Feb. 5, 1924. 1,482,418

C. E. UNGER

CENTRIFUGAL MACHINE

Filed July 5, 1923 2 Sheets-Sheet 1

Fig. 2.

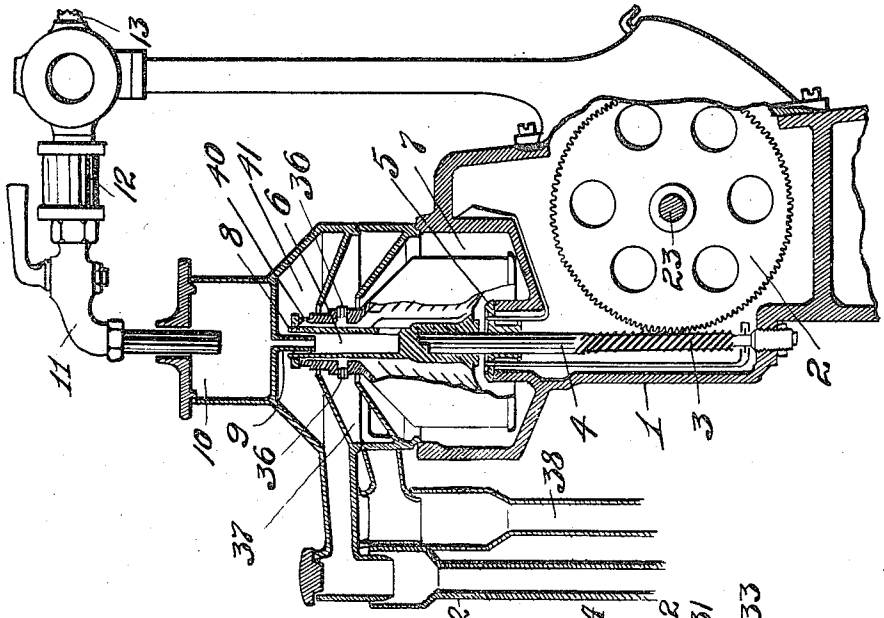
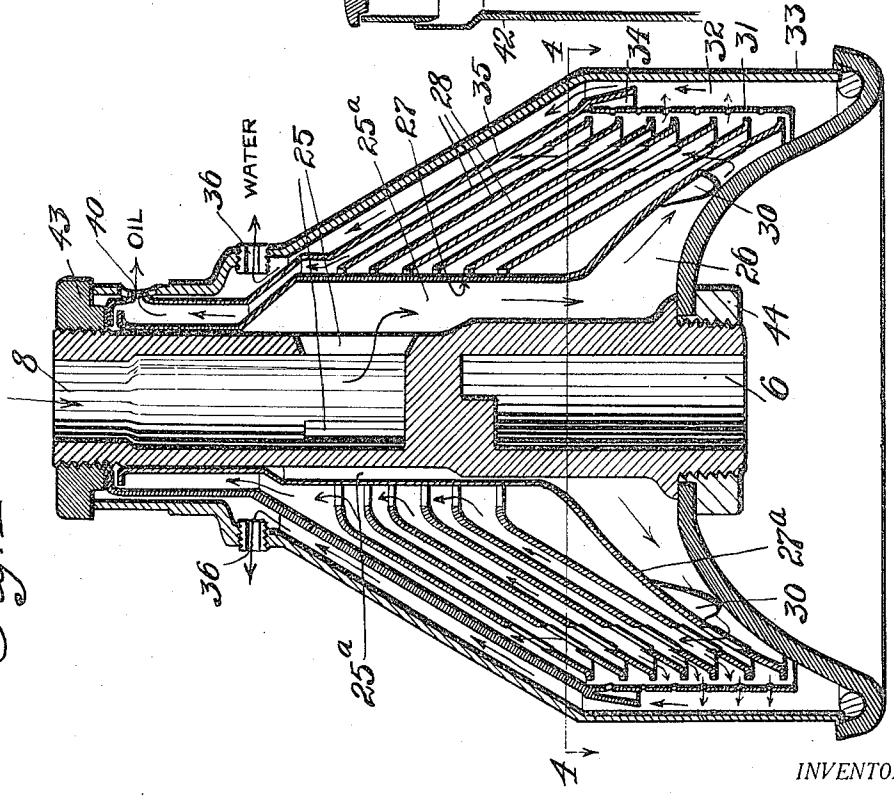


Fig. 1.



