imanes sea de más duración. | Factible pero con una dificultad media en la construcción. | |
| 3 | "Motor Magnético" N° US20070296284 A1 | Victor Diduck | Se encuentran ubicados en un rotor con ranuras de forma diagonal que rodean el total del rotor, además se ubican de forma fija en un carenado con pernos cercanos a los cuales los imanes les inducen un campo. La interacción es de repulsión debido a que tanto los imanaes del rotor y los del carenado se ubican de tal forma que las polaridades sean de igual signo. | Esta conformado por dos ruedas giratorias o esclavos, las cuales se acoplan a un eje. Paralelo a estas ruedan se ubica un carenáje ajustable a través de dos manivelas que se encargan de ajustar el espacio de aire o entrehierro. A lo largo del carenaje se ubican unos pernos enroscables que ayudan a mejorar el campo que producen los imanes en el carenaje. Como forma opcional se pueden ubicar dos ruedas en las cuales se puede acoplar un generador. | Se destaca que los imanes en el rotor están ubicados sobre ranuras que van distribuidas de forma diagonal a lo largo del rotor. Además se puede destacar que el estator es un carenaje o carcasa ajustable con el fin de aumentar o disminuir el espacio de aire o entrehierro. | Factible con poca dificultad en la construcción. | |
| 4 | "Motor de Imanes Permanentes" N° US4151431 A | Howard Johnson | Se encuentran ubicados en el rotor y estator. Los que se encuentran en el estator son de forma rectangular y la separación entre ellos es variable, a diferencia de los imanes del rotor cuya separación es la misma. Teniendo encuenta que en este solo se ubican tres pares de imanes escalonados de forma arqueada en los cuales el campo magnetico se centra en las puntas del imán, y según la polaridad de los imanes del estator sera el sentido del giro del rotor. | Cuenta con un rotor y un estator, el primero forma la parte exterior del dispositivo y sus imanes se encuentran unidos por un núcleo no magnético, mientras el segundo es el soporte y además se encuentra en el interior del dispositivo, cuyo material es de alta permeabilidad magnética. Estos se encuntran acoplados por el eje. | Los imanes del rotor son de forma arqueada, para que el campo magnetico se centre en las puntas del imán. | Factible con una dificultad media en la construcción. | |
| 5 | "El motor de Imanes Permanentes" N° CN1218329 A | Shenhe Wang | Se encuentran ubicados ocho imanes en la pared del cilindro exterior (estator) cuya separación es equidistante y los tres imanes del cilindro interior se ubican de tal manera que forman un triángulo. | En la base posee una copa la cual contiene un fluido magnético. Acoplado a este se encuentra un dispositivo de 4 patas, y estos dos a su vez van conectados al eje de rotación, en el cual se ubican los imanes del rotor y paralelo a estos pero ubicados en la armadura del dispositivos estan los imanes fijos. | Tiene una copa que contiene un fluido magnético el cual es confidencial. | No factible por confidencialidad en algunos materiales. | |

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