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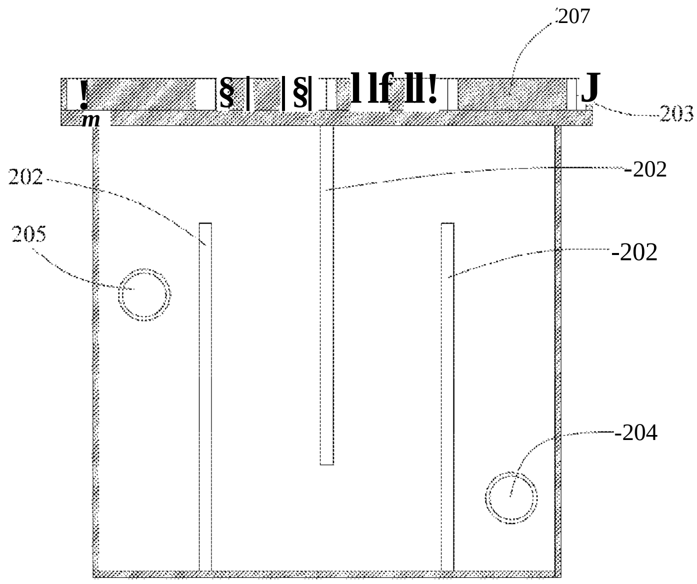

Fig. 14

(57) Abstract: A box for magnetizing fuel (200), characterized in that it comprises a plurality of lateral walls (202), a fuel inlet opening (205), a fuel outlet opening (206) and a back wall defining an internal volume within which is positioned a plurality of internal walls (202) which are adapted to define a winding path which the fuel must travel when fed into said fuel inlet opening (205) and before exiting said fuel outlet opening (206); said box for magnetizing fuel further comprising a plurality of magnets (210) which are introduced inside said volume.

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"Magnetization box for fuel, internal combustion engine with means of magnetization of air and fuel and associated method of magnetization"

Description

Technical field

The present invention describes an innovative integrated system for the magnetization of fuel and of the entire engine itself, which is characterized in the presence of a plurality of components which are constituted by a plurality of individual elements which are conveniently arranged both in the tank, and around any internal combustion engine, in order to improve the yield thereof, decrease fuel consumption and reduce the polluting impact thereof.

In detail, the present invention relates to a magnetization box for fuel.

The subject matter of the present invention is furthermore an engine with a magnetization system that is configured to magnetize at least the air and the fuel that are fed to the engine.

The present invention likewise relates to a method of magnetization of an engine in order to improve its efficiency characteristics.

Background art

For some time and particularly since the early 1960s, it has been known that magnetism and/or radiation exerts a positive influence on the efficiency of internal combustion engines.

The influence of magnetism and/or of radiation on combustion has also been acknowledged very often in recent research carried out in industry, universities and academia, and has been substantially separated into two different types of use: patents for magnetic devices installed on feed pipes for internal combustion engines and patents for magnetic and/or radiation immersion devices in the fuel tank that feeds such engines. This has been a very positive influence, as noted in US patents nos. US 4572145 of 1986, US 5048489 of 1991, and US 5124045 of 1992, and in German patent no. DE 44171676 and in the WO 00/06888 patent of

2000. Up to now however all patents and intellectual property rights that have been filed have related exclusively to ceramics emitting infrared rays, and/or to devices adapted to use magnetic fields to irradiate only the fuel fed, independently of what that is, and the air fed to the engine. Furthermore, said magnetization and/or radiation devices are all irreversibly anchored to the engine.

The applicant has observed that when magnetic devices and/or radiation devices are associated with any internal combustion engine, they offer excellent performance levels in determined functional areas, which are identified by running speed, load, airflow speed and/or fuel-flow speed in the respective feed pipes, but whatever the case, the magnetization and/or radiation devices always result in a decrease in consumption and of pollutant emissions which can be more or less marked, as a function of the above mentioned parameters. The aim of the present invention is thus to describe a magnetization and/or radiation kit for any internal combustion engine, which can be reversibly, easily and rapidly installed, thanks to a plurality of quick-fit couplings that enable its fast installation and removal.

Summary of the invention

According to the present invention, what is provided is a box for magnetizing fuel, characterized in that it comprises a plurality of lateral walls, a fuel inlet opening, a fuel outlet opening and a back wall defining an internal volume within which is positioned a plurality of internal walls which are adapted to define a winding path which the fuel must travel when fed into said fuel inlet opening and before exiting said fuel outlet opening; said box for magnetizing fuel further comprising a plurality of magnets which are introduced inside said volume.

Advantageously, said magnets are installed according to a north-south orientation having a direction which is parallel to the direction identified by the depth of said box.

In detail, said magnets are constituted by rare earth elements, i.e. those belonging to the group of lanthanides to which samarium-cobalt and neodymium-iron-boron magnets belong.

More specifically, said magnets are provided in the form of stacked disks, preferably made of rare earth elements, between which are interposed ceramic spacers (6) which are adapted to space apart, stabilize and increase the magnetic field produced by the magnetic disks themselves.

In detail, the box in the present invention is at least partially provided in stainless steel.

According to the present invention, what is provided is an internal combustion engine, characterized in that it comprises a plurality of magnets and/or electromagnets and/or ceramics emitting infrared rays, which are positioned proximate to at least one fuel feeding pipe and are configured to magnetize at least part of the fuel which is present in a fuel feeding pipe, and which are positioned on an engine air intake pipe, thereby polarizing said fuel feeding pipe and/or said fuel with a first polarity which is different from the second polarity with which the air entering into said engine air intake pipe is magnetized; said engine further comprises a fuel magnetization box, said box being installed upstream of said fuel feeding pipe.

Advantageously, said magnets and/or electromagnets are configurable between a first configuration of use in which they intervene in the magnetization of said pipe and a second configuration of use in which they do not intervene in the magnetization of said pipe and/or of said fuel; said engine being preferably configured to operate in conditions of constant running speed and/or constant load.

Advantageously, said magnets and/or electromagnets are further positioned also at an air intake pipe proximate to the engine and are adapted to provide the air fed to the engine with a magnetic polarization of opposite sign to that provided to the fuel fed to the engine.

Advantageously, said first configuration of use intervenes when said engine is kept at a running speed corresponding to the maximum torque speed.

Advantageously, said box comprises an internal volume which is such as to allow fuel remain inside it for a time significantly longer than that for which it remains inside said fuel feeding pipe.

Advantageously, said first configuration of use is kept in an interval of running speeds which is such as to allow a torque to be maintained which is at least 80% of the maximum torque.

Advantageously, said magnets comprise at least one pair of concave magnets, which are arranged along said fuel feeding pipe so as to substantially envelop, along the entire diameter, said feeding pipe.

According to the present invention, what is also described is a method of optimizing the consumption of an internal combustion engine, said method comprising:

- a step of installation of magnets at least at a fuel feeding pipe to said engine and at an air intake pipe to said engine so as to magnetize the air and fuel with two opposite polarities;

- a step of installation of a box for magnetizing fuel upstream of said fuel feeding pipe;

and wherein said box is defined so as to have inside it a volume which is such as to keep said fuel in substantial contact with the respective magnets for a time significantly longer than that for which the fuel is substantially proximate to said magnets which are placed on said fuel feeding pipe.

Advantageously, said method comprises:

- a further step which consists in bringing said engine to a running speed which substantially corresponds to that of the maximum torque or to a running speed for which the value of torque developed by said engine is at least 80% of said maximum toque value;

- a step of measurement of the consumption and/or of the specific consumption of said engine, and a step of modification of the position of said magnets along said fuel pipe thus setting up a new and subsequent verification of said consumption and/or of said specific consumption in search of a minimum thereof;

- a step of definitive fixing of said magnets in the determined position.

Advantageously, said method comprises a step of measurement of said consumption and/or specific consumption of said engine by way of applying to the latter a load susceptible of simulating a torque requirement that is typical of use, and comprising a new step of measurement of consumption and/or specific consumption followed by a new modification of the position of said magnets along said fuel pipe.

Advantageously, said magnets, once positioned in a new position, are left to act for a predetermined amount of time, preferably limited to a few days, before proceeding with a new measurement of said engine's consumption and/or specific consumption.

Advantageously, said magnets are moved or activated between a first configuration in which they intervene in the magnetization of said fuel and/or of said air and a second configuration in which they do not intervene in the magnetization of said fuel and/or of said air, and wherein said first configuration corresponds to a running speed substantially proximate to that of said maximum torque that said engine can provide, and wherein said second configuration corresponds at least to a minimum engine running speed.

Description of the figures

The invention will be described in a preferred, but non-limiting embodiment thereof with reference to the accompanying drawings wherein:

Figure 1 shows an immersion container 1 arranged inside the fuel tank 2. Note that the immersion container 1 is arranged proximate to the fuel feeding pipe 8 so as to magnetize it fully before it enters the pipe 8.

