Feb. 10, 1931. J. SAVAGE 1,791,906

PROCESS FOR EXTRACTING OLEAGINOUS AND OTHER MATERIALS WITH VOLATILE SOLVENTS

Filed Oct. 18, 1927 3 Sheets-Sheet 1

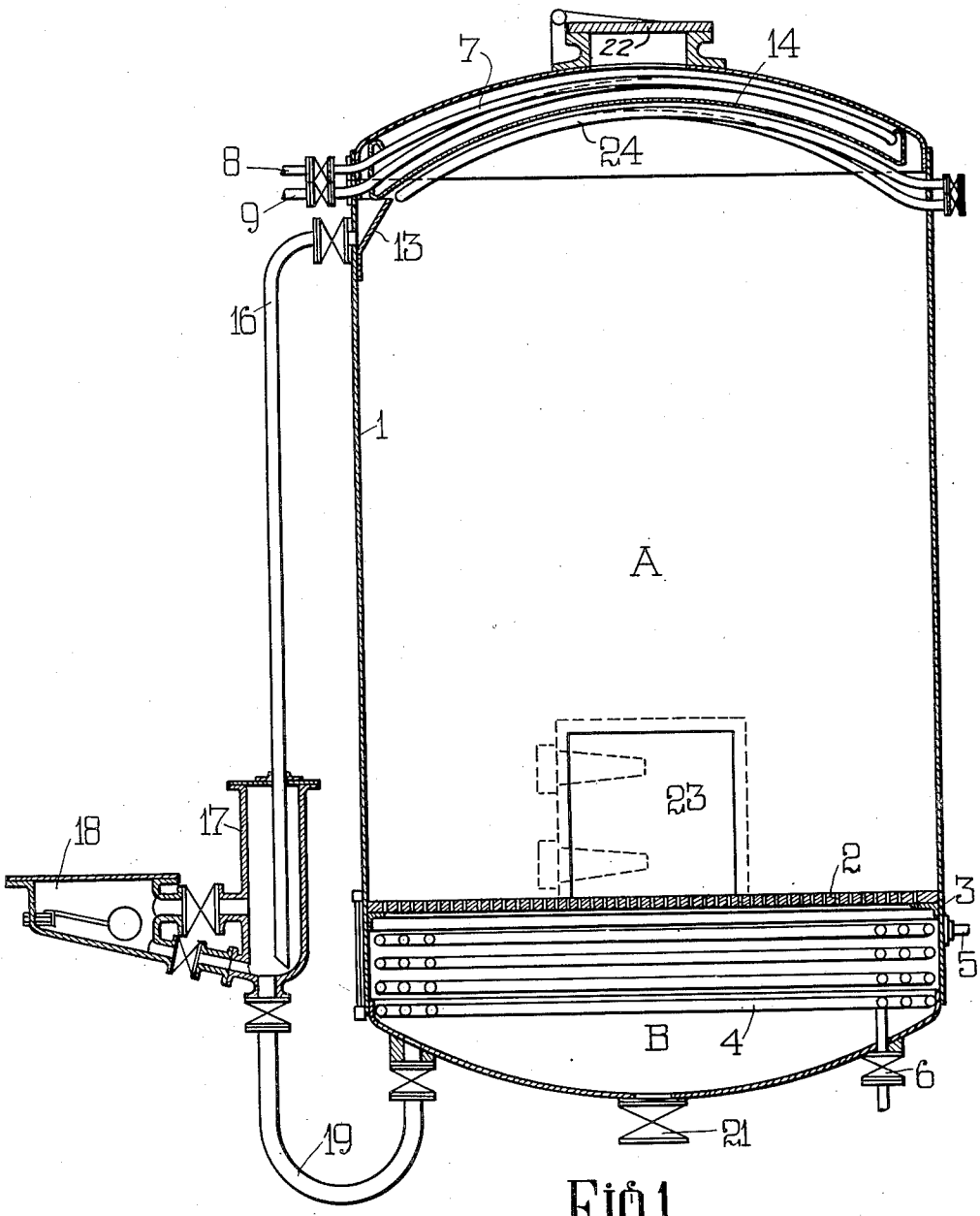


Fig. 1.

