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Oleksii Puzik[1]
Gennadii Zaionchkovskyi
Taras Tarasenko[2]

EXPERIMENTAL TEST-BENCH FOR RESEACHING PROPERTIES OF FUEL-LUBRICANT MATERIALS

National Aviation University
Kosmonavta Komarova avenue 1, 03680, Kyiv, Ukraine
E-mails: [1]oleksii.puzik@gmail.com; [2]nauggs18@ukr.net

Abstract. *Was founded that problem of cavitation technologies based on throttles is little known. Proposed designed and produced experimental test-bench for using, which can exploited for diagnostics properties of working fluids through the analysis of cavitation pressure fluctuations*.

Keywords: cavitation outflow, fuel-lubricant materials, nozzle.

1. Introduction

Cavitation is fundamental problem in hydraulic drive, the cause of which is the property of the liquid take only compression tension. Synchronically decades of research on this phenomenon by scientists allowed to develop hundreds of procedures for fuel, chemicals, petroleum refining sectors of the economy that uses cavitation as a physical phenomenon for solving surface cleaning. Mixing diverse liquids and diagnosing changes in their properties (Patent…10.04.2008; Patent…2009; Patent…10.11.2008). Especially neglected is the direction of diagnosing of fuel-lubricant materials, a special place in which is occupied by determining the total content of water in aviation fuels.

Urgency of the development of this issue is due to the danger of the transformation of dissolved water, which is in intermolecular space of fuel, the ice crystals and further knock them filters with subsequent stop of engines.

No less important is the lack of opportunities with the help of the methods used to determine dissolved water in aviation fuels, even summarily with a free.

The main way to prevent the formation of ice crystals directly into the aircraft tanks is adding Unwatercrystallization (UWC) liquids, but should emphasize no control quantity fusion along with free water settled UWC liquid. Thus less than the required number of UWC liquid can not prevent the formation of ice crystals from dissolved water and therefore be ineffective.

View of physical nature of the flow cavitation process in hydraulic and fuel systems are often the basis of functional cavitation devices responsible use of diverse throttle nozzle.

2. Analysis of publications

Research hydrodynamic characteristics of throttles, which is the initial phase in choosing the optimal geometry of the throttle can be found in literature, particularly the works of by I. Fedotkin (1998), E. Arzumanov (1978).

Most attention to the problem of determining water content in the fuel is still paid to chemical and physico-chemical methods, as evidenced by GOST 2477-65 or GOST 8287-57 and (Instruction…2006).

To develop a fundamentally new hygrometric method before authors faced the task: to design and manufacture advanced experimental research stand.

Purpose of the work is to substantiate advantages of the proposed experimental test-bench for studying properties of fuel-lubricant materials.

3. Results

To perform tasks designed an experimental test-bench, principal hydraulic scheme is shown in Fig. 1.

As a source of pressure of forcing line *14* is used piston rotary hydraulic pump driven by performance pressure NP43M-1.

Liquid pressure at the inlet to explored nozzle *10* is regulated by changing the spring tension force regulator pump. The required pressure at the outlet of explored nozzle set by throttle valve *8*. Pressure at the inlet and outlet of the nozzle controlled by manometers *12* і *9*, the liquid temperature control by thermometer *13*. Consumption of working liquid is determined by measuring tank *6*.

Liquid flow switching to measuring tank occurs with electromagnetic tap *7*. Working liquid from the tank *6* is pumped to spending tank *2* by paging pump *5*.

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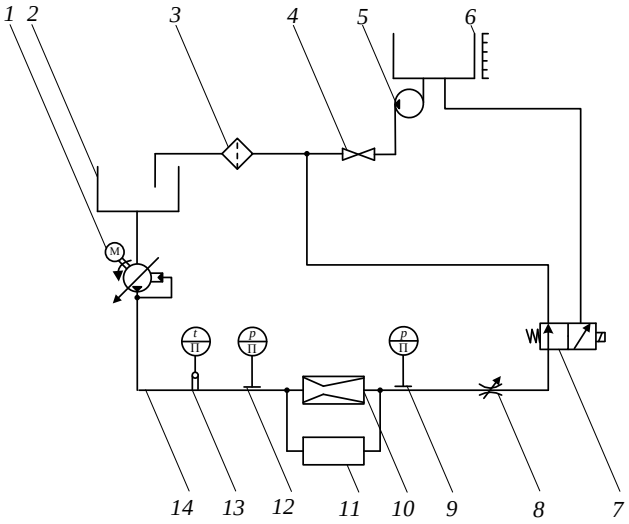