Figure 2 shows the immersion container 1 inside which, in addition to the fuel that flows through the holes 40, there is a plurality of perforated solid cylindrical containers 3 containing inside them the magnetic paramagnetic elements 5 which are constituted by rare earth elements such as samarium-cobalt and neodymium. Said solid containers 3 are provided with a plurality of holes 41 and are stably anchored to the bottom of the immersion container 1, which is arranged in the fuel tank 2, by way of at least one anchoring bracket 4. The immersion container 1 is anchored with a bracket or a plurality of brackets 4 inside the tank 2 and is positioned so as to be as close as possible to the fuel feeding pipe 8. The magnetic elements 3 are provided in the form of stacked disks 5, and are constituted by rare earth elements such as neodymium and samarium-cobalt. Between the individual magnetic disks 3, there are suitable ceramic spacers 6 which are adapted to space apart, stabilize and increase the magnetic field produced by the magnetic disks 5.

Figure 3 shows the passage container 9 in which the fuel pipe 8 originating from the tank 2 enters a containing structure 9 inside which the pipe 8 follows a series of folds and/or curves 12, thus creating a coil and/or windings so that a plurality of magnets 10 can be stably positioned proximate to said coil and/or shape structure of pipes so as to electrically and magnetically charge the fuel that flows inside the pipe 8, along the entire route.

Figure 4 shows a pair of concave magnets 14 made of ferrite or of samarium-cobalt, which are arranged about a substantially rectilinear portion of the pipe 8. The magnets are adapted to further magnetize the flow of fuel which flows inside the pipe 8. Said pairs of magnets 14 are arranged between the fuel filter and the a/c pump of the engine and in any case before the point of injection of the fuel into the combustion chamber of the engine. Externally they have washers 15 made of rare earth elements such as neodymium or samarium-cobalt. The whole is covered externally with a plate of screening material at least 1 mm thick.

Figure 5 shows a sectional view of the pair of concave magnets 14 in which it can be seen that charges of the same sign are in the same positions, internal 21 or external 11, of each pair of magnets 14.

Figure 6 shows a plurality of concave magnets made of ferrite or neodymium or samarium-cobalt 16, optionally covered with a pair of neodymium washers 15, which are arranged radially about the air intake pipe 17 which feeds the internal combustion engine in the present invention. Said magnets 16 are kept stably in contact with the external surface of the air intake pipe 17, by way of at least one retaining band 18, and are covered on the outer face by any kind of insulating layer, at least 1 mm thick, in order to screen the magnetic field.

Figure 7 shows the magnets 16 directly installed on the cooling pipe 20 of the internal combustion engine. The number of magnets 16 present on the cooling pipe 20 is, in the example shown, equal to ten.

Figure 8 shows the magnets 10 complete with neodymium washers installed around the fuel filter 31. Note also the retaining band 18 and the fuel pipe 8.

Figure 9 is a perspective view of mechanical actuator means installed on the fuel feeding pipe 8 of the engine in the present invention;

Figure 10 is a perspective view of an alternative embodiment of the magnetic means in which there are electromagnets radially arranged around the fuel feeding pipe 8.

Figure 11 shows a table of indicative consumption figures of the engine in the present invention;

Figure 12 shows a graph of the consumption trend for the table in Figure 11.

Figure 13 is a front elevation view of a box for magnetizing fuel which is described in the present invention;

Figure 14 is a view from above of the box for magnetizing fuel which is described in the present invention.

Detailed description of the invention

In the present description, the term magnet means any permanent magnet that is capable of creating a persistent magnetic field of from 0.4 teslas to 1.49 teslas, or a permanent magnet that is capable of creating a magnetic field constituted by the sum of many persistent magnetic fields, and of intensity considerably exceeding 1.49 teslas. Therefore, in the present description, the term magnet means all so-called "hard permanent magnets" with high coercivity. The permanent magnets used in the present invention are constituted by ferromagnetic and/or paramagnetic materials. The permanent magnets used in the present invention are made of natural magnetic minerals like magnetite, cobalt, nickel, and rare earth elements like gadolinium or dysprosium. In addition to the above mentioned natural magnets, synthetic materials can be used like boron, ceramic composite magnets, AINiCo magnets, TiCoAl magnets, injection-molded magnets and flexible magnets. The preferred magnets in the present invention are those constituted by rare earth elements, i.e. those belonging to the group of lanthanides to which samarium-cobalt and neodymium-iron-boron magnets belong.

The power of the magnets and of the paramagnetic substances varies between 0.4 teslas and 1.49 teslas.

In order to enable an exhaustive understanding of the method of treatment of the present invention, the devices in the present patent application will now be described in detail, and are the following:

1) The first device, referred to as an immersion container 1, is constituted by at least one conventional container which is conveniently perforated by way of a plurality of openings 40, which are adapted a facilitate the direct contact of the fuel with the magnetic elements 5 arranged inside said immersion container 1. Said immersion container 1, which is shown in Figures 1 and 2, must be stably positioned inside the fuel tank 2 of the internal combustion engine to be treated. There can be one immersion container or there can be more than one. This depends on the power of the engine to be treated, on the capacity of the tank and on the available space. In order to prevent wear and vibrations, the immersion container 1 must be fixed to the internal structure of the tank 2 with adapted welded or screwed brackets or by way of any other retaining element that renders it stably coupled to the inside of the tank 2, taking into account the use of the engine, the size of the tank 2 and its application on stationary land engines, aircraft engines, ship or watercraft engines or engines in any means of terrestrial locomotion, independently of whether it moves on rails, tires, or link tracks.

The immersion container 1 must preferably be arranged proximate to the fuel feeding pipe 8. Inside said immersion container or containers 1 arranged in the fuel tank 2 according to the technique described in the present invention, is at least one solid container of any shape, preferably cylindrical 3, preferably a plurality of cylindrical solid containers 3, which contain inside them a plurality of magnetic elements 5 constituted by disk-shaped permanent magnets constituted by some rare earth elements, some of which are samarium-cobalt and neodymium. Interposed between said magnetic elements 5 are ceramic spacers 6, which are also disk-like and are conveniently spaced apart in order to increase their magnetic effect. Said solid containers, preferably cylindrical 3, are in turn stably anchored to the bottom of the immersion container 1 and in order to facilitate their contact with the fuel to be magnetized, they have a plurality of holes 41. The anchoring occurs by way of stable locking systems 4 such as screws or brackets, so as to conveniently space said solid containers, preferably cylindrical 3 apart from each other by at least three centimeters, so as to optimize the magnetic field created. Each cylindrical solid container 3, arranged inside the immersion container 1 which in turn is immersed inside the tank 2 in a position inside the tank as close as possible to the exit point of the pipe to feed the engine in order to treat the maximum amount of fuel, is made so as to favor as far as possible contact between the fuel contained in the tank 2 and said magnetic elements 5. This contact is essential in order to favor as far as possible the resistance and consequently the time of contact between the fuel and the magnetic components 5, so as to favor the molecular treatment and the magnetization of the fuel. Said magnetic elements 5 are provided in the form of cylindrical disks constituted by rare earth elements such as neodymium and samarium-cobalt, but they can also have other forms and shapes. Between the individual magnetic disks 5 are ceramic spacers 6 which are adapted to space apart and optimize the individual magnetic fields produced by the magnetic disks 5, thus increasing and optimizing the overall power of the resulting magnetic field. The structure of all the above mentioned containers, the immersion container 1 and the cylindrical containers 3 can be made of any solid material, of metal, of any metal alloy or of any natural or synthetic polymer which is not soluble in the fuel contained in the tank 2. Both the cylindrical container 3 and the immersion container 1 according to the present invention can have any form and shape, are provided in a solid structure provided with a plurality of holes 41 and 40 respectively and made of any rigid material, of metal, of any metal alloy or of any natural or synthetic polymer which is not soluble in the fuel present in the tank 2.

The arrangement and the shape of said cylindrical containers 3 inside the immersion container 1 obviously can vary as a function of the size of the tank 2 but it must be noted that at least one immersion container 1, with at least 10 cylindrical containers 3 inside it, is needed for each 2000 liters of fuel contained. The indicative height of each cylindrical container 3 and, consequently, of the immersion element 1 vary, as a function of the supply flow rate and of the type of engine being subjected to the magnetization and molecular treatment process according to the present invention, and range from a minimum height of 6 centimeters, ideal for the tanks of motorcycles, to well over 100 centimeters in height for magnetizing the tanks on board ships, and preferably the height of each cylindrical container is from 20 to 40 centimeters, and the optimal height is around 30 centimeters. The density of the magnetic flux originated by the container, when fitted with the magnetic disks 5 made of rare earth elements and with the ceramic spacers 6, is of the order of over 1.17 teslas. The magnetic disks 5 are made of any rare earth element, preferably neodymium with a magnetic power of at least 1.17 teslas. The immersion container or containers 1 must be arranged inside the fuel tank 2 and proximate to the fuel exit pipe 8.