Inventor:-
Joseph Savage
By Stewart & McKay
his attorneys

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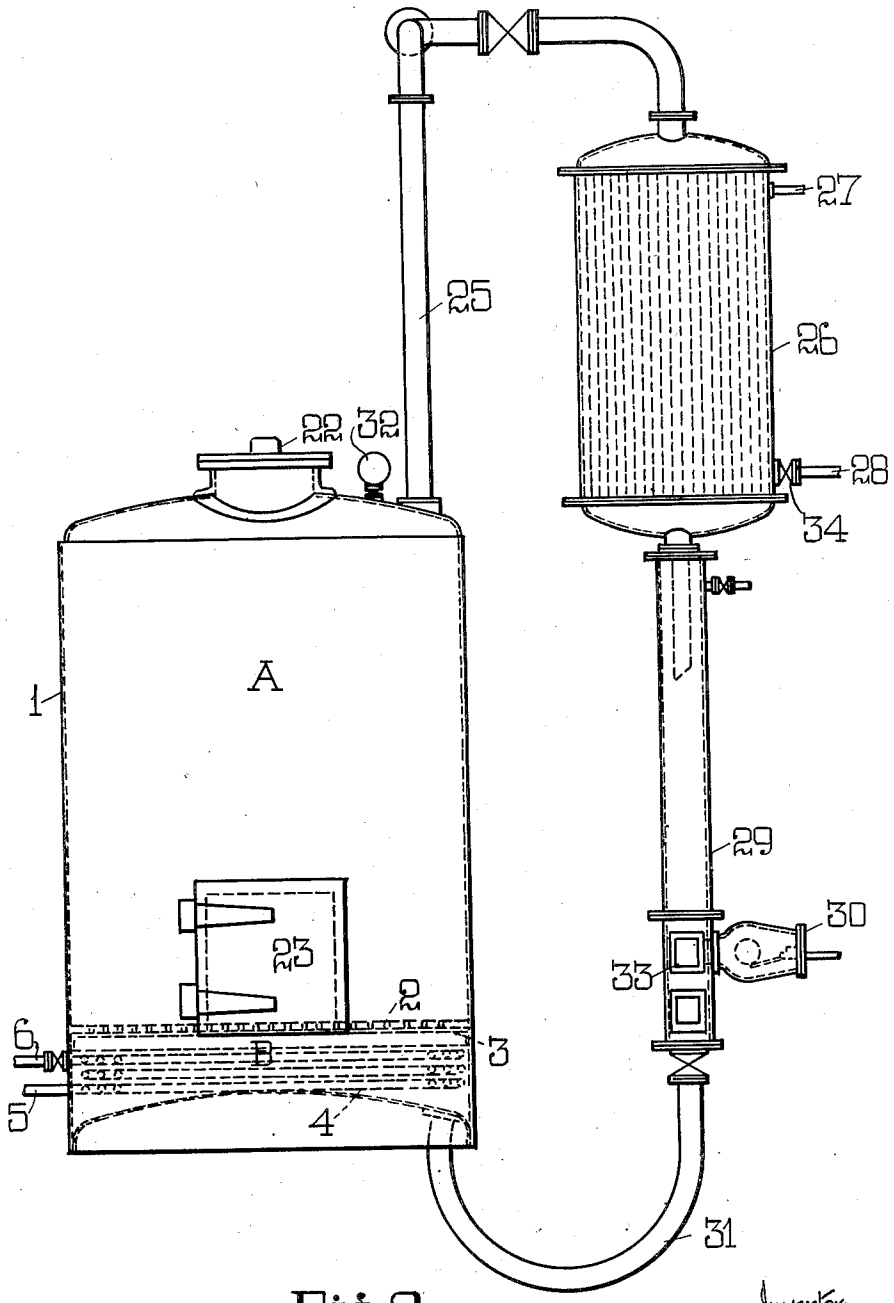


Fig. 2.