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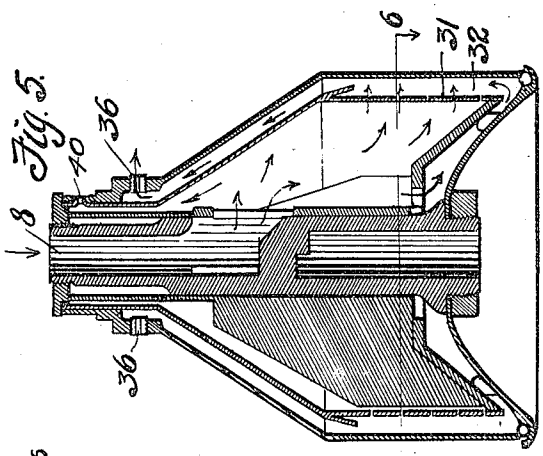
Chester E. Unger.

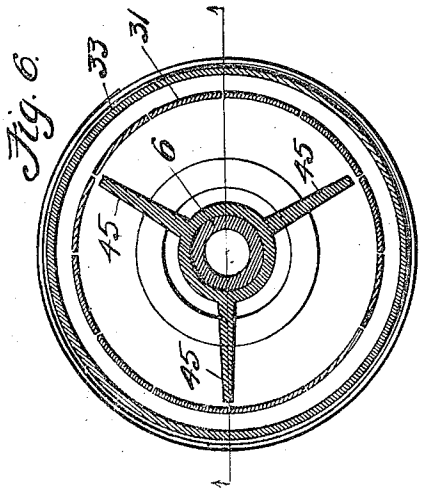
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CENTRIFUGAL MACHINE

Filed July 5, 1923 2 Sheets-Sheet 2





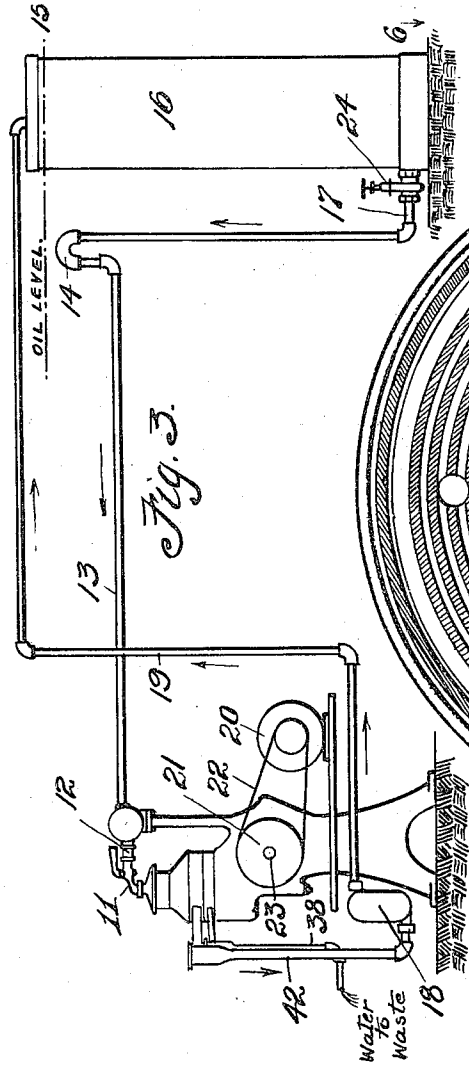


Fig. 3.