2) The second device in the present invention is the passage element 9. Said passage element 9, as shown in Figure 3, is a parallelepiped- shaped solid structure into which the fuel pipe 8, originating from the tank 2 of the internal combustion engine, enters, following a series of folds and/or curves 12 so as to create a coil and/or a winding of pipes so that a plurality of magnets 10 can be conveniently and stably positioned. The manifold and/or the winding of pipes 12 makes it possible to electrically charge the fuel that flows inside said pipe 8 for a long section. The fuel that flows inside the pipe 8, by passing proximate to the magnets 10 present on the coil and/or the winding of pipes 12, is charged by said magnets 10 which are

constituted by ferrite together with rare earth elements like neodymium and samarium-cobalt. The fuel that was previously electrically charged is thus further magnetically treated with charges of the same sign, for the entire route. The sign of the charge given to the fuel must be the same as the sign of the charge that will be received by the elements of the third device and of the subsequent devices prior to being put in contact with the air which instead will be provided with a charge of the opposite sign. Said charge is conferred on the fuel by the magnetic elements 10 and, independently of whether it is positive or negative, it must also be the same sign as the sign of the charge present in the device for treating the cooling liquid. Furthermore, said charge must necessarily have the opposite sign to that created in the air feed device, which is described below. When it reaches the end of the passage container 9, the fuel will necessarily have passed through ten pairs 13 of mutually opposite magnets. Said mutually opposite magnets 13 have a slightly convex shape in order to increase the effectiveness of the magnetic action and in order to best follow the shape of the pipe 8 that they have to envelop. The number of said magnets 10 is from 8 to 30 for each passage container 9.

3) The third device, for the magnetization of fuel in order to optimize the performance of any internal combustion engine, according to the present invention, as shown in Figure 4, is characterized by the presence of at least one pair, preferably up to six pairs, of convex magnets made of ferrite, neodymium or samarium-cobalt 14, which are arranged about a substantially rectilinear and/or curved portion of the fuel pipe 8. Said pairs of magnets 14 are also adapted to further increase the magnetization of the stream of fuel that flows inside the pipe 8. Said pairs of magnets 14 are arranged shortly before or proximate to the a/c mechanical fuel supply pump and/or proximate to the point of injection of the fuel itself into the combustion chamber of the engine. Said pairs of magnets 14 are convex and made of ferrite, neodymium or samarium-cobalt and are approximately 10 centimeters long by 3 centimeters wide and 2.5 centimeters thick, and they must be calibrated for operating temperatures of at least 110 degrees centigrade. Their number varies from 2 to 12, and preferably 5 pairs of magnets are installed. Furthermore, said pairs of magnets 14 can be

covered by a plurality of neodymium washers 15, which are adapted to further increase the magnetic field created. The charge induced, independently of whether it is positive or negative, must compulsorily have the same sign as that induced in the engine cooling system and as that induced in the previous devices for supplying and treating the fuel, but it must have the opposite sign to that induced in the air feed device.

4) The fourth device, shown in Figure 6, of the method of treatment of the fuel-air mixture supplied to an internal combustion engine, is constituted by a plurality of concave magnets made of ferrite 16, which are optionally covered with a pair of neodymium washers 15, and are arranged radially about the air intake pipe 17 that supplies any internal combustion engine. Said magnets 16 are kept stably in contact with the external surface of the air intake pipe 17, by way of at least one retaining band 18. The magnetic field created by said magnets made of neodymium-ferrite or of samarium-cobalt 16 will have the opposite sign, independently of whether this is positive or negative, to the sign with which the fuel passing through the devices 2 and 3 has been charged. This expedient thus makes it possible to give opposite charges to the fuel and to the air fed to the internal combustion engine. It is this difference in charge between the two components of the combustion mixture, the air and the fuel, which optimizes the step of combustion and the yield of said integrated magnetization system while also obtaining the molecular breakdown and reduction of viscosity of the fuel itself. As can be seen from the present discussion, the system in the present invention must necessarily be viewed as a single, integrated system that tends to magnetize, thanks to its intense magnetic field and the plurality of circuits, the entire engine, even though it is provided with six different devices which, however, all contribute to achieving the same goal. The number of magnets 16 present on the air supply pipe 17 is indicatively between 4 and 40, and preferably 20. The size of said magnets 16 is indicatively equal to 10 centimeters long, 3 centimeters wide and 2.5 centimeters thick. The shape of the magnets 16 is vaguely concave in order to better adhere to the air intake pipe 17 on which they are installed. The composition of said magnets can be neodymium-ferrite or samarium-cobalt. Said magnets 17 have a minimum magnetic field density of approximately 1.17 teslas. For the manufacture of

the supply pipe 17, obviously preference must be given to all materials that can transmit the magnetic field created by the magnets 16 inside said pipe 17. The temperature that said magnets 17 must withstand must be at least 110 degrees, at which temperature they must not lose their magnetization power. The position of said magnets must be as close as possible to the combustion chamber of said internal combustion engine, taking into account the temperature of the positioning location and the ability of the magnets to withstand such temperature without losing the magnetic characteristics.

5) The fifth magnetic device, shown in Figure 7, is similar to the fourth device, except in this case the magnets 16 are directly installed on the cooling pipe 20 connected to the radiator of the internal combustion engine and they magnetize the water and/or the liquid of the cooling system with the same sign with which the fuel is charged, effectively making the entire engine magnetically charged with the same sign which is opposite to the sign of the air supply. The sign of polarization of the water is therefore opposite to that of the air supplied to the engine. The number of magnets 16 present on the cooling pipe 20 is indicatively between 4 and 40, and preferably 20. The size of said magnets 16 is indicatively equal to 10 centimeters long, 3 centimeters wide and 2.5 centimeters thick. The shape of the magnets 16 is vaguely concave in order to better adhere to the cooling pipe 20 on which they are installed. Said magnets 16 have a minimum magnetic field density of approximately 1.17 teslas. The number of magnets 16 present on the cooling pipe 20 is indicatively between 4 and 40, and preferably 20. Said magnets 16 must be made by taking account of the temperature they have to withstand, which is at least 110 degrees. This is the temperature at which they must function without losing their magnetization power.

6) The sixth device is entirely similar in all respects to the fourth device, except that in this case the magnets 16 are directly installed around the fuel filter 31 connected to the internal combustion engine. Also in this case, the sign induced in the fuel fed to the engine, independently of whether it is positive or negative, must be the same as the sign induced in the previous systems for treating the fuel and the opposite to the sign given to the air fed to the engine. The number of magnets 16 present on the fuel filter is indicatively between 5 and

14, and preferably 10 for an MTU 396 Diesel engine. The size of said magnets 16 is indicatively equal to 10 centimeters long, 3 centimeters wide and 2.5 centimeters thick. The shape of the magnets 16 is vaguely concave in order to better adhere to the fuel filter 31 on which they are installed. Said magnets 16 have a minimum magnetic field density of approximately 1.17 teslas. The number of magnets 16 present on the fuel filter 31 varies as a function of the power of the engine and is indicatively from 5 to 20, and preferably 10. Account must be taken of the temperature that the magnets must withstand, which must be at least 110 degrees or higher, without losing their magnetization power.

All the magnets placed on the fuel and air pipes can be screened with a protective layer of at least 1 millimeter in order to reduce dispersion and increase the efficiency of the system and better clamp the magnets to the fuel, cooling, and air pipes.

Alternatively, it is also possible to magnetize the fuel before it is introduced inside the tank 2, so as to improve its quality and fluidity while simultaneously decreasing its density. The process of magnetization in the present invention tends, in addition to improving the quality of the fuel by reducing the asphaltenes and carbon residues dissolved in it, to charge the fuel and the air fed to the engine with opposite signs and also to break down, at the molecular level, the carbon chains and the molecular aggregates which are present in the fuel itself. Obviously the method described in the present industrial patent application tends to be more effective the more the fuel has been treated. The results obtained show that by adopting the technique described above, it is possible to obtain a substantial saving in fuel consumption, up to even halving the costs thereof. Furthermore, by decreasing the viscosity of the fuel and improving its quality, an overall improvement is obtained in the yield of the engine, by decreasing the fuel consumption, increasing the engine torque, and also reducing its exhaust, harmful emissions and the carbon deposits in the combustion chamber. In the combustion chamber of the engine treated according to the technique described in the present invention, the encounter between the molecularly and qualitatively treated fuel charged with a sign, and the air charged with the opposite sign, favors the creation of an ideal fuel-air mixture. An optimal mixing naturally provides an optimal combustion, appreciably improving the overall yield of the internal combustion engine on which said apparatus is installed. The apparatus in the present invention is installable on any internal combustion engine, independently of whether it runs on Diesel fuel, gasoline, LPG, methane, kerosene, oil, alcohol or any other liquid or gaseous fuel.

For an engine, at least 220 hours of operation with the system fitted are required in order to see the benefits of the system and begin to evaluate its efficiency, and its optimal performance is reached after another 200 hours of operation. This applies to internal combustion engines of the Otto cycle type, and also to turbine engines like that described in the present description.

In fact, in the first hours the engine is magnetized and the combustion chambers are cleaned, while the subsequent hours stabilize and optimize the yield. The method of magnetization in the present invention causes no damage to the internal combustion engines on which it is installed, and actually increase their operating lifetime over time.

Optionally, furthermore, it is also possible to install magnets on the oil feed circuits, so as to favor further reduction of engine consumption.

In detail, the engine in the present invention is characterized in that said magnets are movable at least between a first, active position and a second, inactive position. While in the first, active position they influence the operation of the engine as described above, contributing to increasing its efficiency, in the inactive position they do not influence the characteristics of the engine and therefore they are not pertinent to the operation of the engine. This advantageously makes it possible to select the activation of the magnets described above only when necessary, in particular if the operating characteristics of the engine, expressed in terms of RPM of the engine, load, expressed torque, and flow speed of water and fuel inside the air intake and fuel pipes, respectively.