Inventor:
Joseph Savage
by Stewart & McKay
his attorneys

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Filed Oct. 18, 1927 3 Sheets-Sheet 3

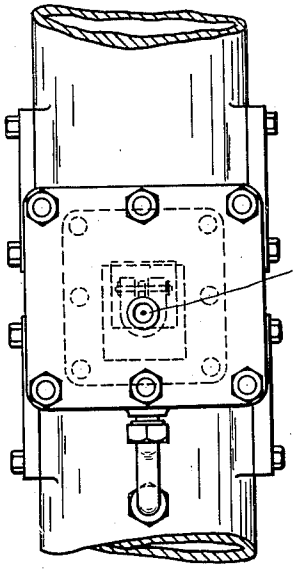


Fig. 5.

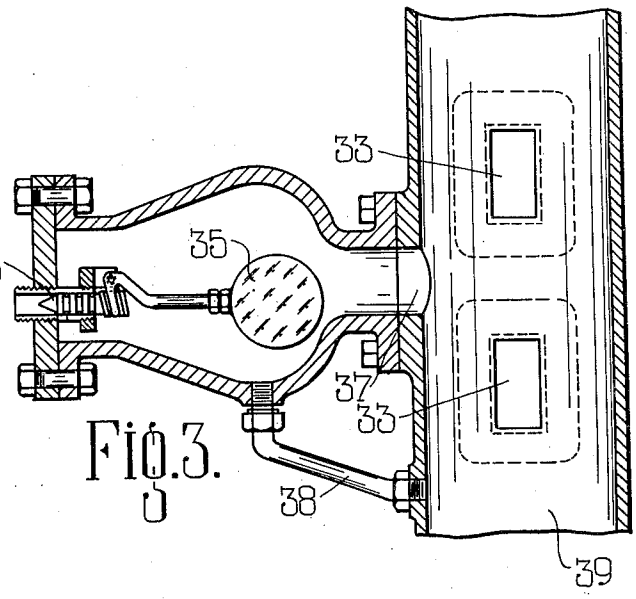


Fig. 3.

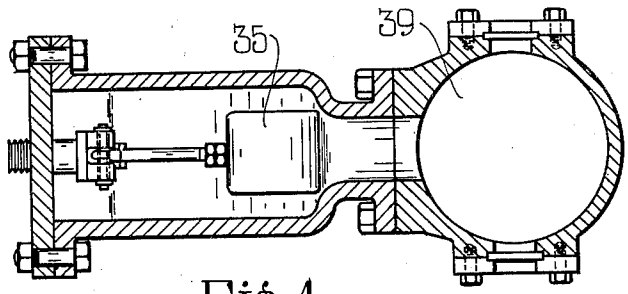


Fig. 4.

Inventor
Joseph Savage
by Steward & McKay
his attorneys

Patented Feb. 10, 1931

1,791,906

UNITED STATES PATENT OFFICE

JOSEPH SAVAGE, OF RUNCORN, ENGLAND

PROCESS FOR EXTRACTING OLEAGINOUS AND OTHER MATERIALS WITH VOLATILE SOLVENTS

Application filed October 18, 1927, Serial No. 227,039, and in Great Britain October 22, 1926.

Part of the subject matter of the present invention was disclosed in my co-pending application Serial No. 155,324 from which it has been transferred to the present application.

The invention relates to an improved process for treating material with volatile solvents. The invention is particularly applicable to substances or materials initially containing substantial quantities of moisture, for example, the degreasing of bones, though the invention is not limited to this process.

One of the objects of the present invention is to provide an extraction process working at super-atmospheric pressure.

Another object of the invention is to provide an extraction process in which moisture extracted during the process is automatically removed.

Further objects of the invention are to effect economy in the heat required for the volatilization of the solvent and to shorten the time required for extraction. The scope of the invention is defined in the appended claims.

Two forms of apparatus with which the process of the present invention may be carried out are illustrated in the accompanying drawings, wherein:—

Figure 1 shows a sectional elevation of one form of the apparatus.

