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TECHNOLOGY AND EQUIPMENT FOR FAST OIL AND ADSORBENT REGENERATION WITH APPLICATION OF HIGH-POWER HF ELECTROMAGNETIC FIELD

The method of adsorbent drying by electromagnetic field is presented. Technology and equipment for fast oil and adsorbent regeneration with application of high-power HF electromagnetic field are shown.

Key words: adsorbent, regeneration, UF electromagnetic field.

Introduction. It is well-known, that one of the most critical problems in hi-power transformers usage is connected to quality of transformers oil. During the transformer operation oil absorbs atmospheric moisture and its dielectric strength decreases. To reduce the water content in the oil it is pumped through the tank containing the adsorbent such as zeolite or silica gel. Adsorbent, which had lost sorption capacity, can be restored by removing the moisture via heating. The treatment of the adsorbent can be produced by its calcinations on metal sheets or heating in sealed containers at reduced pressure by heating coils. Using the first method leads to destruction of the adsorbent during its transfer from the adsorber and back. Disadvantages of the second method are: adsorbent carbonization near heating coils due to overheating and lack of adsorbent drying in the area away from heaters. This is a due to low thermal conductivity of the adsorbent. To eliminate the shortcomings of the second method authors propose a technique of heating and regeneration of the adsorbent by using the HF powerful electromagnetic field.

The aim of the article is observe briefly the method of adsorbent drying by electromagnetic field.

Description of technology. To accelerate the regeneration of the adsorbent we use drying at reduced pressure. Another advantage of this method is application of a cartridge for oil regeneration "adsorber") as drying capacity. Application of the universal cartridge allows reducing the loss of adsorbent during operations of loading and unloading. Proposed cartridge (1), on figure 1, is a coaxial resonator. To enhance the distribution of the electromagnetic field, the center conductor (2) of the resonator is equipped with four bedded ribs (3). With such a construction the field distribution and, consequently heating of the substance becomes more uniform. Gates 7, 8 and 9 are used for the feeding and pumping of the oil in the cleaning oil mode of operation. In the adsorbent regeneration mode the vacuum pump has connected to those gates. Gates 10–12 are used for the emergency thermal control sensors connection. Mesh (4) prevents the adsorbent particles ingress into vacuum and oil pumps. Block (13) serves for matching of the output impedance of the generator to the input characteristic impedance of the cartridge.

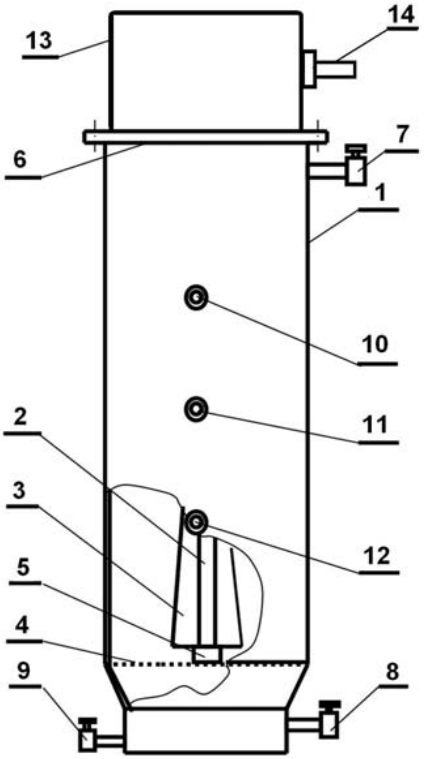

Fig. 1 – Universal regeneration cartridge
1 – external tube, 2 – center conductor, 3 – ribs for redistribution the electromagnetic field, 4 – filtering mesh, 5 – insulator, 6 – flange , 7-9 – oil and air gates, 10-12 – thermometer gates, 13 – device for electric matching, 14 – gate for UHF energy.

Modeling. To produce a uniform power distribution field modeling was carried out in specialized software.

Three were considered the embodiment: Non-ribbed (coaxial) resonator – the simplest variant; 4-ribbed resonator – *best RMS power distribution*; 8-ribbed resonator.

On fig. 3 can see the CAD model of this resonator. The shape of ribs allows matching an impedance of the resonator with the output resistance of the power generator.

Equipment for regeneration of transformer oil works on the two-cartridges scheme: one cartridge is used for transformer oil regeneration, second - for

adsorbent regeneration. After the regeneration of the adsorbent in the second cartridge, it replaces the first one in the scheme of recovery of the transformer oil.