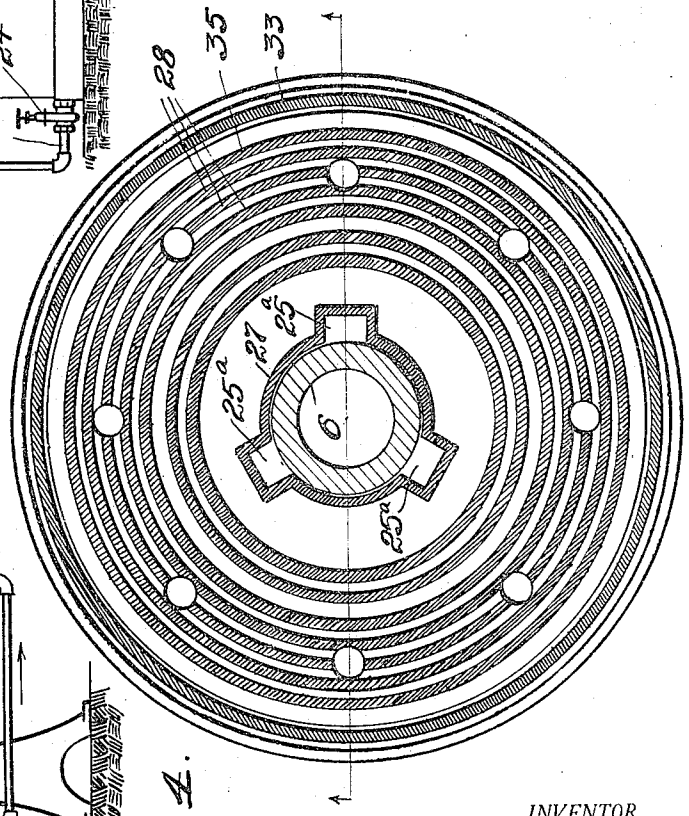


Fig. 4.

INVENTOR.

Chester E. Unger

Patented Feb. 5, 1924. 1,482,418

UNITED STATES PATENT OFFICE.

CHESTER E. UNGER, OF GOSHEN, INDIANA, ASSIGNOR TO INDUSTRIAL PRODUCTS COMPANY, OF GOSHEN, INDIANA.

CENTRIFUGAL MACHINE.

Application filed July 5, 1923. Serial No. 649,527.

To all whom it may concern:

Be it known that I, CHESTER E. UNGER, a citizen of the United States, residing at Goshen, in the county of Elkhart and State of Indiana, have invented certain new and useful Improvements in Centrifugal Machines, of which the following is a specification.

The invention relates to an improved bowl for use in connection with centrifugal machines for removing sediment, and the continuous separation of moisture and free water, if the latter occurs from insulating oils, varnishes and other liquids. The invention is particularly adapted for use in connection with insulating oils, however the bowl may be applied and used for continuous separation of liquids of different densities, or to the separation and removal of viscid or solid matter from liquids.

In electrical apparatus, particularly transformers, the high voltage or primary coils are separated from the low voltage or secondary coils by insulating medium, and the efficiency and effectiveness of the transformer is greatly increased by placing the secondary and primary coils as close together as possible. Usually fuller board made from vegetable fibre, impregnated with insulating varnish is used for separating the coils mechanically, the insulating varnish giving it the required high dielectric strength. However in order to prevent the absorption of moisture after the transformer is in service, the coils are usually placed within a tank containing insulating oil. This insulating oil serves two purposes. It provides an insulating medium, which flows into every crack and crevice of the fuller board between the transformer coils thereby greatly increasing the dielectric strength of the fuller board and also serves as a conveyor of the heat which is produced by the coils. The heat from the coils causes a constant circulation of the oil, which in turn carries the heat to the outside surface of the tank, which is usually corrugated, or to cooling coils where it is dissipated. Obviously any moisture entering the transformer casing, either through condensation or the breathing action of the transformer caused by temperature changes is absorbed by the oil which is continuously circulating over the coils. It is a further object of the invention to provide an improved centrifugal machine bowl and machine used in connection with the tank whereby a continuous separation of the moisture, sediment and water from the oil may be accomplished with the maximum degree of efficiency when desired without disconnecting the transformer from its source of electric supply. Unless the moisture is removed thoroughly from the oil at frequent intervals, the fibrous fuller board, between the coils, which has a great affinity for water, will absorb moisture from the oil which decreases its dielectric strength and greatly lowers the ability of the transformer to resist puncture.

A further object is to provide a centrifugal machine particularly adapted for separating moisture, sediment and water from transformer oil or insulating oils whereby a maximum dielectric strength is obtained, and the separation may be a continuous one if so desired.