Figure 2 shows a modified construction using an external condenser.

Figures 3, 4 and 5 show enlarged views of the automatic water separator in side elevation, plan, and end elevation respectively.

A closed container 1 in which a volatile solvent may be volatilized has a perforated platform 2 supported on suitable brackets 3, which divides the container into upper and lower chambers A and B respectively. The lower chamber B contains a coil of tubing 4 with external pipe connections 5 and 6 through which tubing steam or other heating medium may be passed.

In the apparatus shown in Fig. 1 the condensing coil 7 having external pipe connections 8, 9 and a loose tray 14 are arranged below a fixed top in which is a port 22 with a hinged cover. A cup 13 is welded on to the inside of the vessel 1 and a lip on the tray overhangs the cup. A pipe 16 through which condensed liquid collected on the tray flows down to the water separator 17 and the automatic water release 18, passes through the wall of the container 1 into the cup 13. Solvent is returned to the chamber B by the pipe 19, while a draining valve 21 may be provided.

The charge of material is introduced through the opening 22 and when extracted is removed through 23.

In order to provide a sprinkling effect over the material an additional coil 24 is provided below the tray. Solvent vapour condenses on this coil and then drops back on to the material giving a sprinkling effect. The tray 14 may be made in two semi-circular halves, which can be introduced through the man-hole 23.

Referring to Fig. 2 a pipe 25 leads the hot vapours of solvent and extracted water to an external condenser 26. Inlet and outlet pipes for the condenser cooling medium are shown at 27 and 28. The condensed solvent and water fall by the pipe 29 to a water separator 30 including an automatic ball release valve arranged to separate the condensed solvent and water. A sight glass 33 may be provided in the water separator if desired. The solvent is returned to the chamber B by the pipe 31. A pressure gauge 32 may also be provided.

In operation, a charge of the material to be extracted is placed in the upper chamber A and a volatile solvent contained in B is vapourized by the heating coil 4. The vapour passes through the perforate partition 2 and penetrates to the material. The water present in the material is removed by the vapour of the solvent and the mixed vapours of water and solvent rise to the top of the apparatus, where they pass through the pipe 25 to the external condenser 26, and the liquid falls directly into the separator 30.

The hot solvent and water are separated at the highest possible temperature consistent with effective separation. The amount and temperature of the cooling fluid circulating the condenser is capable of regulation by the valve 34. After the removal of the

water from the charge, the oil is removed by the solvent and the solution of oil in solvent is removed as desired and distilled in any known manner to isolate the oil and recover the solvent.

The process is extremely simple and efficient. The solvent circulates continuously in a single closed cycle under substantially the same pressure in all parts of the cycle and considerable economy of heat is effected by returning the solvent in a nearly boiling condition to the extraction chamber. The working conditions are arranged so that the temperature of the extracting medium never falls more than a few degrees below its boiling point under the pressure existing in the apparatus, and consequently the heat lost by condensation is reduced to a minimum. Hence the amount of heat which has to be supplied for revolatilization is small, and the thermal efficiency of the process is correspondingly high.

The action of the automatic water separator 17 (Fig. 1) or 30 (Fig. 2) is as follows. The water is released by the movement of a float 35 (Fig. 5) contained in a chamber wherein the pressure is substantially the same as the working pressure in the extraction chamber. The float 35 actuates a spring loaded needle valve 36, which is arranged so that the water is automatically run off when more than a certain minimum quantity has collected in the chamber. The invention is not restricted to solvents heavier than water (e. g. trichlorethylene) but can be used with solvents lighter than water (e. g. benzene) by a slight modification of the release valve.

The water and solvent levels may be observed through the sight glasses 33. If the normal level of the heavy solvent is below the lower edge of the opening 37 it is desirable to provide a solvent drain pipe 38 as shown, to drain the float chamber of solvent.

The normal solvent level is just below the platform 2 and the position of the separator in relation to this level is so arranged that the separation and stratification of the liquids takes place in and about the space 39, and can be watched through the sight glasses. In operation, owing to the slight drop of pressure through the condenser 26 the level of the liquids in the separator is slightly above the level in the volatilization chamber, permitting separation to occur in the region of the float-actuated valve.

