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METHOD OF EXTRACTING OILS AND FATS FROM OIL SEEDS AND OTHER VEGETABLE RAW MATERIALS CONTAINING OILS AND FATS.

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1,076,997. Patented Oct. 28, 1913.

Fig. 2.

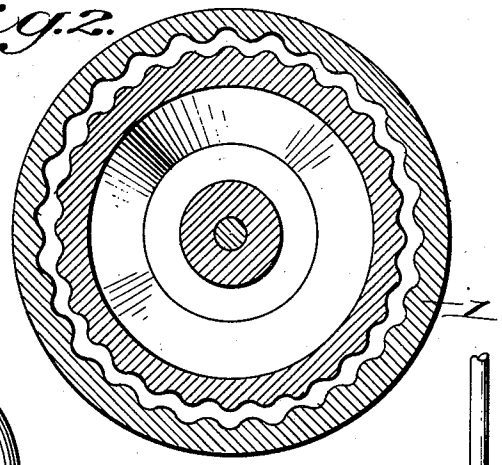


Fig. 1.

WITNESSES

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METHOD OF EXTRACTING OILS AND FATS FROM OIL-SEEDS AND OTHER VEGETABLE RAW MATERIALS CONTAINING OILS AND FATS.

1,076,997. Specification of Letters Patent. Patented Oct. 28, 1913.

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To all whom it may concern:

Be it known that I, ROBERT N. RIDDLE, a citizen of the United States, residing at Rahway, in the county of Union, State of New Jersey, have invented certain new and useful Improvements in the Method of Extracting Oils and Fats from Oil-Seeds and other Vegetable Raw Materials Containing Oils and Fats, of which the following is a full and correct description.

My invention relates to a new method of extraction by the aid of solvents of vegetable oils and fats. It is well known that in practice these oils and fats are extracted either by pressure, following a grinding or crushing of the oil-containing raw materials, which pressing may take place either hot or cold, according to the nature of the material, or by the solvent action upon the oil or fat of a suitable solvent, usually a volatile liquid. Pressed oils, especially cold-pressed oils are preferred in some cases, particularly in the case of edible oils, as they are generally free from flavoring and coloring impurities which injuriously affect the flavor or color of an otherwise bland and agreeable oil. On the other hand, it is impossible to extract all of what may be a valuable oil by this method of expression, much being left in the oil-cake. Hence the introduction of the method of extraction by the aid of volatile solvents, which will effect a more complete extraction. As at present practised, this extraction by the aid of a solvent is, however, combined with numerous difficulties and drawbacks, making it a tedious and complicated process, unnecessarily expensive and often dangerous when using an inflammable solvent like carbon disulfid or petroleum naphtha.

As now practised, the oil-seeds, or oil or fat-containing material is first ground very fine so that the solvent may get at the contents of the oil or fat-containing cells. The finely ground material is then transferred to the extraction vessel, where it is submitted to the action of the solvent. After the completion of the action of the solvent upon the ground material in the extraction vessel, the oil-containing solvent is either displaced by running through the vessel large volumes of fresh solvent or the mixture is drained and then pressed or washed with solvent in a filter press. These operations require much expenditure of time and labor, large volumes of solvent, and generally considerable loss by evaporation of the solvent in handling, as well as the danger arising from the escape of inflammable vapors.

My process obviates and overcomes most of these difficulties and introduces great economy of time and labor in handling the materials and prevents loss of solvent by evaporation and escape of dangerous inflammable vapors. At the same time it effects a very complete extraction of the oils and fats from the oil seeds or other vegetable raw material containing oils and fats and leaves the oil cake or residue in a satisfactory condition for utilization as a valuable by-product.

The general procedure in the carrying out and practising of my invention, applicable under a variety of special conditions involving minor differences in apparatus according to the nature of the raw material and the solvent, will be described and then a specific illustration of its application will be set forth using a definite raw material and a definite solvent.