In order to do this, as illustrated in Figure 8, the concave magnets 14 are physically and non-removably coupled to the first movement means 100, which comprise an arm 101 which extends in a perpendicular direction with respect to the direction along which the axis of the pipe 8 is oriented. Installed at the end of the arm 101 which is opposite with respect to the arm joined to the concave magnet 14, there is a pin 102 which is coupled to a rotating shaft of an electric motor 103, which preferably is of the stepper type.

Such electric motor is activated by conventional command means. The rotation of the shaft of the electric motor 103 in a first direction of rotation causes a separation in a radial direction between the concave magnet 14 and the pipe 8. The rotation of the shaft of the electric motor 103 in a second direction of rotation then causes a coming together in a radial direction between the concave magnet 14 and the pipe 8.

The use of electric motors 103 of the stepper type is advantageous because these are capable of keeping the shaft stationary, in a position of equilibrium: if powered they will in fact only be immobilized in a well-defined angular position. It is only indirectly possible to obtain their rotation: if it is desired to move the position of equilibrium, it is necessary to send the motor a series of pulses of current, according to a preset sequence, for successive clicks. This means, advantageously, that even if the concave magnet 14 is positioned in said first, active position, the precision of coupling is ensured by the power supplied to the electric motor 103. This is particularly useful because the magnetic field B [in teslas or Wb/m^2] decreases rapidly with the increase of the mutual distance between the concave magnet 14 and the pipe 8.

As an alternative, the pin 102 can be coupled to a gearwheel which in turn meshes with a gear which is keyed on the rotating shaft of an electric motor 103. This advantageously makes it possible to have a reduction of the useful ratio of rotation in order to improve the precision with which the concave magnet can be moved away from the pipe.

As another alternative, the electric motor 103 can be substituted with an actuator comprising a small pneumatic or hydraulic fluid cylinder, which is capable of moving said concave magnet 14 between a first position of minimal radial distance with respect to said pipe 8 (which corresponds to the first, active position) and a second position of maximum radial distance with respect to said pipe 8 (the inactive position).

Advantageously, by way of the use in particular of the electric motor 103 it is possible to define a plurality of intermediate positions between the first, active position and the second, inactive position in which the action of the concave magnets 14 on the pipe 8 can be adjusted at will.

Alternatively, the magnets 16 can be substituted by a plurality of electromagnets 110, each one of which has a metal core 111 on which is wound a metal solenoid 112 (by way of non-limiting example, made of copper) which is externally insulated in order to not create a short-circuit with said metal core. The metal core 111 advantageously has an elongated body with a longitudinal axis 114 thereof oriented so as to have a magnetic orientation of the north-south type similar to that shown in Figure 5. To make this possible, each one of the electromagnets 110 is arranged so that the axis of the solenoid 112 is oriented radially with respect to the pipe 8. All the electromagnets 110 are activated together by way of the passage of an electric current i(t) [A] through the metal solenoid. When the electric current flows through the solenoid 112, said electromagnets are activated. When the electric current is cut, said electromagnets are no longer active, and the magnetic field induced on the pipe 8 therefore becomes null.

In this case too it is advantageously possible to adjust the intensity of the electric current flowing through the solenoids 112, causing the more or less intense forcing of a magnetic field on the pipe 8.

In detail, control of the movement of the concave magnets 14 between the first, active position and the second, inactive position can advantageously be done manually by the user by way of for example a switch (if there are only two positions of operation) or for example a multistage selector or potentiometer (if said magnets can instead be set to various different positions).

The same applies if the magnets are substituted by electromagnets 110. In this case too, control of these can be done by way of a switch.

Alternatively, an electronic control unit 130, which is electrically connected to the said electromagnets 110 or with the electric motors 103, can be used. In such case, the electronic control unit 130 comprises a plurality of receiving input terminals, for example, but not limited to, a first electrical signal corresponding to the RPM of the driving shaft, or an electrical signal for the engine load, for valve lift and/or the temperature of the air supply, of the electric motor or of the exhaust gases, and also a signal indicating the supercharging pressure if the engine is fitted with a turbocharger or with a displacement supercharger.

In detail, by way of analysis of said plurality of signals, the electronic control unit 130 processes in real time and automatically the optimal position of the concave magnets 14 and/or the activation and intensity of the current to power the electromagnets 110, so as to advantageously make it possible to define at least one first condition in which said electromagnets are activated and/or said concave magnets 14 are positioned in said first, active position.

From experimental trials it has been found that magnetizing the fuel and the air that are fed to the engine, as described above, is particularly effective if the engine operates at a constant running speed. This means that during transients, and that is to say those moments when the engine undergoes sudden changes in load - i.e., inverse demand for power or torque applied to the rotating shaft - magnetizing the fuel and air has less influence on reducing consumption, with respect to what occurs when operating at a constant running speed and load.

Thus, the engine fitted with magnets as described above becomes particularly advantageous for all those applications in which the running speed is substantially fixed; in motor vehicles, this occurs in particular when driving on a motorway or freeway, especially under conditions of constant speed which are typically obtainable by way of using a conventional cruise control system.

Differently, the above operating conditions occur in particular during sailing. In fact, when sailing, ships - which are in any case provided with piston engines and which therefore can advantageously employ the engine in the present invention - can advantageously avail of an engine like the one in the present invention, thus achieving a significant reduction in consumption.

Figure 11 and Figure 12 show in detail a table and a graph of consumption as a function of the installation time of the magnets on the engine. In particular, Figure 11 and Figure 12 refer to the case of engines using magnets as described above which are positioned at least on the fuel pipe 8 and on the air intake pipe. Figures 11 and 12 refer to a case of a ship engine operating at a constant running speed and a constant load.

From the experimental results shown in these figures, it can be seen that after a period of some days, specifically 7 days, the efficiency of the ship engine with magnets, with respect to the efficiency of the ship engine without magnets, increases perceptibly, leading over time to a lowering of consumption of the order of approximately 30%.

Specifically it has furthermore been observed that the position of the magnets 16, 14 with respect to the engine appreciably influences the result that can be obtained.

Therefore the present invention also relates to a method of installation of magnets on an engine in order to optimize the yield (consumption) thereof, wherein said magnets are installed at least on the air and fuel pipes, as described above, so as to magnetize the air and the fuel with two opposing polarities. The method developed comprises a first step which consists of bringing the engine to a running speed substantially corresponding to that of maximum torque, preferably but not exclusively with a tolerance of approximately 20% of such maximum torque value.

At this point the method involves positioning the concave magnets 14 on the fuel pipe and the further magnets on the air supply pipe so as to enable the air and fuel to be magnetizes with two opposing polarities.

Then, said method comprises a step of analyzing the specific consumption [g/kWh] or consumption [1/h] of said engine, by axially moving the concave magnets 14 along the fuel pipe 8 and/or along the air intake pipe and verifying, leaving the engine to run thusly for a preset time (preferably up to a few days), whether the value of said consumption decreases.

Once the ideal position has been found for the concave magnets 14 and for the magnets of the air intake pipe, a step may be carried out of varying the magnetic induction that these exert on said pipe, in order to verify whether the consumption or the specific consumption are reduced further.

Optionally, said method is characterized in that the consumption measurements are taken not only in the maximum torque zone, but also by connecting said engine to a load that is susceptible of simulating what will then be the average load to which said engine will be subjected during use.

Upstream of the engine fuel pipe 8, a box is installed for the magnetization of the fuel 200. In detail, said box 200 comprises a body which is preferably but not exclusively parallelepiped in shape with a square cross-section in plan view, thus having four lateral walls 206 and a back wall which delimit an internal volume that is adapted to contain liquids.

As illustrated in Figure 13, on one lateral wall there are at least two holes, which provide an inlet opening 204 for fuel into said box 200 and an outlet opening 205 for fuel from said box 200. In detail, the inlet opening 204 and the outlet opening 205 are arranged at a different height: the first is arranged at a lower height, while the second is at a higher height. Clearly, such configuration should not be understood to be limiting.

Likewise, although in the accompanying figures an embodiment of the box for magnetizing fuel is illustrated in which both openings are arranged in a same lateral wall 207, such configuration should be understood to be not limiting.

Inside the volume delimited by the lateral walls and by the back wall, there is a plurality of internal walls 202, which, looking at the box 200 in plan view, are joined alternately to the internal faces of two opposite lateral walls, so as to define an S-shaped path. In detail, in the embodiment shown, such walls are 3 in number, of which two are joined to the same lateral wall in which the inlet opening and the outlet opening 205, 206 are defined.

The box 200 finally comprises a cover 207 which has a plurality of fixing nuts 203 which are perimetrically arranged so as to engage on the lateral walls.

