

May 27, 1930.

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1,759,971

APPARATUS FOR CONTROLLING BREATHING OF OIL CONTAINING HOUSINGS

Filed Sept. 22, 1924

4 Sheets-Sheet 1

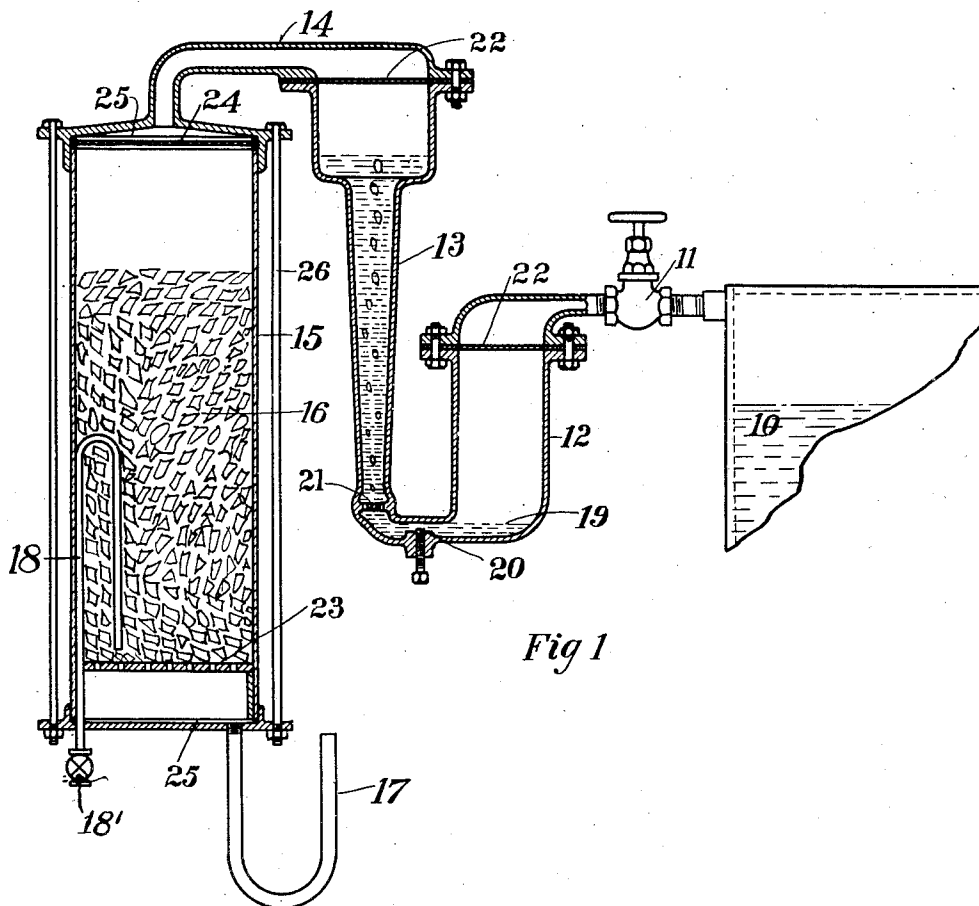


Fig 1