The process is usually carried out at a pressure of from 10 to 25 lbs. per square inch above atmospheric pressure. When treating bones or other organic materials the pressure should not be too high or it is possible that the materials will char.

As the separation takes place at the pressure existing in the apparatus, a pump to return the separated solvent to the volatilization chamber is rendered unnecessary.

If desired, electrical or other methods of heating may be used to volatilize the solvent.

I declare that what I claim is:—

1. A process for extracting oleaginous materials containing aqueous moisture with a water insoluble liquid volatile hydrocarbon solvents which comprises performing the following operations in a closed circuit under pressures substantially greater than atmospheric: volatilizing said volatile solvent in the base of an extraction chamber, passing the vapours through said material, condensing said vapours to a limited extent consistent with effective separation of water and solvent, automatically separating said water, and returning said separated solvent direct to said extraction chamber for re-volatilization at a temperature just below its boiling point at the pressure existing in said circuit.

2. A process of extracting moist oleaginous materials with water insoluble liquid volatile hydrocarbon solvents consisting in distilling a volatile solvent in a closed circuit under pressure substantially greater than atmospheric through the material to be extracted, condensing the vapours by external means, separating the extracted water automatically and returning hot separated solvent for re-distillation at temperature near the boiling point of said solvent at the pressure existing in said circuit.

3. A process of extracting moist oleaginous materials with water-insoluble, liquid, volatile hydrocarbon solvents which comprises circulating said solvent in a closed circuit through an extraction chamber, said solvent passing as vapour through said extraction chamber, under pressure substantially greater than atmospheric, condensing said vapours, automatically separating the extracted water, and returning hot, separated solvent to the circuit at a temperature near the boiling point of said solvent at the pressure existing in said circuit.

4. A process of extracting moist oleaginous materials with water-insoluble, liquid, volatile hydrocarbon solvents which comprises vapourizing said solvent, passing the vapours through said material under superatmospheric pressure, condensing said vapour, automatically separating the extracted moisture, and returning separated solvent for revapourization at a temperature just below the boiling point of said solvent at the existing pressure, the solvent circulating in a continuous closed circuit.

5. A process of extracting moist oleaginous materials with water-insoluble liquid volatile hydrocarbon solvents which comprises volatilizing the solvent in the base of a container, passing said vapour through the material to be extracted, condensing said vapours to a limited extent consistent with effective separation of water from solvent, automatically separating condensed solvent

from water in an automatic water separator, and returning separated solvent for re-volatilization at a temperature very near to the boiling point of said solvent at the pressure existing in said container, all the above operations being performed in a closed circuit.

6. A process for extracting oleaginous materials containing aqueous moisture with water-insoluble liquid volatile hydrocarbon solvents operating continuously in a closed circuit which comprises vapourizing said solvent, circulating the vapours through said material under pressure substantially higher than atmospheric, condensing said vapours, automatically separating said solvent and water in a water separator exposed to the pressure in said circuit, and returning separated solvent direct for re-vapourization at a temperature just below the boiling point of said solvent at the pressure existing in said circuit.

7. A process of extracting moist oleaginous materials with water insoluble liquid volatile hydrocarbon solvents which comprises volatilizing a solvent under super-atmospheric pressure, passing the vapours through said material, condensing the vapours to a limited extent in an external condenser, automatically separating said solvent and water, and returning nearly boiling solvent direct for re-volatilization.

8. A process of extracting moist oleaginous materials with water insoluble volatile hydrocarbon solvents which comprises volatilizing the solvent in the base of a container, passing the vapours through the material under superatmospheric pressure, condensing said vapours in an external condenser, separating said solvent and water automatically in a separating chamber exposed to the pressure of said vapours, releasing said water from said separating chamber, and returning nearly boiling separated solvent to the base of said container for re-volatilization.

In witness whereof, I have hereunto signed my name this 7th day of October 1927.

JOSEPH SAVAGE.