Inside the box 200 there is a plurality of magnets 210, preferably but not exclusively of the cylindrical type and also made with natural magnetic minerals such as magnetite, cobalt, nickel and rare earth elements like gadolinium or dysprosium. In addition to the above mentioned natural magnets, synthetic materials can be used like boron, ceramic composite magnets, AINiCo magnets, TiCoAl magnets, injection-molded magnets and flexible magnets. The preferred magnets in the present invention are those constituted by rare earth elements, i.e. those belonging to the group of lanthanides to which samarium-cobalt and neodymium-iron-boron magnets belong.

During use, the fuel originating from the tank is fed to the inlet opening 205 of the box 200, and follows an S-shaped path, thus coming into substantial contact with the magnets 210, in so doing becoming magnetized.

In detail, the bigger the internal volume of the box 200, the better its effect on the magnetization of the fuel and thus on the reduction in consumption of the engine. In fact, differently from what occurs in the fuel pipe 8, precisely because of the large volume of the box 200 the fuel remains proximate to the magnets for a significantly longer time than the time it remains proximate to the concave magnets 14 of the fuel pipe. In this manner, the induction effect of the magnets on the fuel is greater. However, the dimensions of the magnets can also be significantly larger, thus contributing to increasing the induction effect.

In the accompanying figures, there are 12 cylindrical magnets 210 installed, but this number can be varied and their shape can be modified according to the dimensions, shape, and S-shaped path identified within the volume of the box.

Preferably, in any case, the magnets 210 inside the box are installed so as to have a north-south orientation parallel to the direction identified by the depth of said box. However, such configuration should not be understood to be limiting.

More preferably, the magnets 210 can be provided in the form of stacked disks, and are constituted by rare earth elements such as neodymium and samarium-cobalt. Between the individual magnetic disks, there are suitable ceramic spacers 6 which are adapted to space apart, stabilize and increase the magnetic field produced by the magnetic disks themselves.

From the mechanical point of view, the box 200 described herein is preferably made of stainless steel in order to withstand the chemical action of the solvents of the fuel. Preferably, such steel is of the AISI316 type. Such box 200 can withstand a hydrostatic head to about 30kPa, and its lateral walls are preferably about 3mm thick.

Advantageously, the inventors have considered that the optimal running speed for the activation of the magnets as described above is the running speed that corresponds to the development of maximum torque. Therefore, in the engine in the present invention, the first configuration of use, in which the magnets interact with the fluids of the engine, occurs when the engine approaches the maximum torque speed, while the magnets are left deactivated outside the band of running speeds proximate to the maximum torque, in particular at the minimum running speeds and/or during transients.

The advantages of the device in the engine in the present invention are clear in light of the foregoing description; in particular, the engine in the present invention can advantageously be favored by the action of the magnetic field produced by magnets and electromagnets only when it is most convenient. This makes it possible to further increase the efficiency of the engine in the present invention with respect to the known art.

Furthermore, control of the movement and/or activation of the magnets and electromagnets, if it is done by way of an automatic procedure, frees the user from all burden of controlling them. The term magnet, in the present patent application for an industrial invention, means any permanent magnet that can be sourced on the market or any electromagnet with fixed or variable actuation, i.e. programmed with variable frequencies, optionally associated with a magnet and/or with a conventional device for emitting infrared rays, which also has a fixed or variable actuation.

The term fuel pipe, in the present patent application for an industrial invention, means the possibility of making the fuel itself flow through multiple passages of the same fuel pipe, in order to be able to amplify the effects on it. Said passes are achieved by way of any fixed or mobile and/or electronic redirecting device.

The term air pipe, in the present patent application for an industrial invention, means the possibility of making the air flow through multiple passages of the same treated air pipe, in order to be able to amplify the effects on it, by way of any fixed or mobile and/or electronic redirecting device.

The term cooling liquid pipe, in the present patent application for an industrial invention, means the possibility of making the cooling liquid flow through multiple passages of the same cooling liquid pipe, in order to be able to amplify the effects on it, by way of any fixed or mobile and/or electronic redirecting device.

Finally, it is clear that what is described herein can be subjected to additions, modifications or variations which are obvious to a person skilled in the art but without for this reason leaving the scope of protection provided by the appended claims.

Claims

1. A box for magnetizing fuel (200), characterized in that it comprises a plurality of lateral walls (202), a fuel inlet opening (205), a fuel outlet opening (206) and a back wall defining an internal volume within which is positioned a plurality of internal walls (202) which are adapted to define a winding path which the fuel must travel when fed into said fuel inlet opening (205) and before exiting said fuel outlet opening (206); said box for magnetizing fuel further comprising a plurality of magnets (210) which are introduced inside said volume.

2. The box for magnetizing fuel according to claim 1, characterized in that said magnets are installed according to a north-south orientation having a direction which is parallel to the direction identified by the depth of said box.

3. The box for magnetizing fuel according to claim 1, wherein said magnets (210) are constituted by rare earth elements, i.e. those belonging to the group of lanthanides to which samarium-cobalt and neodymium-iron-boron magnets belong.

4. The box for magnetizing fuel according to any of the preceding claims, characterized in that said magnets are provided in the form of stacked disks, preferably made of rare earth elements, between which are interposed ceramic spacers (6) which are adapted to space apart, stabilize and increase the magnetic field produced by the magnetic disks themselves.

5. The box for magnetizing fuel according to any of the preceding claims, characterized in that it is at least partially provided in stainless steel.

6. An internal combustion engine, characterized in that it comprises a plurality of magnets

(14) and/or electromagnets (110) which are positioned proximate to at least one fuel feeding pipe (8) and are configured to magnetize at least part of the fuel which is present in a fuel feeding pipe (8), and which are positioned on an engine air intake pipe, thereby polarizing said fuel feeding pipe (8) and/or said fuel with a first polarity which is different from the second polarity with which the air entering into said engine air intake pipe is polarized; said engine further comprises a fuel magnetization box (200) according to any of the preceding claims, said box being installed upstream of said fuel feeding pipe (8).

7. The engine according to claim 7 and wherein said magnets (14) and/or electromagnets (110) are configurable between a first configuration of use in which they intervene in the magnetization of said pipe (8) and a second configuration of use in which they do not intervene in the magnetization of said pipe (8) and/or of said fuel; said engine being preferably configured to operate in conditions of constant running speed and/or constant load.

8. The internal combustion engine according to claim 7, characterized in that said magnets (14) and/or electromagnets are further positioned also at an air intake pipe (17) proximate to the engine and are adapted to provide the air fed to the engine with a magnetic polarization of opposite sign to that provided to the fuel fed to the engine.

9. The internal combustion engine according to any of claims 7 or 8, wherein said first configuration of use intervenes when said engine is kept at a running speed corresponding to the maximum torque speed.

10. The internal combustion engine according to claim 9, wherein said box (200) comprises an internal volume which is such as to allow fuel remain inside it for a time significantly longer than that for which it remains inside said fuel feeding pipe (8).

11. The internal combustion engine according to any of the preceding claims 6-10, wherein said first configuration of use is kept in an interval of running speeds which is such as to allow a torque to be maintained which is at least 80% of the maximum torque.

12. The internal combustion engine according to any of the preceding claims 6-11, wherein said magnets (14) comprise at least one pair of concave magnets, which are arranged along said fuel feeding pipe (8) so as to substantially envelop, along the entire diameter, said feeding pipe (8).

13. A method of optimizing the consumption of an internal combustion engine, said method comprising:
- a step of installation of magnets (14) at least at a fuel feeding pipe (8) to said engine and at an air intake pipe to said engine so as to magnetize the air and fuel with two opposite polarities;
- a step of installation of a box (200) for magnetizing fuel according to any of claims 1-5 upstream of said fuel feeding pipe (8);
and wherein said box (200) is defined so as to have inside it a volume which is such as to keep said fuel in substantial contact with the respective magnets (210) for a time significantly longer than that for which the fuel is substantially proximate to said magnets (14) which are placed on said fuel feeding (8) pipe.

14. The method according to claim 13, further comprising a further step which consists in bringing said engine to a running speed which substantially corresponds to that of the maximum torque or to a running speed for which the value of torque developed by said engine is at least 80% of said maximum toque value;
- a step of measurement of the consumption and/or of the specific consumption of said engine, and a step of modification of the position of said magnets (14) along said fuel

pipe (8) thus setting up a new and subsequent verification of said consumption and/or of said specific consumption in search of a minimum thereof;

- a step of definitive fixing of said magnets (14) in the determined position.

15. The method according to claim 14, comprising a step of measurement of said consumption and/or specific consumption of said engine by way of applying to the latter a load susceptible of simulating a torque requirement that is typical of use, and comprising a new step of measurement of consumption and/or specific consumption followed by a new modification of the position of said magnets (14) along said fuel pipe (8).

16. The method according to claim 14 or claim 15, characterized in that said magnets, once positioned in a new position, are left to act for a predetermined amount of time, preferably limited to a few days, before proceeding with a new measurement of said engine's consumption and/or specific consumption.

17. The method according to any of claims 14-16, characterized in that said magnets are moved or activated between a first configuration in which they intervene in the magnetization of said fuel and/or of said air and a second configuration in which they do not intervene in the magnetization of said fuel and/or of said air, and wherein said first configuration corresponds to a running speed substantially proximate to that of said maximum torque that said engine can provide, and wherein said second configuration corresponds at least to a minimum engine running speed.