Fig. 1. Principal hydraulic scheme of experimental test-bench for research working parameters of functional cavitation devices:
1 – pump;
2 – spending tank;
3 – filter;
4 – tap;
5 – paging pump;
6 – measuring tank;
7 – electromagnetic tap;
8 – throttle tap;
9, 12 – manometers;
10 – explored nozzle;
11 – measurement unit;
13 – thermometer;
14 – forcing line

Pump is outtank motorized centrifugal, model 463, capacity is 4000 l/h, rotation frequency is at least 7000 min^{-1}. To prevent leakage from measuring tank for draining through pump used tap *4*. Cleaning of working liquid is carrying by filter *3*.

A significant difference of the proposed construction is foreseen possibility to connection the measuring unit *11*, which allow recording experimental data directly to a computer for further processing.

In Fig. 2 shows a variant of configuration of the measuring unit *11*, proposed by the authors. This scheme advisable to apply when performing tasks similar to those described above, which involve the analysis of working liquid parameters change after the influence of physical effects such as hydrodynamic cavitation. Sensors LH-601 *2* і *6* through the channels *3* and *5* transmit a signal to register, whose role carries USB-oscilloscope *4*. Recorded signal is transmitted to a computer *1* with necessary software.

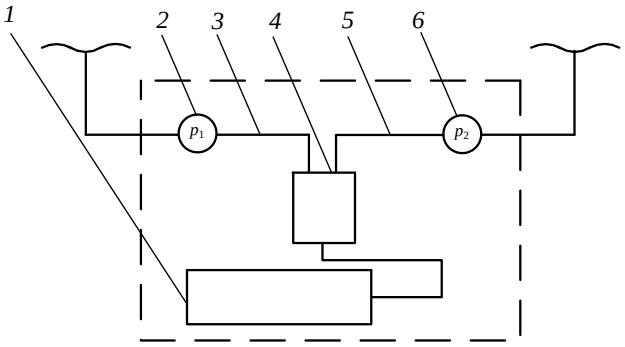

Fig. 2. Principal scheme of the measuring unit of experimental test-bench for research working parameters of functional cavitation devices
1 – computer;
2, 6 – sensors LH-601;
3 – first channel of transmitting parameters;
4 – USB-oscilloscope;
5 – second channel of transmitting parameters

In Fig. 3 depicts spectrum cavitation fluctuations of pressure fuel TS-1 depending on the total water content in it.

4. Conclusions

1. Experimental stand allows to diagnose condition lubricants by Analysis of cavitation fluctuations of pressure.

2. Feature of stand is the ability to instant recording useful information on the computer, which greatly reduces the impact of human factors on the adequacy of the results.

3. Was found that the spectrum of cavitation fluctuations of pressure fuel TS-1 significantly differ from the total water content.