A further object is to provide a centrifugal separating machine wherein oil to be dehydrated is passed over a finely perforated, but otherwise smooth surface, while subjecting the oil to the influence of a high centrifugal force by rapidly revolving the bowl of the machine and providing a passage for the water to flow from the bowl as rapidly as it is removed from the oil.

A further object is to provide a centrifugal machine bowl for use with insulating oil comprising a plurality of cone shaped perforated discs mounted upon a central support or disc holder, a perforated cylinder smooth upon the inside and surrounding the discs and forming a sedimentation cylinder, the upper end of which terminates into a conically shaped portion, and the lower end of which is open, and a cone shaped skirt adjacent the upper end of the sedimentation cylinder and having its lower end overhanging and surrounding the upper end of the sedimentation cylinder; all of the above parts being supported on a stem which is carried by a base member. Also to provide means whereby a spindle may be received within the lower end of the stem for revolving the bowl as a whole.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawing, described and claimed, it being understood that changes

in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawing:—

Figure 1 is a vertical sectional view through the separator bowl.

Figure 2 is a vertical sectional view through a centrifugal machine, showing the bowl partially in section.

Figure 3 is a side elevation of the centrifugal machine, showing the same connected to a transformer casing or tank.

Figure 4 is a transverse sectional view of the separator bowl taken on line 4—4 of Fig. 1.

Figure 5 is a vertical sectional view through a modified form of bowl wherein radially disposed wings are used instead of perforated conically shaped discs.

Figure 6 is a transverse sectional view taken on line 6—6 of Figure 5.

Referring to the drawing, the numeral 1 designates the casing of the centrifugal machine and 2 a drive worm gear, which meshes with a worm 3 carried by the spindle 4, which is vertically disposed and is driven at a high speed. The spindle 4 extends upwardly through the neck bearing member 5, and has detachably connected to its upper end the stem 6 which carries the bowl assembly, which rotates within the chamber 7 carried by the upper end of the casing 1 of the machine. The upper end of the stem 6 is provided with an intake passage 8, into which liquid or oil is discharged through the nipple 9 carried by the feed cup 10, which feed cup gets its supply of oil through the faucet 11, heating element 12 and pipe 13, which pipe is provided with an upwardly extending loop 14 which extends to an elevation adjacent the oil level 15 within the transformer 16, however the pipe 13 is connected to the transformer 16 at 17 adjacent the lower end thereof where the oil to be treated may be pumped by means of the pump 18 in the pump line 19 which is connected to the upper end of the transformer casing. It will be seen that the oil is pumped from the bottom of the tank through the dehydrater and back again into the top of the tank and that the dehydrating operation is a continuous one. By continuously passing the oil through the dehydrater the oil is rapidly brought to a high dielectric strength so that it will give the maximum dielectric efficiency. The upwardly extending loop 14, which extends to substantially the oil level 15 is provided to prevent any possibility of lowering the oil level, and if desired a sight overflow may be placed in the pipe line for further protection against accidental draining of the oil from the tank. The centrifugal machine is preferably driven by a motor 20, which drives a pulley 21 through the medium of the belt 22, and which pulley is carried by the shaft 23 which drives the worm gear 2. The pipe line 13 adjacent the lower end of the transformer casing is preferably provided with an oil valve 24 whereby the amount of fluid flowing through the pipe line 13 may be regulated and entirely cut off when so desired when the centrifugal machine is not in use.

The lower end of the intake passage 8 of the stem 6 terminates in spaced discharge ports 25, communicating with passages 25ª formed on the cylindrical disc holder 27, and through which the oil to be treated passes to the annular chamber 26 formed by the lower end of the disc holder 27, the lower end 27ª of which is conically shaped to provide said annular chamber, and which holder is held in spaced relation to the bowl base 29 by means of lugs 30. The disc holder 27 is provided with a plurality of spaced registering conically shaped discs 28, which are provided with a plurality of perforations, preferably about one fourth of an inch in diameter, and surrounding the conically shaped discs is a cylindrical perforated sediment casing 31, through which, during the rapid rotation of the bowl as a whole, water, sludge and emulsified oil passes into the annular chamber 32 between the perforated sediment cylinder and the outer cylindrical wall 33 of the bowl, and then passes upwardly outside of the skirt 34 of the conically shaped casing 35 and through the discharge openings 36 into the water casing 37, and thence through the discharge pipe 38.