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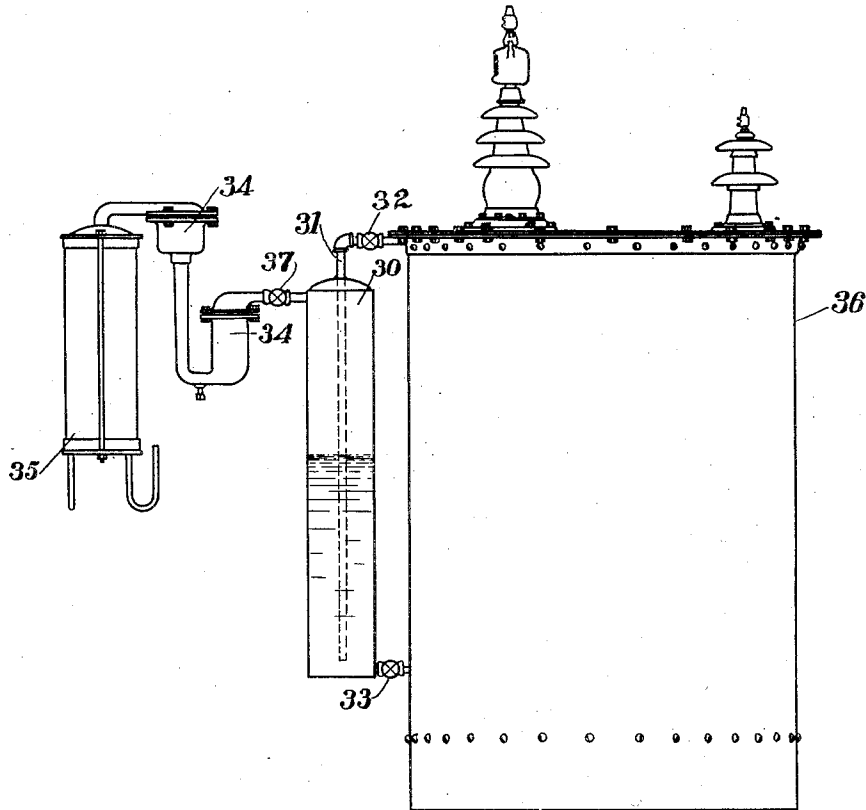


Fig 2

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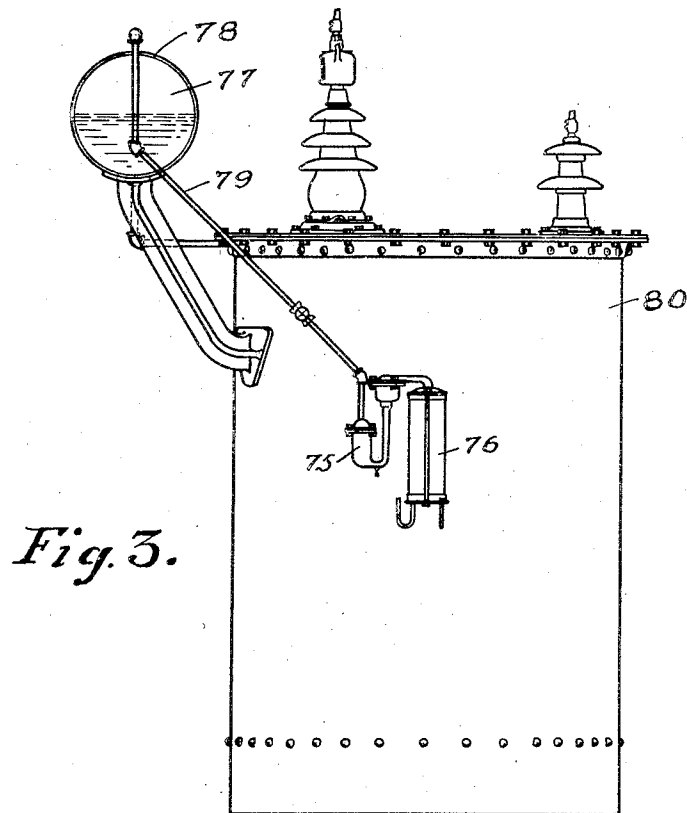
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Filed Sept. 22, 1924

