The Quantum Energy Saver design and Fuel-saving application

Xiong Fang¹, Wenwu Mao², Xisheng Shen¹, Jianyu Li¹, Wenchao Huang¹ and Zhixin Chen¹

¹ Fishery Machinery and Instrument Research Institute, Chinese Academy of Fishery Sciences Research Laboratory of marine fishing vessels and equipment, Shanghai, China
² School of Engineering, Shanghai Ocean University, Shanghai, China

Abstract: In order to reduce the high fuel consumption of the shipping industry, a new type of quantum energy saver device is studied and developed. According to a period of time to use the energy saving device and the users’ feedback, by recording the fuel consumption of diesel engine usage, and comparing the changes in fuel consumption before and after the installation of quantum economizer in the same ship, it can reflect the ability of the fuel consumption. After analyzing the data, it shows that the installation of quantum economizer can significantly reduce the fuel consumption of a diesel engine ship. The analysis and application of this paper can play an important role in saving energy and reducing consumption, and provide a reference for other related research.

1. Introduction

Now shipbuilding industry is very important, it has a direct connection to the 97 industries in the national economy, which provides important equipment for our country's energy transportation, international shipping and ocean development; it is also a very important industry chain in the national economy. The marine diesel engine is the heart of the ship, if it has characteristics of reliable quality and low energy consumption, it will provide a huge driving force to make China’s shipbuilding industry develop more quickly, healthy and continuously.

In modern shipbuilding industry, fuel and oil fees accounted for about 50%-60% of the whole cost, even more. With the reducing of the oil production of the whole world and oil price rising, it makes high cost of enterprise operation. In order to save energy and reduce the cost, the actions have been taken by most of the shipbuilding factories. Such as using low price oil and improving featuring cost. [1, 2] In this paper, by the research and application of a new type of quantum economizer, to achieve injection system to reduce fuel consumption. But the methods above are unreliable and it also increase the diesel engine manufacture the purpose of saving energy and reducing consumption.
2. Quantum energy

In 1900, the German physicist Max Planck found in the research of electromagnetic radiation energy distribution: The emission and absorption of electromagnetic waves are not continuous, but one by one. Everyone has energy; the energy could be a multiple of an elementary unit:

$$\varepsilon_0 = h \nu$$ (1)

where $\varepsilon_0$ is energy, $h$ is Planck's constant, and $\nu$ is the frequency of the radiation. He called the energy unit which is the minimum and cannot be divided as energy quantum. When explain the distribution of the energy of the electromagnetic radiation, Planck first creatively put forward the concept of “quantum” and introduce the Planck’s constant; There are more than 100 years when “quantum” was firstly introduced. Further research shows, in the micro field, some physical quantities are also jumping in the smallest units, not continuous, and the smallest units are called the quantum of the physical quantity. Such as: energy quantum, light quantum, flux quantum, sound quantum and etc [3].

In the composition of the universe, there are different levels of the smallest units, such as: all kinds of molecules, atoms, neutrons, protons, electrons, etc. In the range of $10^{-10} m$ and smaller scale, the material movement has obviously shown "quantized" characteristics. And in which, the Planck constant always plays an important role.

At the end of the 19th Century, scientists tried to understand the micro world classical mechanics and macro view, but they failed, which reflected the contradiction between people's subjective understanding and objective reality. In order to solve this contradiction, the only way is to change the view of microscopic particles and get knowledge from practice. From the classical physics, we know that all microscopic particles have the property of the particle and the property of the wave. In 1905, the German physicist Albert Einstein's (1879 - 1955) introduced the concept of quantum and photons and also put forward the “wave-particle duality” of the light. The concept of particle are mutually exclusive, but in a unified entity and it is shown by De Broglie equation

$$\lambda = h / p$$ (2)

The De Broglie wavelength is the wavelength, $\lambda$, associated with a massive particle and is related to its momentum, $p$, through the Planck constant, $h$ [4].

Entire quantum mechanics is based on the concept of wave-particle duality and uncertainty relationship is very important. When it is out of the accuracy which is ruled by uncertainty relationship, we can follow the classical laws, otherwise, follow the quantum laws. Therefore, the uncertainty relation is the boundary of quantum mechanics and classical mechanics; it reflects the process from quantitative change to qualitative change.

3. Quantum technologies

Quantum theory has been perfected and developed from theoretical research to practical application. This kind of wave can be stored in different carrier by the laser sintering machine, which makes it produce energy value in different applications. Materials which have been conversed by quantum energy create billion/sec supermicro wave in the effect of light, force and heat. When the liquid flows
through the quantum pipe, hydrocarbon chains are rearranged into a long molecular chain, which greatly improves the combustion and explosion, so it can reduce the fuel consumption.