The oil passes upwardly through the apertured conically shaped discs 28 between the vertical passages 25ª carried by the disc carrying cylindrical member 27, and between said member and the conically shaped casing 35, through the light liquid outlets 40, into the oil casing 41, oil pipe 42 and thence to the pump 18, and to the upper end of the transformer casing through the pipe 19. The above operation is continued until all of the moisture is removed from the oil, water and sludge also being removed during the same operation. The perforated sediment cylinder 31, which surrounds the conically shaped discs 28 is smooth upon the inside and the skirt 34 overlies its upper end, and it has been found that by providing this skirt and perforated cylindrical sediment member 31, that an oil treated by the machine will have an exceptionally high dielectric strength in one passage of the oil through the bowl. The bowl does not retain moisture, which is an objection where an ordinary cream separator bowl of the plugged or closed type is used. In tests of oil treated by the bowl set forth in this application and made with various grades of insulating oils containing an excessive quan-

tity of water, oil of excessive high dielectric strength is obtained, when measured by accepted standard methods. Tests of the oil so produced by one passage through the bowl set forth in this application result in a dielectric strength of 25,000 volts for 0.1 inch oil gap, or 50,000 for a 0.2 inch oil gap with one inch electrodes. This result is obtained by the rapid passing of the oil to be dehydrated over the finely perforated, but otherwise smooth surface of the cylindrical member 31, while subjecting the oil to the influence of tremendous contrifugal force by rapidly revolving the bowl and providing a passage for the water to flow from the bowl as rapidly as it is removed from the oil. The entire assemblage is held in position in relation to each other and machine by means of the top nut 43 threaded on the upper end of the stem 6, and the bowl base is secured to the lower end of the stem by means of the nut 44 threaded on the lower end of the stem. It will be seen that during the rotation of the bowl that the oil will pass upwardly through the conically shaped discs 28, and that the water and moisture from the oil as well as sediment and the like will pass through the perforations of the perforated cylinder 31, and will be discharged through the discharge openings 40, in case of the oil, and the discharge openings 36 in case of water and foreign matter. It will also be seen that the entire assembly may be easily and quickly removed from spindle 4 by simply removing the casing 37 and 41 from the upper end of the machine.

Referring to Figure 4 wherein a modified form of the invention is shown, the operation is substantially the same as that shown in Figures 1 and 2 and the structure is substantially the same with the exception that the cone shaped discs 28 are eliminated and the radially disposed veins 45 provided; however the oil passes upwardly inside of the perforated cylindrical sediment cylinder 31, and is discharged in the same manner as Figure 1. In this form oil from the intake port 8 discharges directly into the cylinder 31, and during the rapid rotation of the bowl, the oil moves upwardly and the water and sediment passes outwardly through the perforated cylindrical casing 31 into the annular chamber 32, from which it passes to the discharge ports 36 into the waste water casing 37.

From the above it will be seen that an insulating oil centrifugal separator is provided, preferably in connection with a transformer wherein the oil may be easily and quickly treated without the inconvenience of disconnecting the transformer from its source of electrical energy for changing the insulating oil, and the oil is pumped from the bottom of the transformer through the dehydrater and back again in to the intake at the top. Frequently the moisture will accumulate in excessive quantities and settle to the bottom of the transformer casing or tank, and should the dehydrating of this oil be attempted with a conventional form of closed bowl separator, for instance of the clarifier type, the water would quickly accumulate within the bowl to a point where the water might become entrained with the oil and discharged in slugs with the supposedly dry oil. This might occur without the operators' knowledge and result in not only contaminating the oil previously treated, but also result in putting the wet oil back into the transformer and over the coils of the transformer.

The invention having been set forth what is claimed as new and useful is:—

1. A centrifugal separator comprising a stem having an intake port in its upper end in communication with ports extending through the side of the stem, a cylindrical disc carrier surrounding the stem, the lower end of said carrier being conically shaped, a plurality of perforated cone shaped discs carried by the disc carrier, a perforated sediment cylinder surrounding the discs and having its upper end cone shaped, a bowl base carried by said stem and a casing surrounding the perforated cylinder and having its upper end conically shaped and provided with discharge openings in communication with a chamber between the sediment cylinder and the casing.

