MOBILE DEGASSING UNIT FOR TRANSFORMER OIL

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ABSTRACT OF THE DISCLOSURE

A self-contained mobile oil degassing plant which includes, on a single self-propelled wheeled vehicle, equipment for treating transformer oil, a self-contained heating system, providing heat for the oil heating equipment, an electricity generator, and a laboratory section in the vehicle equipped to carry out various tests on the oil and having a supply of hot water heated by the heating system.

This invention relates to the provision of a self-contained mobile oil degassing plant.

With oil filled equipment, for example transformers, it is proving necessary to provide larger transformers to keep pace with the increasing demand for electricity, and the transportation and installation of these transformers, if filled with oil, can raise many problems. Similarly the quality of the high dielectric oil must be maintained.

An object of the present invention is to provide a self-contained plant which will facilitate the necessary oil quality control and permit also "on-site" filling of the equipment which greatly facilitates the transportation and installation of the equipment.

According to the present invention there is provided a self-contained mobile oil degassing plant carried by a mobile wheeled vehicle for treating oil, including in series fluid communication, an oil inlet, a heat exchanger, a filter press, a degassing unit and an oil outlet, direct fired heating means, having its own self-contained fuel supply, providing heat through the medium of a heating fluid for the heat exchanger.

Preferably pumps are provided to pump the oil at selected points in the oil path, for example upstream of the heat exchanger and downstream of the outlet from the degassing unit.

Preferably the direct fired heating means comprises a liquid fuel fired boiler, for example an oil fired steam or hot water boiler.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a schematic plan of a plant according to the present invention, and
FIG. 2 is a schematic view of the wheeled vehicle carrying the plant.

The plant as a whole is mounted on a semi-trailer forming part of a large motor driven vehicle having a cab. The semi-trailer has a laboratory section and a plant section. The plant itself is designed to be self-contained and comprises a number of oil treating stages in series fluid communication. An oil inlet leads, through a self-priming centrifugal pump to a concentric tube heat exchanger and then to a filter press and finally to a two-stage vacuum degassing unit, before passing out through a pump the discharge of which is connected to an oil outlet.

The oil fired heat exchanger is provided by an oil fired high pressure hot water boiler, pressurised by nitrogen, having its own fuel supply tank and a generator being provided to drive a pump to pump the fuel to boiler burner.

As an alternative to the hot water boiler, the boiler can be a low pressure steam boiler, the steam pressure being arranged to be lower than the oil pressure. Different boiler heating systems could be used using other fluids as the heating medium for the heat exchanger.

The filter press is filled with paper filter sheets and serves to remove all dirt or other fouling particles of size larger than 1 micron, and it serves also as a trap for free water which may be entrained in the oil, thus to prevent temporary overloading of the following degassing stages. The paper filter sheets after soiling can, of course, be useful for examination of the dirt or other particles particularly to trace from where they came.

Filtered oil from the filter press is fed to the first vacuum stage of the oil degassing unit in which the pressure is reduced to about 30—40 torr, depending upon the water content, and where 95% or more of the dissolved air is removed. Thence the oil flows to the second vacuum stage of degassing unit where the pressure is reduced to under 1 torr and the water content of the treated oil is under five parts per million. At reduced oil feed rates it is possible to produce water contents in the order of one part per million.

Under normal conditions, transformer oil contains about 10% dissolved air by volume and a certain amount of water which has a marked effect on the dielectric strength of the oil. The extent to which water may be removed from transformer oil is dependent on the vapour pressure of water, oil and air, at a given temperature, and the optimum condition for water removal can be obtained using a low vacuum and a low temperature, the limiting factor being the tendency of the oil to froth which in practice gives a working minimum temperature of about 50°C at this temperature, the lowest vacuum that can be drawn is dependent upon the boiling point of the oil which is about 0.01 torr. Providing that an adequate surface of oil is exposed to the vacuum, this will give a water content of down to one part per million or less. It is important that the oil be exposed to the vacuum in thin films and not in small drops, and this has been achieved by towers (not shown) packed with pall rings, giving a total exposed surface of, in this instance, 800 square feet. The vacuum is drawn by two gas-ballasted pumps which have a water capacity of 4 lbs./hr, and this enables the plant to cope with an oil feed of 1,000 gallons per hour, the oil containing over 400 parts per million of water.

The finished oil passes out of the degassing unit through the centrifugal pump to an outlet which would be coupled to, for example, a transformer requiring to be filled with refined oil. Both the centrifugal pumps fitted with double Flexibax (trademark) seals, to prevent air or water leeking from the atmosphere into the oil in the pumps.

The plant is fully instrumented, all the instruments and controls being inside the semi-trailer, having ammeters, current meters and voltmeters to measure the current and voltage to the heating and other equipment, and a range of other gauges, including vacuum gauges and pressure gauges. Furthermore a rotameter is provided just upstream of the degassing unit and valve arrangements to permit bleeding are provided at 35 for the hot water or steam generated by the boiler and at 36 should the oil be at too high a temperature after passing through the heat exchanger.

The motor driven vehicle (FIG. 2) which carries the plant, also includes a laboratory section, as aforesaid, and this is equipped to carry out dielectric, Karl Fischer, gas content acidity determination and other tests.
3. A self-contained mobile oil degassing plant as claimed in claim 1, in which the direct fired heating means comprises a liquid fuel fired boiler.

4. A self-contained mobile oil degassing plant as claimed in claim 1, in which the degassing unit is in two vacuum stages, vacuum pumps being provided for the stages to reduce the pressure in the first stage to approximately 30–40 torr, and in the second stage to under approximately 1.00 torr.

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