CONSIDERATIONS ON TREATING SOME FUEL FLUIDS IN A MAGNETIC FIELD

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Abstract – Starting with the issues that the entire humanity faces due to the constant and uncontrolled rising prices of petroleum and as well as the restrictions set by the C.E. in what concerns the fumes released into the atmosphere after burning fossil fuels, this magnetic system solves a series of problems concerning the efficiency of the burning process and the decrease of the released fumes.

Key words – fuel treatment, magnetic field, flow, paramagnetic.

1. Introduction

Considering that most regular fuel fluids contain hydrocarbons who have cyclic chains (heavy fractions) and linear chains (light fractions), their stereochemistry shows some asymmetries that can increase the probability of asymmetries appearing in their electrostatic polarity and also in the polarization of the magnetic moment of the fuel molecules.

Applying a magnetic field to the fuel, with some strict parameters specify, the magnetic susceptibility of the molecules belonging to some fuel fluids can increase the effect produced by the magnetic field applied to the fuel, with positive results on the burning process.

The liquid or gaseous fuels, at molecular level, the molecules, macromolecules and the polar chains have weak connections due to their gaseous or liquid aggregation stage. If we apply a magnetic field to the macromolecules and polar chains, these brake giving polar fractions that have a bipolar electrostatic stage as well as a magnetic part of the bipolarity. The level of stability of the fluid’s new state, will be influenced at its own turn by a series of physical factors such as temperature, pressure, the speed and characteristic of fuel flow in the area where the magnetic field works, as well as a series of inner features of the fuel liquid, such as its chemical purity, the magnetic properties of the fuel’s molecules, the fuel’s degree of impurity (the impurity might “saturate” the previously created polarity) and other factors who have a disturbing effect on the treated fuel’s state and characteristics.

By applying certain successions and alternations of the gradients of the magnetic fields to the fuel fluid it appears an intensification of the process of change in the stereochemistry of molecules producing brakes which leads at the increase of the characteristic magnetic moment and at a stronger ionization.

These changes lead at an increased affinity of the fuel’s molecules compared with other molecules and ions from their proximity, so, implicitly, compared with the oxygen in the air which ensures the fuel’s burning process which will take place at superior parameters.

2. Description

A series of results of the experimental research can be found in specialized literature, and they put down the good effects of the magnetic field on the increase of the heating production and on the reduction of the fumes that are released when treated fuels are burned. In these works there are proposed some systems for treating the fuel fluids in a magnetic field [5,6], systems which use magnets set radial or along the pipeline that creates an uniform magnetic fields or other magnetic devices have the magnets set apart at angles of 120 degrees or 180 degrees in the radial section of the fluid pipeline. These magnetic fields have a series of disadvantages because they don’t treat the entire fuel mass, keep a circular flow of these in the area of the magnetic treatment device and some systems need electrical energy to work.

Due to these disadvantages, the magnetic system created has the permanent magnets set in such a way that it forms certain successions and changes of the gradients of the magnetic fields that are applied to the fuel liquid; this way of setting
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The Romanian Review Precision Mechanics, Optics & Mechatronics, 2010 (20), No. 38

them increases even more the changing process of the stereochemistry of the fuel molecules.

As an effect, there will appear breakages that lead at the increase of the characteristic magnetic moment, and at a stronger ionization of these. All these changes lead at an increased affinity of the fuel’s molecules compared with other molecules and ions from their proximity, so, implicitly, compared with the oxygen in the air which ensures the fuel’s burning process which will take place at superior parameters.

The oxygen’s ability of being paramagnetic strong make it “searched” by the hydrocarbon breakage “ready” after being treated in a magnetic field. The result is that a more complete burn of the fuel blend takes place with an improved heating yield and with a notable reduction of the fumes eliminated in the burning process.

Our objective was the building of a magnetic system for the treatment in magnetic field of some of fuel liquid, so our team designed and created a magnetic system which magnets are set in such a way that they create some magnetic fields curtain, with banded directions, and the fuel liquid flows streamline in the magnetic devices’ area because of the plate shape of the pipeline, mentioning also that the entire system is set downstream from the burner.

The magnetic system (Fig. 1) creates some magnetic fields curtains A with banded direction that were obtained with the help of some permanent magnets 1 and 2, set banded N-S and S-N, the pipeline 4 not out of magnetic material(copper) through which the fuel liquid flows, is set at an equal distance from the magnets 1 and 2. The distance is set according to the fuel liquid’s flow in pipeline 4, the fuel’s nature and characteristics, and the usable parameters of the system’s permanents magnets.