4. Designs and application

4.1. Structure of quantum economizer

The new quantum economizer is a cylinder which is combined with two symmetrical quantum tile pipes. There are two grooves on both sides of the cylinder and it can be fastened in the middle. Grooves and fasten are used to fix the cylinder on the oil pipe, so fluid can flow through the pipe and affected by the cylinder. The tile tubes are used to enhance the physical and chemical properties of the fluid in the pipe and reach the aim of high efficiency and optimization. Structure is shown in Figure 1.

![Figure 1. Structure of quantum economizer](image)

4.2. Application on fishing vessel diesel engine

4.2.1. Using objects and operating conditions. In ship industry, fishing vessels has great influence on the ecological environment and highly depend on resources and energy. Fishing vessel is the most traditional and popular fishing platform, both sea farming and sea fishing, and it is driven by diesel engine. According to incomplete statistics, the number of existing fishing vessels in the country is about 1.06 million, accounting or 1/4 of the total number of fishing vessels in the world. [5] So it is a hot topic in the field of fisheries environmental protection for the diesel engine energy saving and consumption reduction. All relevant research institutions have focused on it and hope to have breakthrough. So we also put the fishing vessel diesel engine as the test object to verify the energy saving effect of quantum economizer.

The test fishing vessel is belong to Guangdong Lufeng Kundu ecological Co., Ltd. Ship No. “Yuelufeng 51103”, Length: 18.3m, Width: 3.8m. The operation mode is single towing. The parameters of the engine “Jina”: Power: 111.8KW, 1500rpm, single engine, single propeller, reduction ratio: 4:1.

Sailing speed is 7-7.2nmi/h, engine speed 700rpm, it depends on wind, flow and wave. When trawling, ship speed is 2.9-3.1nmi/h and it depends on wind and wave in fishing area. Shown in figure 2 and 3.
4.2.2. Verification. The main part of the fuel consumption of the fishing vessel is used for navigation and production, accounting for more than 95%, other operations such as nets out and in, account for little time, fuel consumption can be ignore, so the test use the data of whole fuel consumption and voyage time, calculate the average fuel consumption per hour. Every normal voyage operating time does not exceed 24 hours; other abnormal voyage is not included in the calculation.
4.3. Application result

Before installing the economizer, the fishing vessel has been in operation for 36 months, in normal voyage, the average fuel consumption is 7.6kg/h. After installing the fuel economizer, fuel consumption dropped to 7kg/h, average oil saving is 0.6kg/h, fuel saving effect is about 9.1%. Data is shown in table 1.

In the test of the ship vessel engine, quantum economizer has obvious effect on fuel saving. There are no negative impacts and accidents in the test, the engine operated in good condition and the quantum economizer ran stably.

| Time | Total fuel consumption (kg) | Time (hour) | Average fuel consumption (kg/h) |
|------|-----------------------------|-------------|-------------------------------|
| 1    | 108.7                       | 15          | 7.25                          |
| 2    | 128.2                       | 18          | 7.12                          |
| 3    | 149.8                       | 22          | 6.81                          |
| 4    | 139.6                       | 20          | 6.98                          |
| 5    | 140.8                       | 20          | 7.04                          |
| 6    | 122.4                       | 17          | 7.2                           |
| 7    | 149.2                       | 22          | 6.78                          |
| 8    | 131.5                       | 19          | 6.92                          |

5. Conclusion

According to the application above, use of new quantum economizer can obviously save energy and reduce fuel consumption. Conclusion can be drawn by analyzing the data: the time on the sea is longer, the average fuel consumption is lower.

Focus on the problem of high consumption of vessel diesel engine; design the new quantum economizer by the research of quantum theory. There are many advantages such as simple structure, convenient to install and there is no negative impacts.

If the new quantum economizer can be promoted to the shipbuilding industry and all diesel engines install energy economizer, it can save nearly million tons of fuel and billions of cost. Also make the industry develop more healthy and sustainably.

References:
[1] J.Z.Wang and J.Cheng 2010 ship & ocean engineering 39 74-75.
[2] J.J.Cao and B.Guo 2015 Fishery Modernization 42 (5) 54-56
[3] R.X.Yu and H.T.Chen 2013 Electronic Design Engineering 21(14) 15-16
[4] J.H.Gong and J.F.Gao 2006 Journal of Teaching and Management 12 99-100
[5] J.H.Zhang, J.L.Ding and H.Liu 2015 Fishery Modernization 42(5) 69-72