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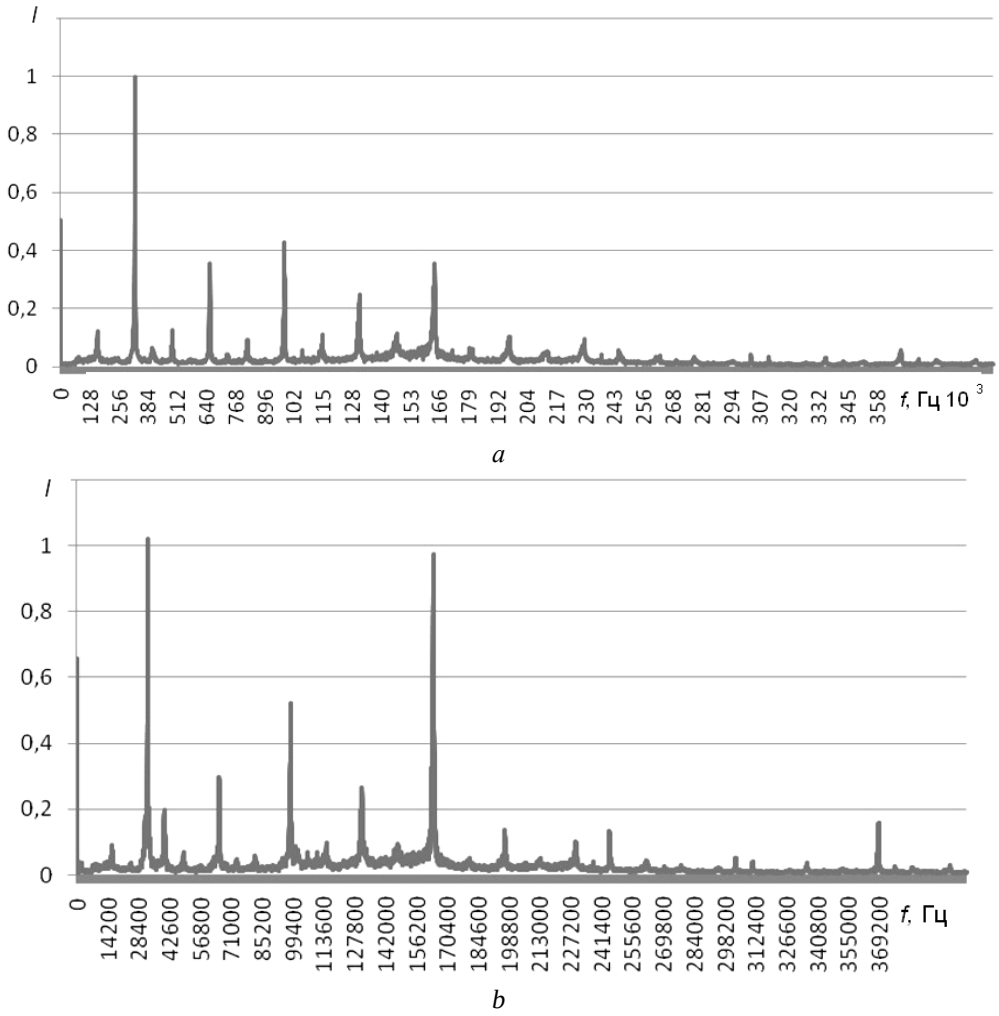

Fig. 3. Spectrum cavitation fluctuations of pressure fuel TS-1 with different water content:
a – 0,006 %;
b – 0,032 %

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О.С. Пузік[1], Г.Й. Зайончковський, Т.В. Тарасенко[2]. Експериментальний стенд для дослідження властивостей паливно-мастильних матеріалів
Національний авіаційний університет, проспект Космонавта Комарова, 1, Київ, Україна, 03680
E-mails: [1]oleksii.puzik@gmail.com; [2]nauggs18@ukr.net

Спроектовано і виготовлено дослідний гідравлічний стенд для вивчення зміни параметрів робочої рідини після впливу гідродинамічної кавітації. Обґрунтовано використання стенда для діагностування паливно-мастильних матеріалів. Проаналізовано зміну спектра кавітаційних коливань тиску.
Ключові слова: експериментальний стенд, кавітаційне витікання, насадок.

А.С. Пузик[1], Г.И. Зайончковский, Т.В. Тарасенко[2]. Экспериментальный стенд для исследования свойств горюче-смазочных материалов
Национальный авиационный университет, проспект Космонавта Комарова, 1, Киев, Украина, 03680
E-mails: [1]oleksii.puzik@gmail.com; [2]nauggs18@ukr.net

Спроектирован и изготовлен опытный гидравлический стенд для изучения изменения параметров рабочей жидкости после воздействия гидродинамической кавитации. Обосновано использование стенда для диагностирования горюче-смазочных материалов. Проанализировано изменение спектра кавитационных колебаний давления.
Ключевые слова: кавитационное вытекание, насадок, экспериментальный стенд.

Puzik Oleksii (1988). Postgraduate student.
National Aviation University, Kyiv, Ukraine.
Research area: cavitation.
E-mail: oleksii.puzik@gmail.com

Zaionchkovskyi Gennadii (1937). Doctor of Engineering. Professor.
Hydraulic-gas Systems Department, National Aviation University, Kyiv, Ukraine.
Education: Kyiv Institute of Civil Aviation Engineers (1967), Ukraine.
Research area: driving systems.
Publications: 100.

Tarasenko Taras (1978). Candidate of Engineering. Associate Professor.
Hydraulic-gas systems department, National Aviation University, Kyiv, Ukraine.
Education: Kyiv international university of Civil Aviation (2001), Ukraine.
Research area: cavitation phenomenon and technologies.
E-mail: nauggs18@ukr.net