In order for the stream lines inside a fluid, lines which define the flow of the fluid, to be parallel and to be in an angle of approximately 90 degrees with the magnetic field lines generated by the permanent magnets, advanced research in the field of fluid dynamics have been conducted.

In the case of a flow going through of a tube with an R radius circular section, the nature of the flow (laminar or turbulent) is determined by the value of a dimensionless measure, named Reynolds number [7], defined as:

$$Re = \frac{2Rv_m}{\nu}$$

where $\nu = \eta/\rho$ is the fluid’s factor of cinemetic viscosity, $\eta$ is the factor of dynamic viscosity, and $\rho$ the density.

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V_m is the fluid’s average flowing speed through the tube (the speed with which the fluid would flow through the tube, when the value of the speed is the same for all the tube’s sectional area points).

After computer simulation we have chosen a smart solution for disposing the problems concerning the nature of flow which largely depended on properties which characterized the treated fuel fluid by modifying the section from circular in an aplatisate elliptical shape (fig. 2) realized by hot plastic deformation (the material was melted through a thermal treatment of annealing, tempering and partial recrystallization at a temperature of 350 degrees/10-15minutes).
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This type of pipeline ensures a homogeneous and optimal magnetic treatment of the fluid, which at a molecular level provides a more facile break in the intermolecular cross-links as well as in their respective polar chains.

Table 1.

<table>
<thead>
<tr>
<th>Characteristics of permanent magnets</th>
<th>Remanent magnetic induction</th>
<th>Coercive field of magnetic induction $H_{\text{c}}$ [Oe]</th>
<th>Coercive field of magnetic polarization $H_{\text{p}}$ [Oe]</th>
<th>Magnetic field in the optimal operating point $H_{\text{op}}$ [Oe]</th>
<th>Specific magnetic energy $B_{\text{H}} [10^6 \text{ Gs Oe}]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. crt.</td>
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<td>1</td>
<td>3.625</td>
<td>2.650</td>
<td>2.985</td>
<td>1.720</td>
<td>3.30</td>
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The maximum admitted temperature for the magnetic system is the interval of -20 C - +100C. In this temperature interval, the system is not affected, and the reversible fluctuations of the magnetic induction in air gap do not exceed 0.2 % /°C.

In order to attain such magnetic fields, while taking into account the technical and economical reasons, we have chosen to utilize permanent magnets made of sintered hard ferrite Fe2O3BaO, with dimensions 48x24x14 mm(fig. 3).

The main characteristics of these magnets, resulted after being measured with a histerezisgraph, are presented in table 1.

Due to the aforementioned technical and economical reasons, the magnetic system cannot be set up in the furnace, as this is placed at a distance of approximately 0.5-1 m upstream from the burner, and under certain special conditions the system needs to be protected by special protection shields(fig. 4). We could have used magnets RE-PM with $B_{\text{H}}=5-12 \text{ KOe}$, but these magnets are almost 1000 times more expensive.

For the polar parts needed to shape the magnetic field feeds, we did not use materials with pemendur (Bs=23.5 KGs) which is very expensive( 30$/Kg), we selected cheaper materials, the drop in the magnetic saturation was compensated by an intelligent technical solution in the conception of the magnetic circuits.

The need for protection and the stability when the magnetic systems were working, as well as avoiding accidents required a building solution that couldn’t be disassembled.

3. Conclusions

After testing, it resulted that through magnetic field treatment of the fuel liquids upstream from the burner, the heating randament is improved with almost 8-10% as well as the fuel liquid consume drops with 5-10% and the subsequent drop in the fumes eliminated as an effect of improving the burning process.
Moreover the change of the pipeline’s shape has as an effect the change of the type of flow of the fuel liquid in that area, from disorderly to streamline, creating an even greater increase of the effect of the magnetic field on the fuel liquid which is treated before it gets to the burner.

Fig. 5

In conclusion we can say that the original constructive solution taken for the magnetic system for treating liquid and gaseous fuels(fig. 5) in alternating curtains of magnetic fields, is the response to all the requirements to touch our purpose which is increasing heating yield and reducing the eliminated fumes.

These magnetic systems with the changes they require can be used for small capacity burners as well as in power plants, in which the advantages of the system are considerable increased from both an ecological point of view and an economic one.

Ongoing research on this topic will highlight other aspects that will be communicated in other scientific papers.

4. References

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