4 Sheets-Sheet 3



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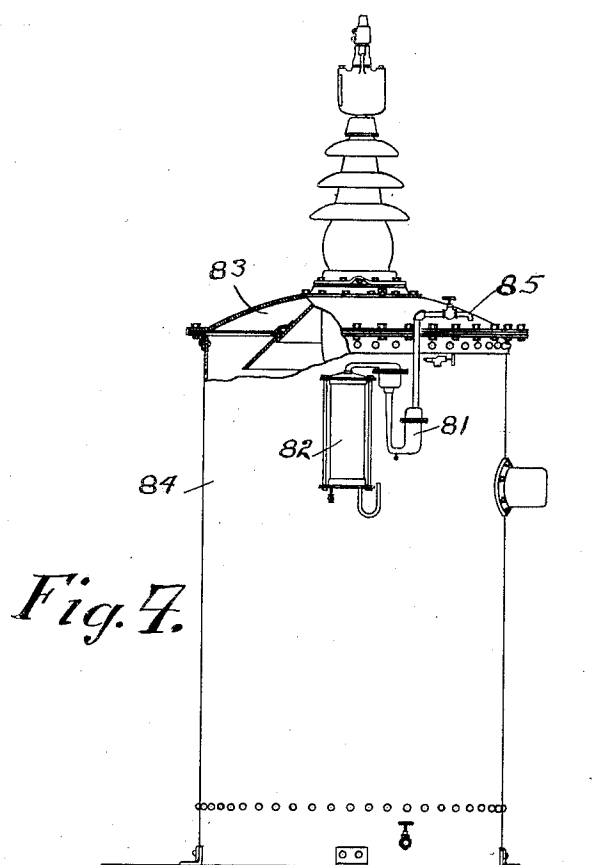
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APPARATUS FOR CONTROLLING BREATHING OF OIL CONTAINING HOUSINGS

Filed Sept. 22, 1924

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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APPARATUS FOR CONTROLLING BREATHING OF OIL-CONTAINING HOUSINGS

Application filed September 22, 1924. Serial No. 739,003.

This invention relates to apparatus for use in connection with housings for transformers, condensers, oil circuit breakers, or other apparatus where the dielectric strength of the oil is an important factor, and has for its object the provision of such apparatus which will control the breathing of air by such housings and restrict or prevent the entrance of moisture thereto.

The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawings and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawings—

Fig. 1 is the vertical section of one form of trap and dehumidifier forming a portion of the present invention;

Fig. 2 is an elevation of a transformer case having a pressure tank and trap connected therewith;

Fig. 3 shows the manner of applying the invention to a transformer housing having a conservator tank connected therewith;

Fig. 4 is an elevation showing the invention applied to a transformer tank having an air chamber in the top thereof.

In electrical apparatus containing oil, it is essential that the high insulating strength of the oil be maintained. This is exceedingly difficult where the oil is subjected to contact with air at normal atmospheric pressure. This is true even though a free circulation of air be prevented by a case which is nominally closed. Unless the case will withstand pressure and is tightly sealed, the expansion and contraction of the oil will cause a breathing action, drawing in fresh air when the oil contracts with the lowering temperature and discharging the air when the oil expands on a rising temperature. This is particularly true when the oil is rather cool at all times, such as in oil circuit breakers and electrostatic condensers or transformers operating with a small load. This may readily happen in the case of water cooled transformers where the load is reduced on the transformer and the cooling water allowed to remain on. This may cause a contraction in the oil with a consistent

drawing in of fresh air so that when the oil becomes cooler the air condensation readily takes place.

A small leak in transformers or other oil containing cases which are otherwise tightly sealed may cause trouble on a falling temperature due to condensation from the cooling of the incoming air. The expansion of the moist air coming in through the leak absorbs heat and tends to cause condensation.

It is the object of the present invention to eliminate these difficulties as far as possible. A large transformer case may draw in and discharge a considerable quantity of air, particularly where the temperature and height of the oil changes. If the fresh air carrying moisture comes in contact with the oil in the transformer or in a conservator tank, the dielectric strength of the oil will be reduced in time. If the breathing action can be greatly reduced or eliminated except at long intervals, the dielectric strength of the oil will tend to be maintained.

