

MODULE FOR COLD BLENDING OF LUBRICANT MATERIALS AND CUTTING FLUIDS

FIELD OF THE INVENTION

The invention relates to the field of producing lubricant materials, and specifically to a device for initiating cavitation and bringing about the process of cold blending of base oils and additives to produce lubricant materials, namely commercial oils and cutting fluids (CF).

BACKGROUND OF THE INVENTION

There is information about the oil blending device which is described in WO 2008/016937 A2, published on 07.02.2008. The prior art device includes an oil and fluid supply unit to supply the above fluids to the accumulating tank, a pump for oil and fluid pumping, a cavitation chamber and a drain channel for the finished mixed product.

There is a disadvantage of the prior art device that it is able to blend finished products, but is unable to blend base oils and additives to produce finished lubricants (industrial oils) and cutting fluids (CFs). There is another disadvantage of the prior art device that it is configured to do blending operation only under a high temperature, which means that the components should be pre-heated up to +60C.

The closest equivalent to the claimed invention is the device for producing liquid mixtures which is described in RU 131 310 U1 published on 20.08.2013. The device claimed in the closest equivalent includes a housing with the plates located inside this housing, transversally to the flow direction, the plates have holes, and the equivalent diameter of holes in each of the subsequent downstream plates is smaller than in the previous one. Wherein behind the last downstream plate there is an additional plate made of solid porous material.

There is a disadvantage of this closest equivalent that the cavitation process requires the mixture to be heated prior to mixing, and it is impossible to mix complicated components to produce cutting fluids (CFs). The obvious difference is the absence of planar channels and combination of planar and cylindrical channels to ensure high mixability.

SUMMARY OF THE INVENTION

The object of the claimed invention is the development of a module for cold blending of lubricants and cutting fluids which is able to ensure high quality of mixture homogenization under the temperature of blending up to 20-30°C.

The technical result of the invention is that of increasing the uniformity of homogenization, increasing dispersion, and reducing energy consumption during the blending of base oils and various additive packages.

The said technical result is achieved by introducing a module for cold blending of lubricant materials and cutting fluids comprising a housing, a supply unit for blended components and a withdrawal unit for blended components, wherein at least two entirely metal blocks comprising cylindrical and planar through-channels are sequentially arranged in the housing, and the active blending zone is situated between adjacent blocks

Each block comprises 4 planar channels with the channel height growing narrow, from the beginning of the channel across its whole length, which is equal to $\frac{3}{4}$ of the channel length.

The planar channels in each block are located at equal distances from each other, and 5-7 mm away from the edge of the block.

The cylindrical channels in each block are located at equal distances from each other and inside the perimeter which is formed by the planar channels.

The diameter of the cylindrical channels is constant.

The first block has not less than 4 cylindrical channels.

Each subsequent block has two more cylindrical channels than the previous ones.

Each subsequent block has cylindrical channels with the smaller diameter than the previous ones.

A pressure sensor is located at the supply unit for the blended components.

A viscosity gauge is located at the withdrawal unit for the finished product.

BRIEF DESCRIPTION OF THE DRAWINGS

It will be easier to understand the essence of the invention from the description, which is not restrictive and is given with the reference to the attached drawings wherein the following figures are depicted:

Fig. 1 - longitudinal section of the module

Fig. 2 - transversal section of the module

Fig. 3 - tank for components mixing with the cold blending unit

1 - entirely metal block; 2 - planar channel; 3 - cylindrical channel; 4 - active blending zone; 5 - supply unit for blended components; 6 - withdrawal unit for finished product; 7 - pressure sensor; 8 - viscosity gauge; 9 - cold blending module; 10 - tanks; 11 - pump; 12 - strain gauge.

DETAILED DESCRIPTION OF THE INVENTION

A module (9) for cold blending of lubricants and cutting fluids, comprising a housing, a supply unit (5) for the blended components, a withdrawal unit (6) for the blended components, wherein in the housing, at least, two entirely metal blocks (1) are sequentially arranged, comprising the through-going cylindric (3) and planar (2) channels, wherein the active blending zone (4) (a cavitation chamber) located between the adjacent blocks (1). The module has up to six entirely metal blocks (1).

Each block (1) comprises 4 planar channels (2) with the channel (2) height growing narrow, from the beginning of the channel (2) across its whole length, which is equal to $\frac{3}{4}$ of the channel length. The planar channels are rectangular- or oval-shaped, with the width of 7-10 mm and the height of 1.5-5.0 mm. Wherein from the beginning of the channel across the whole length $\frac{3}{4}$ of the channel, the channel height will be reducing (the channel will be getting narrower), and after this height reduction the channel will be getting wider again (to reach the value of height equal to one in the beginning of the channel), wherein the channel height across the length $\frac{3}{4}$ of the channel will be 0.5-4.0 mm.

The planar channels (2) in each block (1) are located from each other at equal distances, and 5-7 mm from the edge of the block (1).

The cylindrical channels (3) in each block (1) are located at equal distances from each other and inside the perimeter which is formed by the planar channels (2).

The diameter of the cylindrical channels (3) is constant.

The first block (1) has not less than four cylindrical channels (3), but it is recommended to have not less than eight cylindrical channels (3). The maximum number of cylindrical channels (3) in the first block (1) is at least 10 channels. The diameter of cylindrical channels (3) in the first block (1) is 1.5 - 1.7 mm.

Each subsequent block (1) has two more cylindrical channels (3) than the previous ones.