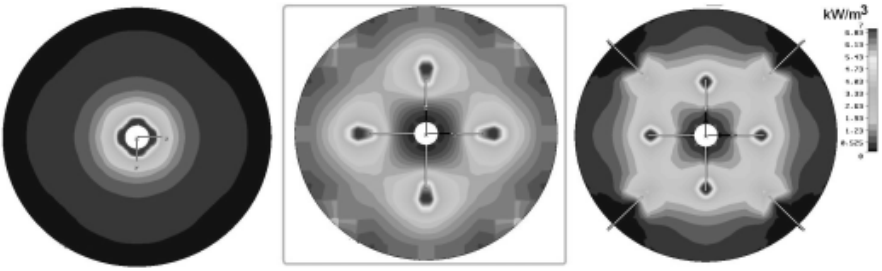

Fig. 2 – RMS power distribution in the different types of cartridges

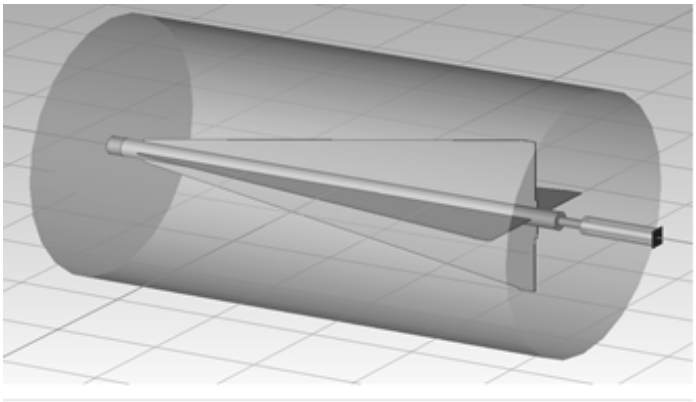

Fig. 3 – Cartridge for adsorbent regeneration

Industrial equipment. The construction of the universal cartridge presented on Fig. 1. Fig. 4 shows the outward of the device.

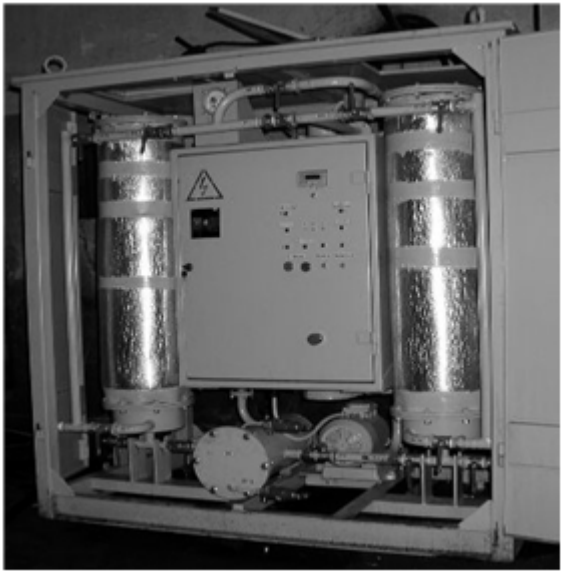

Fig. 4 – Industrial equipment for regeneration of transformer oil

Conclusion. The sorbent regeneration by proposed technique can increase the initial sorption capacity, prolong the life of sorbent, decrease a regeneration time and decrease the total energy consumption. Application of the presented technology and equipment allows to

- Increase the initial sorption capacity of the new zeolite in 15-20%
- Increase the number of cycles of zeolite usage from 3-4 to 8-10 (in comparison to the method of drying by heating coils).
- Decrease the time of regeneration from 15-16h to 7-8h (in comparison to the method of drying by heating coils).

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Представлен способ сушки адсорбента электромагнитным полем. Показаны технология и оборудование для быстрой регенерации нефти и адсорбента с применением мощных ВЧ электромагнитных полей.

Ключевые слова: сорбент, регенерация, ВЧ электромагнитное поле.

Представлений спосіб сушіння адсорбенту електромагнітним полем. Показано технологію та обладнання для швидкої регенерації нафти і адсорбенту із застосуванням потужних ВЧ електромагнітних полів.

Ключові слова: сорбент, регенерація, ВЧ електромагнітне поле.