

**PLANT FOR TRAPPING VAPORS OF OIL AND OIL PRODUCTS**

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The problem of emissions of oil and oil products is one of key questions in providing energy and ecological safety of the country. Much attention is paid to huge emissions of harmful vapors from oil and oil products and to losses of precious hydrocarbon raw material. At the same time annual nonrenewable losses of oil and oil products for Russia is equal mln ton. World statistical data state that the total loss of oil and oil products from evaporation varies in a range 0,5– 1,7% from the total volume of processed raw material.

While modern science and technology tend toward development and implementation of new alternative energy sources, oil is still the most important and widely used energy carrier all over the world.

Special attention should be paid to losses of oil products during technological processes. During storage, transportation, swapping, and application of oil fuels we can observe their significant losses caused by hydrocarbons evaporation.

Control of oil and oil products losses nowadays is stipulated by will to use hydrocarbon raw material more effectively. Oil products losses control is one of the most important ways to safe fuel-energy resources, which play leading role in economics development. Elimination of hydrocarbons losses in a result of evaporation may save up to 20% of oil products and money as well.

Problem forming negative impact of filling stations on environment is revealed much greater than comparing to other storages of oil products. It is explained in a following way: From one hand filling stations are displaced in large cities with high density of buildings and high concentration of motor transport; from another hand emissions at filling stations take place at height just 2 – 3 m above the ground. Independently on the source of loss hydrocarbons get into the atmosphere, they negatively influence environment and human health in particular.

Known that from the moment of tank truck filling with oil product at petroleum storage depots up to its distribution in fuel tanks of auto transport at filling stations it is lost 0,64% of fuel in a result of evaporation [1].

Losses at filling stations take place during filling-discharge operations in reservoirs (“big breathing”), fuel storage in reservoirs (“small breathing”), filling of auto transport fuel tanks through fuel distribution pump and also in a result of spillages and disturbances in hermiticity of pumps, refueling hoses, absence of tightening gaskets [2].

Situation with emissions of oil and oil products is intensified by significant deterioration of equipment, which is used in oil and gas industry. Only small part of tanks is equipped with pontoons and floating roofing. Park of railway and truck cisterns and filling discharge equipment is already out of date as well.

Gasoline needs to evaporate easily to burn properly in an internal combustion engine. But this property also means it evaporates easily into the atmosphere at ordinary temperatures and pressures.

Fuel losses from evaporation (natural losses) lead to worsening of fuel exploitation characteristics, such as triggering and antiknock stability, which limits technical resource of engines of transport means. Damage, made by these losses, is not only decrease of fuel resources quantity and cost of losing products, but it is also negative ecological consequences, which are a result of environment pollution by oil products.

Hydrocarbon emissions react with other compounds in the atmosphere to produce photo-chemical smog. Hydrocarbons are a major source of motor vehicle emissions.

High concentration of hydrocarbons in air cause increased morbidity disturbances of respiratory system, functional changes of nervous system and other health disturbances. Considering the problem of oil products losses we came to conclusion that it concerns all spheres of human activity. That is why this problem requires a complex approach to its solution [1].

Invention relates to oil-and gas industry. Proposed plant comprises refrigerator, pipeline connected with tank vapor zone and refrigerator, pump, shutoff valves and accessories and connection pipelines. Note here that refrigerator is composed of vapor-air mix condenser communicated with refrigerator and comprises cylindrical body with outer heat insulation. Said body accommodates coaxial one or several hollow baffles composed of sleeves. Coolant pipeline is coiled outer surface of every said sleeve at staggered pitch to make vapor-air flow swirl to create centrifugal forces and optimum contact with cold surface. Ends of pipeline are rigidly fixed at bottom of said body having coolant inlet and outlet pipes, connected with refrigerator. Vapor-air mix condensate collection tank equipped with water header with drain valve. Pipeline with valve is connected to said tank to communicate the latter with pump of tank. Body top is tightly closed by cover fitted with vapor-air mix feed union to feed said mix from tank and union to discharge clean air to drain tank. Note here that refrigerator housing accommodates pressure and temperature gages connected with instrumentation and refrigerator control unit.

Effect: higher quality of oil products, better ecology [3].

Venting of such vapors is essential to prevent possible rupture of the storage tank due to the extremely high vapor pressure which can occur, particularly with relatively highly aromatic hydrocarbon fuels such as gasoline. However, it is also essential that the vapors be captured in order to avoid polluting the atmosphere in the vicinity.

Accordingly, the present invention provides a means of recovering such hydrocarbon vapors, and is particularly well adapted for use with stationary fuel storage tanks and the like, as commonly installed at refineries, tank farms, etc.

Thus, it is a principal object of the invention to provide an improved vapor recovery system for the recovery of volatile organic compounds, which vent from hydrocarbon storage tanks and the like. This invention is inexpensive, dependable and fully effective in accomplishing its intended purposes.

If we consider the advantages of installing plant from the economic side, of course, it saves a significant portion of money. It is very important to mention that well-known idiomatic expression "to throw money down the drain", and in our case – in the atmosphere. Generally, presenting this plant, we solve a number of problems, which are directly connected with the environment conditions of the city Krasnoyarsk and its residents. Given invention has been subjected to a number of experiments. The plant for trapping vapors of oil and oil products showed their true effectiveness, a few liters of gasoline were caught (tests have been carried out at zero environment temperature), otherwise hydrocarbons could simply evaporate harming ecology. It is significant to underline the fact that caught condensed vapors can be used as a high-grade fuel. Thus obtained fuel does not yield in terms of fuel produced by refineries. Moreover, this fuel exceeds the physico-chemical properties of fuel produced by refineries, because first of all the lightest fraction evaporate.

Today man is both master and slave of petroleum. We shouldn't only consume natural recourses, but to protect and save them for the future generations.

## References

- 1 Oil & Gas Vapor Recovery Systems | PetroGas Systems [Электронный ресурс]. Режим доступа: <http://petrogassystems.com/technology/vapor-recovery>.
- 2 Бронштейн И.С., Вохмин В.Ф., Губин В.Е., Ривкин П.Р. / Выбор технических средств для сокращения потерь нефтепродуктов от испарения из резервуаров и транспортных емкостей: методическое пособие / ЦНИИТЭнефтехим – Москва, 1969.-169с.
- 3 Пат. №2496559 РФ МПК В01D 53/75. Установка для улавливания паров нефти и нефтепродуктов. / Ковальский Б.И., Юдин А.В., Безбородов Ю.Н., Шумовский И.А., Рунда М.М. Опубл. 27.10.13.