Each subsequent block (1) has cylindrical channels (3) with the smaller diameter than the previous ones. Each subsequent block (1) has cylindrical channels (3) with the diameter which is 0.2-0.25 mm smaller than those in the previous block (1).

A pressure sensor (7) is located at the supply unit (5) for the blended components.

A viscosity gauge (8) is located at the withdrawal unit (6) for the finished product.

The module (9) has an automated control system with integrated software. The cold blending module (9) with 2 entirely metal blocks (1) operates as follows: The cold blending module (9) is connected to the tank (10) with two pipelines, one of them is connected at one end with the tank bottom, and at the other end - with supply unit (5) inlet of the blended components, the second pipeline is connected at one end with the upper part of the tanks, and at the other end - with withdrawal unit (6) outlet of the blended components, forming a closed circuit, wherein the pump (11) is located inside the first pipeline. Then, the tank for accumulation of blended components is filled in, following the prescribed volumes of mixed components (see Table 1), for example, two base oils Brightstock and SN500, two additives - ADD1 and ADD2 PPD. After the tank is 30% full, the level inside the tank (10) is monitored with a strain sensor (12), the software actuates the cold blending module (9) to operate in a pre-blending mode, when the pump is running at 50% of its operational power and passes the components through the cold blending module (9) during 10-15 minutes under 20-30°C to ensure uniform distribution of additives throughout the whole volume of base oils. When operated in this mode, the software is controlling over the frequency converters within a range of 0-30 Hz to manage the pump (11) motor rotation.

Table 1

No	Components	kg	% proportion
1.	Brst Base Oil	1,725	28,75%
2	SN 500 Base Oil	2,949	49.15%
3	ADD1 package	1,320	22.00%
4	ADD2 PPD package	6	0.10%
TOTAL		6,000	100.00%

After the right volume of all the components has been supplied to the tank (10), the strain sensor (12) generates the signal that the tank loading is finished, and the software switches the cold blending module (9) to main operational mode when the speed of supplying the flow of components is increasing, as well as the pressure in active blending zones (4) to the cold blending module (9). When the cold blending module (9) is operated in the main blending mode, the pump supplies the components through the first pipeline to supply unit (5) for the blended components of the cold blending module (9), then the flow of components at a high speed passes the cylindrical (3) and planar (2) channels to reach the active blending zone (4) (a cavitation chamber), wherein billions of tiny bubbles collapse and cause a number of micro-bursts to provide for molecular-level blending of organic components. After the cavitation chamber (4) the flow of components at a high speed passes the cylindrical (3) and planar (2) channels and goes out through the withdrawal unit (6) for the blended components of the cold blending module (9) and through the second pipeline it is supplied back to the tank (11). Therefore, the components mixing process is operated inside the closed circuit: the tank (10) - cold blending module (9) until the viscosity gauge generates the signal that the mixture has stable viscosity indicators and homogeneous. After the main blending mode is completed, the software automatically deactivates the pump (11) and the finished product is pumped to the tank or is immediately supplied to a packaging line, or samples are taken for analysis. To provide for the necessary flow speed and pressure in active blending zones (4) the software aligns the settings of the frequency converters within the range of 0-50 Hz to manage the rotation of the pump (11) motor. A pressure sensor and a viscosity gauge allow the software to track the necessary signals and regulate the frequency of the pump motor rotation to ensure the right speed of the flow for the efficient cold blending process.

Integration of both cylindrical (3) and planar (2) channels in the design of the module increase the flow speed inside the module to provide for the necessary conditions for efficient mixing of

the components in active blending zones and achieving a high level of homogeneity during a short period of time and without extra heating.

Active blending zones (4) provide for higher dispersity, improved efficiency of blending processes and components homogenization under 20-30° to reduce power consumption.

Therefore, the claimed invention is to improve the homogenization smoothness, dispersion and reduction of energy consumption during mixing the base oils and different additive packages.

The invention has been disclosed above with reference to a specific embodiment. To those skilled in the art, there are other embodiments of the invention may be obvious, which do not change its essence, as disclosed in this detailed description. Accordingly, the invention should be considered limited in scope only by the following claims.

CLAIMS

1. A module for cold blending of lubricants and cutting fluids, comprising a housing, a supply unit for the blended components, a withdrawal unit for the blended components, wherein the housing includes, at least, two entirely metal blocks sequentially arranged as tandem and containing the through-going cylindric and planar channels, with the active blending zone located between the adjacent blocks.
2. The module according to claim 1, wherein each block comprises 4 planar channels with the channel height growing narrow, from the beginning of the channel across its whole length, which is equal to $\frac{3}{4}$ of the channel length.
3. The module according to claim 2, wherein the planar channels in each block are located at equal distances from each other, and 5-7 mm away from the edge of the block.
4. The module according to claim 1, wherein the cylindrical channels in each block are located at equal distances from each other and inside the perimeter which is formed by the planar channels.
5. The module according to claim 4, wherein the diameter of the cylindrical channels is constant.
6. The module according to claim 4, wherein the first block has not less than 4 cylindrical channels.
7. The module according to claim 6, wherein each subsequent block has two more cylindrical channels than the previous ones.
8. The module according to claim 6, wherein each subsequent block has cylindrical channels with the smaller diameter than the previous ones.
9. The module according to claim 1, wherein a pressure sensor is located at the supply unit for the blended components.
10. The module according to claim 1, wherein a viscosity gauge is located at the withdrawal unit for the finished product.