One method of accomplishing this result is shown in Fig. 1 in which 10 is an oil containing tank, housing electrical apparatus, the tank being connected through a pipe and valve 11 to one side of a trap 12. The other side 13 of the trap is connected by a passage 14 to a receptacle 15 containing a dehumidifying agent 16. The receptacle 15 is connected to the outside through an inverted syphon or trap 17 or by a breathing tube 18. When the oil in the tank 10 expands, the air above the oil will be compressed and if the valve 11 is open, pressure will be exerted on the surface of the trap fluid 19, which may be mercury or oil. This will cause the trap fluid to rise in the column 13 until air is forced through the opening or control valve at 20. The air will then rise in the column 13, pass over into the chamber 15 and escape through the breathing tube 18. If this tube is omitted, the air will force up the liquid in the trap 17 and escape. It is possible to provide a restricted opening at 20 or a baffle as at 21 having several small openings so that air cannot go out in a rush, displacing the trapping fluid entirely. By making these restrictions, small enough compared with the

cross-section of the trap, the air will go out in small bubbles and the effective height and pressure of the trap column will not be lost. If this is not done, the trap may have a tendency to blow. In order to prevent escape of the trapping fluid, either in handling or in operation, porous baffles 22 are used on each side of the trap. These baffles permit the passage of air, but may be used to prevent the passage of the trapping fluid which is highly advisable where mercury is used. These baffles may be made of felt, blotting paper, chamois, or other material, preferably backed up with a wire screen or perforated metal to provide mechanical strength.

Although the trap may prevent breathing with slight changes in temperature or pressure within the case, it may not be advisable to prevent passage of air under extreme conditions. This may be regulated by the height of the vertical columns composing the trap and by the weight of the fluid in the trap. As shown in Fig. 1, the trap is designed to relieve the difference in pressure when the pressure inside of the tank or case becomes slightly below atmospheric pressure.

If the arms of the trap in some instances are found to be too long as in the case where a light fluid, such as oil, is used, several traps may be used in series to obtain the desired pressure. To obtain dry air at all times, it is advisable to take the incoming air through a chamber which will take out the water. One method is to fill a chamber 15 with calcium chloride 16. If the breathing tube 18 is closed by a valve 18' or is omitted entirely, the trap 17 will prevent a breathing of the chamber 15 for relatively small fluctuations of pressure. A slight breathing, even though air does not pass the main trap, would tend to use up the store of calcium chloride, lime, or other dehumidifying agent. This will be prevented to a considerable extent by the trap 17 where the arms are of suitable length. As the calcium chloride takes up water, it will be liquefied and dropped through baffle 23 and overflow from the end of the trap 17. Where the walls of the chamber 15 are made of glass, the condition of this chamber can be readily determined at all times. It is evident that the dehumidifying chamber may be placed between the main pressure regulating trap and the case. This has the advantage in that minor fluctuations in the columns of the trap and in the expansion of the air in the dehumidifier will not tend to use up the dehumidifying agent. Any breathing of the air between the case and the dehumidifier will be an advantage as it will tend to take water out of this air. In this case it is usually necessary to eliminate the trap for the dehumidifier or provide a series trap, composed of a number of U-tubes in series, in order to prevent the drawing in or discharge of air

through this trap. The valve 11 may be used to shut off the air supply or prevent flow while the apparatus is being charged or regulated. It is evident that the amount of fluid in the trap can be changed to regulate the pressure.