2. The combination with a centrifugal machine, of a bowl for said machine, said bowl comprising a casing, a perforated sediment cylinder within the casing and spaced from the inner wall thereof and having its upper end conically shaped, a stem having an intake passage therethrough, a disc holder surrounding the stem and forming a chamber around the stem in communication with the intake passage of the stem, the lower end of said disc holder being flared, and a plurality of conically shaped perforated discs carried by the disc holder between said holder and the perforated sediment cylinder, and means whereby oil and water may continuously flow from said bowl.

3. A centrifugal separator bowl comprising a cylindrical casing having its upper end conically shaped, a cylindrical sediment cylinder within the casing and perforated, the upper end of the sediment cylinder being conically shaped, a disc holder within the sediment cylinder and having its lower end flared, a plurality of conically shaped perforated discs carried by the disc holder and disposed within the sediment cylinder, and a downwardly extending skirt carried by the upper end of the sediment cylinder and disposed between said sediment cylinder and the inner wall of the casing.

4. A centrifugal separator comprising a stem, means for attaching said stem to a spindle, the upper end of said stem being provided with an intake passage in communication with ports extending through the stem, a disc supporting casing surrounding the stem and having its lower end conically shaped, a plurality of perforated cone shaped discs carried by the disc holder above the conically shaped portion, a perforated sediment cylinder surrounding the discs and having its upper end conically shaped, a casing surrounding the above named elements and forming a discharge passage for separated material, said conically shaped upper end of the sediment cylinder in combination with the disc holder forming a discharge passage for separated material.

5. A centrifugal separator comprising a casing, a detachable dished base carried by the casing, a stem connected to the base detachably and extending axially through the casing, a member carried by the upper end of the stem and cooperating with the upper end of the casing for rigidly holding the casing assembled, a sediment cylinder disposed within the casing and having its upper end restricted and its lower end cylindrical shaped and perforated, a downwardly extending flared skirt carried by the upper end of the sediment cylinder, a disc holder surrounding the stem and having its lower end flared and engaging the lower end of the sediment cylinder, a plurality of perforated discs carried by the disc holder, said perforated discs being conically shaped, means for admitting fluid between the disc holder and the stem through ports in the stem, and means for discharging separated material between the restricted end of the sediment cylinder and the disc holder and between the restricted end of the sediment cylinder and the inner wall of the casing adjacent the upper end of the casing.

6. The combination with a bowl of a centrifugal separator, said bowl having a centrally disposed stem through which fluid may flow to the interior of the bowl, of a disc holder surrounding the stem, a plurality of conically shaped perforated discs carried by the disc holder, and a perforated sediment cylinder surrounding the discs and having its upper end restricted.

7. The combination with a bowl of a centrifugal separator, said bowl having a centrally disposed stem through which fluid may flow into the bowl, of a disc holder surrounding the stem and spaced therefrom, a plurality of conically shaped perforated discs carried by the disc holder, a cylindrically shaped perforated sediment member surrounding the discs and having its upper end restricted, and a downwardly extending flared skirt carried by the upper end of the sediment member adjacent its restricted portion.

8. The combination with a bowl of a centrifugal separator, said bowl having a centrally disposed stem through which fluid may pass into the bowl, of a disc holder surrounding the stem and spaced therefrom, a plurality of conically shaped perforated discs carried by the disc holder, a cylindrically shaped perforated sediment member surrounding the discs and having its upper end restricted, a downwardly and outwardly flared skirt carried by the sediment member, and means carried by the ends of the stem for holding the bowl as a whole assembled.

9. The combination with a perforated sediment cylinder of a centrifugal separator bowl, said cylinder being disposed within the bowl and spaced from the inner wall thereof, of a skirt carried by said cylinder and disposed between the cylinder and the inner wall of the bowl, and perforated conically shaped discs disposed within the perforated cylinder.

10. The combination with a liquid container, a centrifugal separating machine having an intake end, a discharge end and a waste port, a pipe connection between the intake end and the bottom of the liquid container, said pipe connection having a loop extending substantially to the oil level within the container, a pipe connection between the discharge end of the separator and the upper end of the container, and a pump in said last named pipe.

In testimony whereof I affix my signature.

CHESTER E. UNGER.