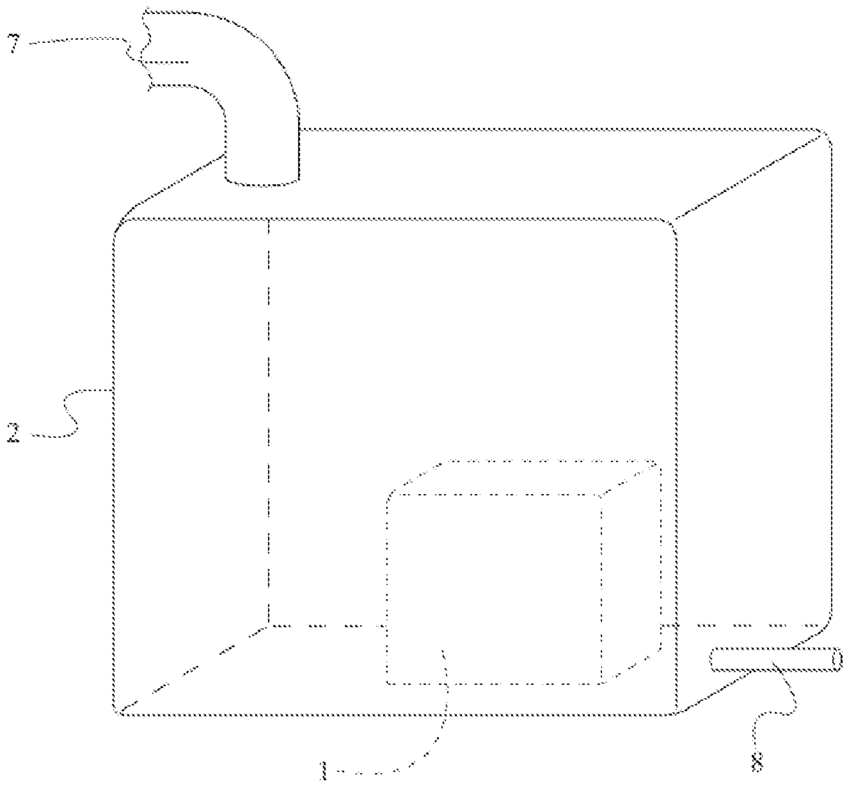

Fig. 1

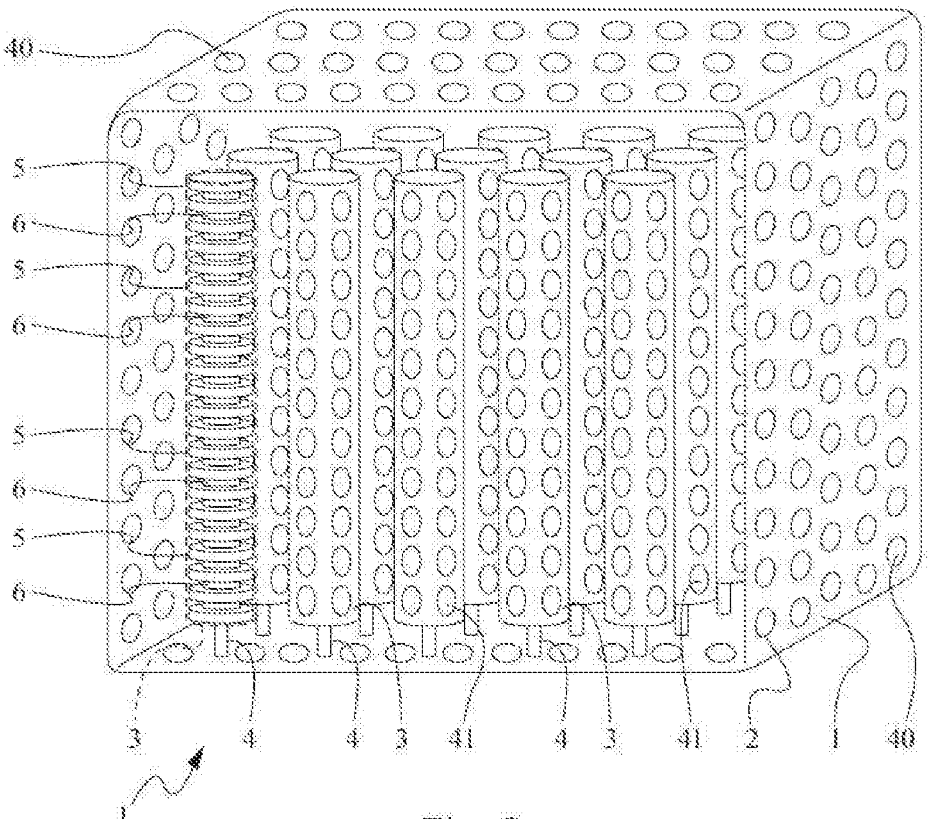

Fig. 2

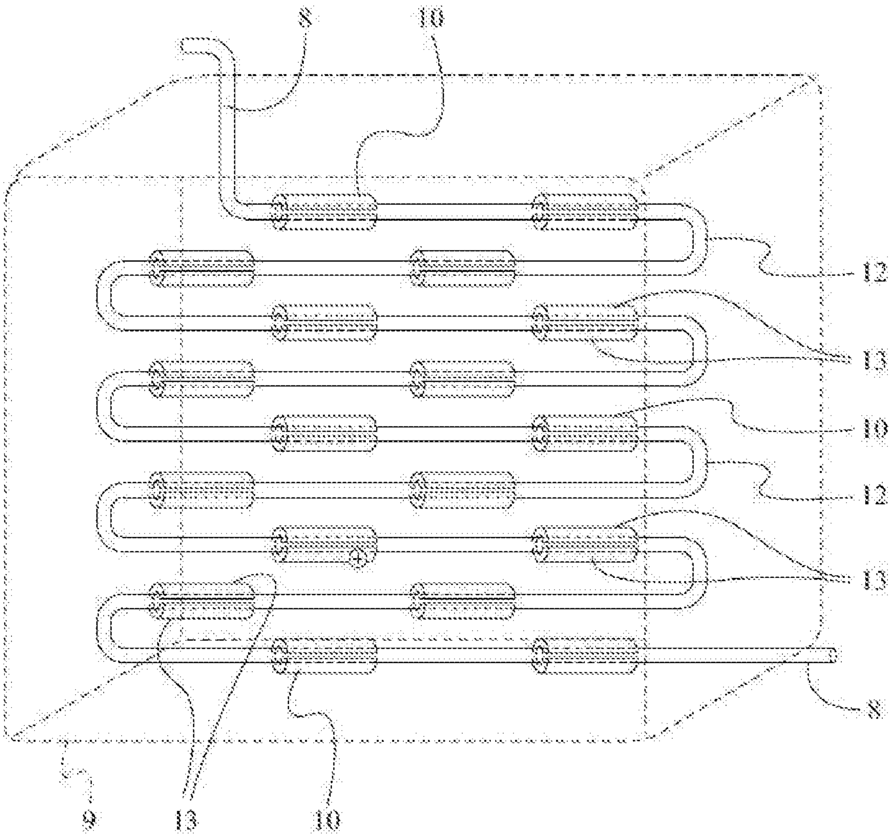
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Fig. 3

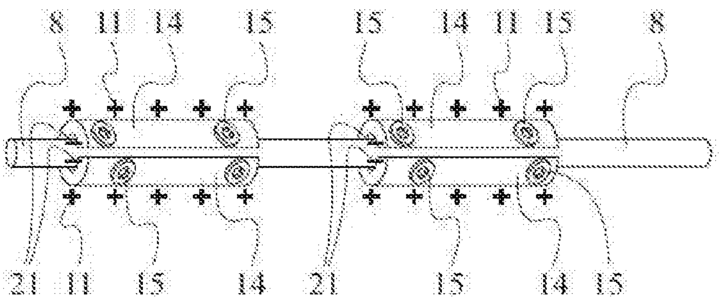
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Fig. 4