Fig. 2 shows one application to a transformer tank. In this case the trap is connected to an auxiliary breather tank 30. This tank has a pipe 31 which extends nearly to the bottom and which is connected to the top of the transformer case through the valve 32. The bottom of the tank 30 is connected to the transformer case by the valve 33. Under operating conditions, the transformer case should be full of oil and the tank 30 partially full of oil. Under falling temperature and a contraction of the oil there will be a tendency for a vacuum to form in the top of the transformer case 36 and the air in the upper portion of the tank 30 will expand due to the decrease in pressure in the case 36 and force the oil up through the pipe and valve 31 and 32 into the transformer case to equalize the pressure. If the pressure is reduced below the setting of the trap, air will be drawn in through the dehumidifier 35 up through trap 34. This air will enter the upper part of the tank 30. If the tank 30 has sufficient volume, no air will pass over into the transformer case through the pipe and valve 31 and 32. It is understood that the valve 33 is closed at all times, except in the case of making repairs to the transformer and regulating the height of the oil in tank 30, which will be explained later. If there is any air in the transformer case during a rising temperature this air will be dispensed through the valve 32 and pipe 31 into the tank 30. By placing the entering point high on the transformer case, it will be seen that any air in the transformer case will be discharged up to this point and replaced on the falling temperature by oil which will be forced up through the pipe 31. This method then may be used to keep the main transformer case filled with oil although the oil in the breather tank 30 may be at a lower level. The breather tank may be large so that the fluctuation in pressure can be controlled within fairly narrow limits. Ordinarily the valve 33 is closed as this will tend to discharge any air in the top of the transformer case in line with the valve 32. If the transformer or oil containing case has no leaks, the valve 33 may be opened after the air is pumped out in which case the tank 30 will permit circulation of the oil. Where the transformer tank is full of oil, it is frequently necessary to provide storage for oil before opening up the transformer case. Where the tank 30 is empty or only partially filled, the valve 33 may be opened and as soon as the air is admitted to the transformer case, the oil will rise in the breather tank 30 and drop in the main transformer tank 36.

Fig. 3 shows the adaptation of a trap system 75 in series with a dehumidifying chamber 76 connected to the air space 77 of a conservator tank 78 through a pipe 79. The conservator tank being above the height of the transformer or oil containing tank 80 will keep the transformer tank full at all times. The trap system and dehumidifying chamber 76 may be used to prevent excessive breathing in conservator tank 78 so that the high insulation of the oil may be maintained.

Fig. 4 shows the adaptation of a trap system 81 in series with a dehumidifying chamber 82 connected to the air space 83 to an oil tank of a condenser 84, connection being made through the valve and connecting pipe 85. It is evident that as the principal object is to dry and control the nature of the incoming gas or air, that a discharge trap without the dehumidifying chamber may be used for the relief of pressure above that of the atmosphere, permitting same to discharge directly into the air. This type of trap was shown in former application Serial No. 722,204, filed June 25, 1924.

I claim:—

1. The combination with a casing for electrical apparatus having expansible liquid therein, of a trap connected with said casing, a receptacle having a moisture absorbing material therein, said receptacle being arranged in series with said casing and trap, and porous baffles for preventing the escape of liquid from said trap.

2. The combination with a casing for electrical apparatus having expansible liquid therein, of an expansion chamber connected with said casing for maintaining the liquid level in said casing when the liquid therein expands and contracts, a trap connected with said expansion chamber to prevent passage of air between said chamber and atmosphere for relatively small variations in pressure in said chamber but permitting passage of air for greater variations in pressure, and means for dehumidifying the air which passes through said trap.

3. The combination with a casing for electrical apparatus having an expansible liquid therein, of an expansion chamber having a gas therein for maintaining the liquid level in said casing, a trap having one leg thereof connected with said expansion chamber, and a receptacle having moisture absorbing material therein for removing moisture from air which enters said expansion chamber through said trap.

4. The combination with a sealed casing having an expansible liquid therein, of an expansion chamber connected with said casing having gas under pressure for maintaining the liquid level in said casing, a trap connected with said expansion chamber, baffles for preventing escape of liquid from said

trap, and a receptacle having moisture absorbing material therein arranged in series with said trap and expansion chamber to absorb moisture from air passing through said trap to said expansion chamber.

5. The combination with a tank for containing liquid under pressure, of a conduit connected with the upper part of said tank and having a trap therein, a chamber having a partition therein providing two compartments communicating at the bottom of said partition, means for connecting the upper part of one of said compartments with said trap, and means for connecting the upper part of the other of said compartments with said tank.

In testimony whereof I have signed my name to this specification on this 18th day of Sept. A. D. 1924.

ARTHUR O. AUSTIN.