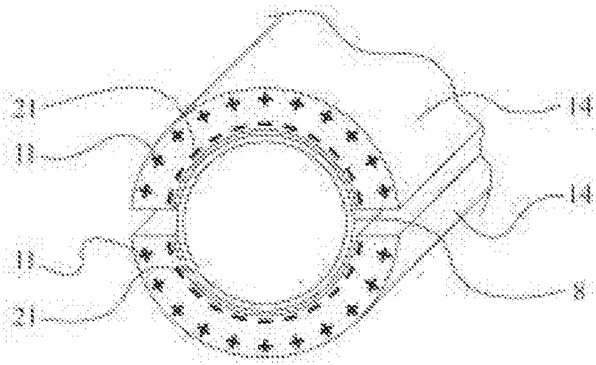

Fig. 5

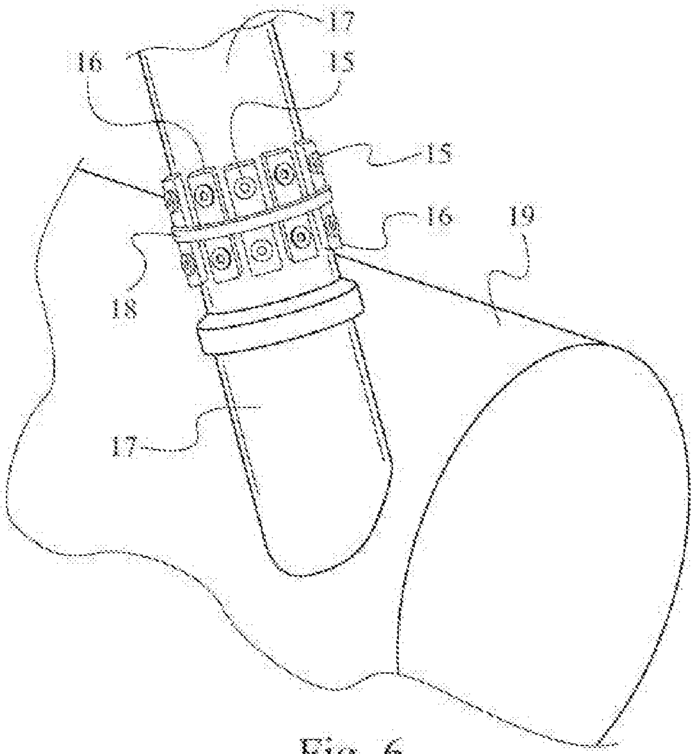

Fig. 6

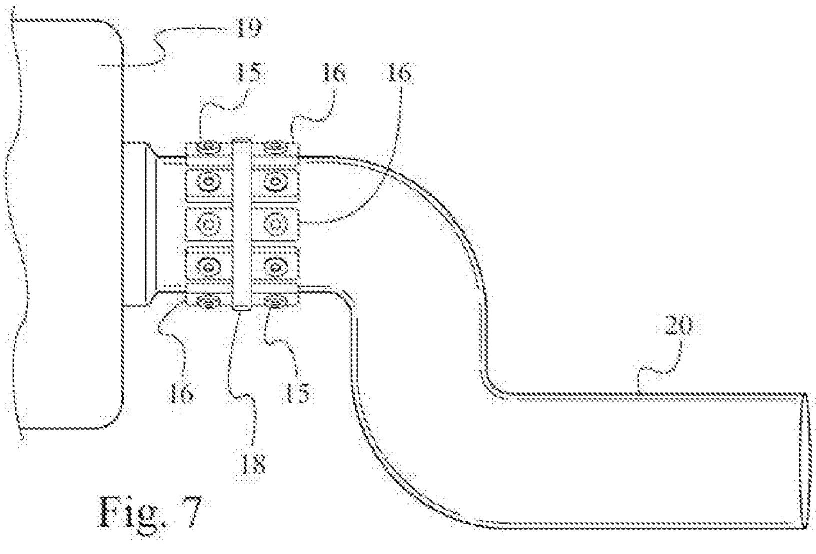

Fig. 7

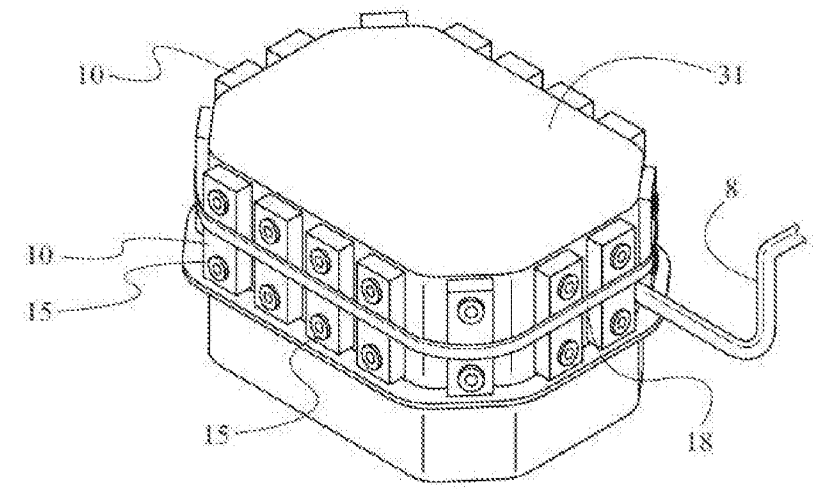

Fig. 8

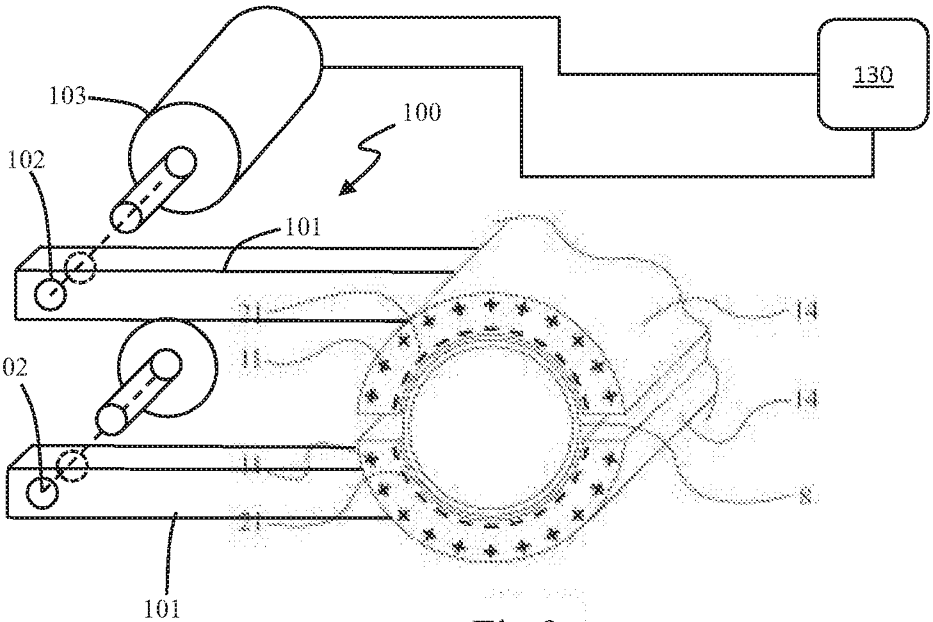

Fig.9

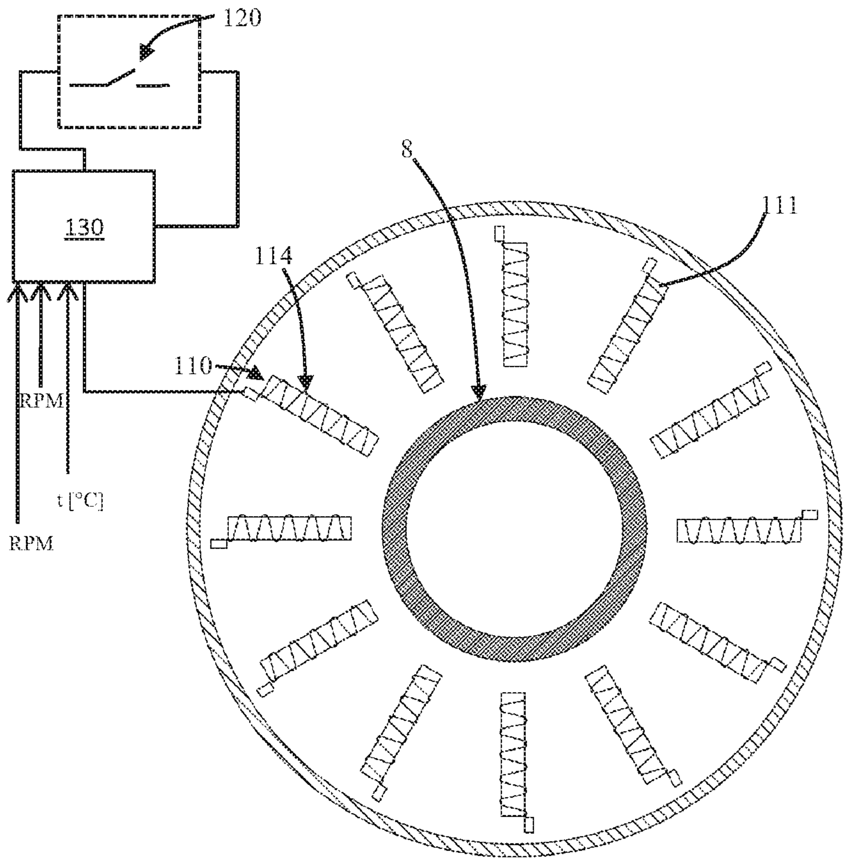

Fig.10

Day	Engine consuption without magnets	Engine consuption with magnets	Benefit rate
	[l/h]	[l/h]	[%]
1	123	128,64	-4,59
2	124,75	123,36	1,11
3	136,7	130,67	4,41
4	135,47	123,18	9,07
5	119,67	124,21	-3,79
6	140,33	126,5	9,86
7	107,71	98,8	8,27
8	148,8	85,87	42,29
9	141,22	74,63	47,15
10	130,17	78,4	39,77
11	148,64	87,6	41,07
12	139	88,76	36,14
13	139,63	94,47	32,34
14	140,07	82,67	40,98
15	136,25	92,2	32,33
16	147,93	86,53	41,51
17	143,24	95,12	33,59
18	153,71	101	34,29
19	153,71	101	34,29
20	153,71	101	34,29
21	144,95	87,62	39,55
22	133,28	97,58	26,79
23	137,71	81,33	40,94
24	129,33	68,93	46,70
25	118	71,14	39,71
26	124,33	72,93	41,34
27	137,78	99,7	27,64
28	150,64	112,43	25,37
29	144,95	112,43	22,44
30	137,94	112,43	18,49
31	139,05	109	21,61
32	135,82	133,95	1,38

Fig.11

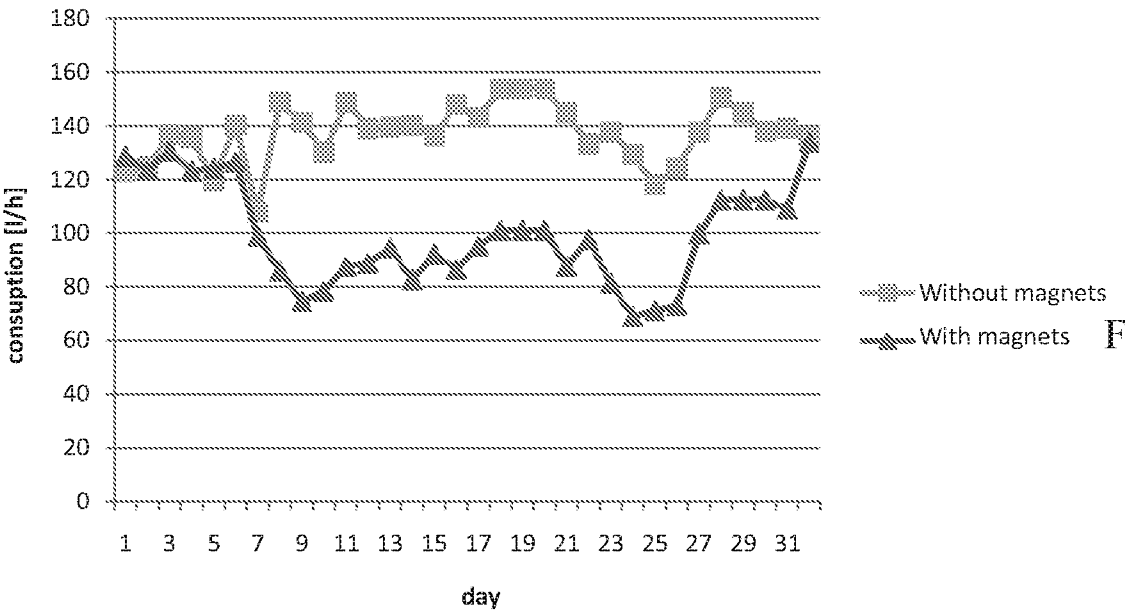

Fig.12

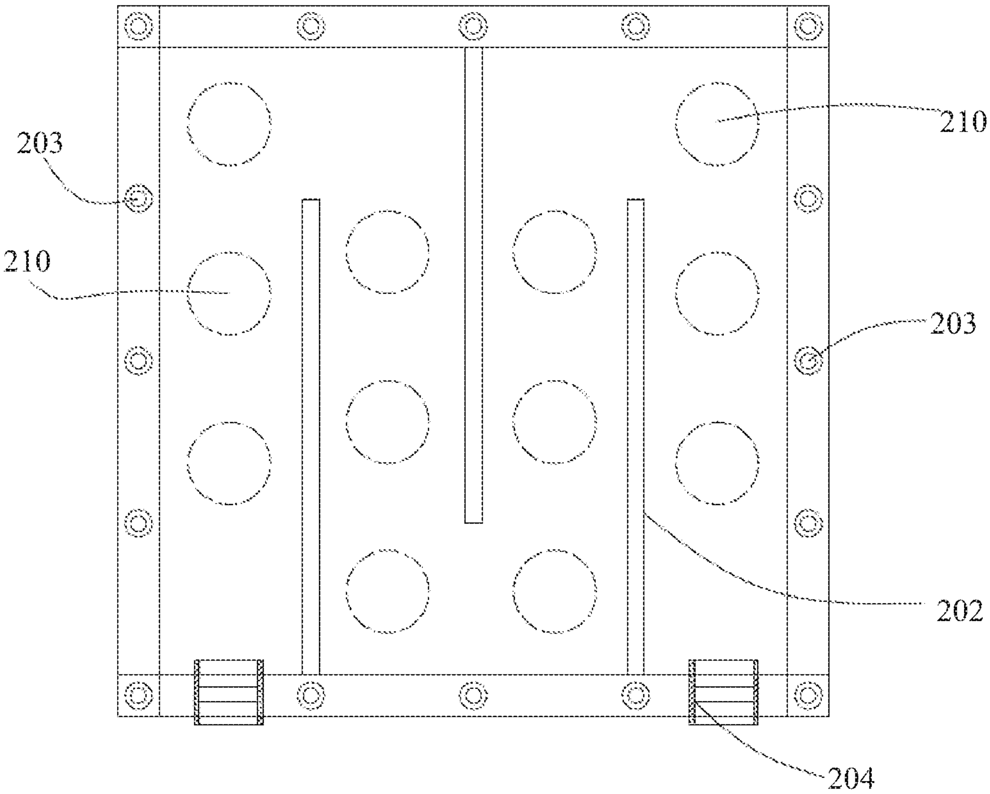

Fig.13

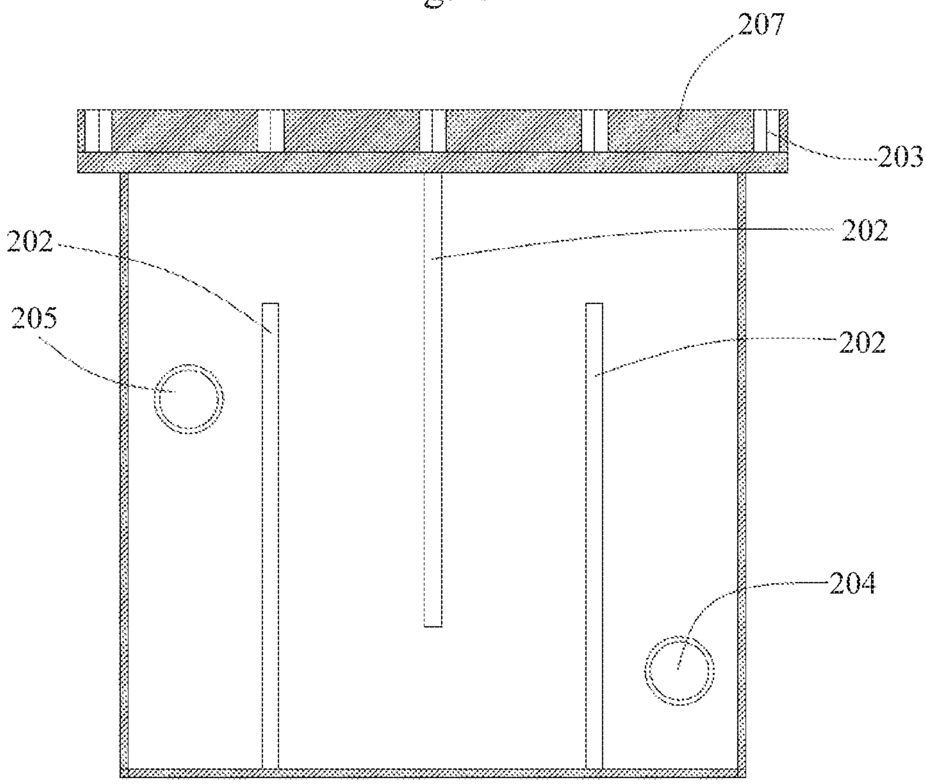

Fig.14

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/056503

A. CLASSIFICATION OF SUBJECT MATTER
INV. F02M27/04 F02B51/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F02M F02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 388 466 Al (SHIN FUJI MINING CO LTD [JP]) 23 November 2011 (2011-11-23)	1-5
Y	paragraph [0016] - paragraph [0022] ;	6-13
A	figures 1,4	14-17
Y	W0 2012/143804 Al (B0VE FABRIZI0 [IT] ; B0VE ALESSANDR0 [IT]) 26 October 2012 (2012-10-26) page 9, line 1 - page 9, line 24; figures 3,6	6-13
X	US 5 873 353 A (MAKITA HIDEAKI [JP]) 23 February 1999 (1999-02-23) column 3, line 25 - column 4, line 40; figures 1,6	1

-/- ·

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" documentwhich may throw doubts on priority claim(s) orwhich is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 November 2015	02/12/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Marsano, Flavio

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 757 797 AI (SCHLACHET HENRY RICHARD [FR]) 28 February 2007 (2007-02-28) paragraph [0011] - paragraph [0016] ; figures 22a, 22b -----	1
X	JP S60 259761 A (OHARA SHIZUKI ; NISHIMURA KUNI0; KAGIM0T0 TAKESHI) 21 December 1985 (1985-12-21) abstract; figure 1 -----	1

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2015/056503

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			CN 102770656	A	07-11-2012
			EP 2388466	A1	23-11-2011
			JP 2015057555	A	26-03-2015
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