The principle involved in my invention is that illustrated in the washing of clothes on a corrugated surface in which the pressure and release of pressure during the washing action take place in the presence of the solvent (water). I utilize this principle by using any apparatus provided with corrugated plates (either metal or stone) which grind against each other.

In order that my invention may be more readily comprehended reference may be had to the accompanying drawing in which—

Figure 1 is a view showing diagrammatically one form of apparatus which may be employed in carrying out or practising my invention, the various parts indicated therein being shown in elevation; and Fig. 2 is a transverse section of the grinding machine taken on the line 2—2 of Fig. 1.

In the said drawing, 1 designates a crushing and grinding mill or apparatus into which the substances from which oil or fat is to be extracted are introduced through a chute 2. The crushing and grinding mechanism of this mill may be of any construction, the only requirement being that it shall have the capacity of reducing the vegetable substances which may be introduced thereinto to a finely divided state and that in so doing it will subject the

said substances to alternate pressure and release of pressure. I introduce through the pipe 3 into the mill 1 a solvent. Preferably such solvent should be introduced simultaneously with the introduction of the vegetable substances into the mill, the said substances being ground as they are introduced. My invention is not limited, however, to the simultaneous introduction of the substances and the solvent and the crushing and grinding of the same but desired quantities of the substances and the solvent may be introduced, the introduction discontinued, and the quantities previously introduced thereafter ground.

The top of the crushing and grinding mill is closed as indicated in order to prevent the loss of the solvent by evaporation and also to prevent the escape of inflammable vapors.

The relative amounts of the solvent and the fineness of the comminution of the oil or fat containing substances will vary in different cases but are soon found in practice and can be adjusted without difficulty. When this relation is ascertained and properly adjusted, there is no danger of the clogging of the grinding or reducing mill or apparatus 1 and in fact the mechanism or means employed to reduce the oil and fat substances to a finely divided state usually appear as if washed after the crushing and grinding or reducing action is completed.

Because of the application of the mechanical principle before stated of alternate pressure and release of pressure while the substances are being crushed, ground or otherwise reduced to a finely divided state in contact with the solvent the extraction of the oils and fats therefrom is very complete.

The creamy semi-liquid mass formed in the mill or apparatus 1 is discharged therefrom through the discharge conduit 4 into a filter press 5 consisting of a cylinder having a piston plunger therein (not shown) operated by the power device 6. One end of the said press is adapted to be closed by means indicated at 7 so that when the semi-liquid mass in the filter press is subjected to pressure the solid matter thereof will be prevented from escaping from the said press while the liquid matter consisting of the solvent and oil or fat in solution will be expressed and will escape from the said press through the pipe 8 to a tank, or more properly speaking, a still 9. After the oil or fat in solution has been expressed the oil cake or residue is washed with a little free solvent.

After the oil or fat in solution has been separated from the oil cake or residue the closing means 7 of the filter press is opened and such residue is discharged through the discharge conduit 10 into a revolving drum 11 fitted with interior shells and double jacketed (such detail of construction not being illustrated) to admit of treating by heat derived from steam. The said drum 11 having been filled with the press cake or residue is closed and heat is applied through the jacket while the drum is set in revolution. The solvent is thus vaporized and is drawn off through pipes 12 and 13 to a condensing tank 14. In order to displace and remove the last trace of solvent from the said press cake or residue an inert gas, such as carbon dioxid, may be introduced into the said drum.

It will be understood that when the solvent is passing from the drum 11 to the condenser 14 the valve 15 is open while the valve 16 is closed.

In order to vaporize and expel the solvent from the solution of oil or fat and solvent in the tank or still 9, steam is passed through the steam coil 17. The solvent is thereby vaporized and escapes through the pipe 18, the valve 16 having been opened and the valve 15 closed, and thence through the pipe 13 to the condenser 14. It will be understood also that at such time the valve 20 is closed. Should the fatty oil be very unstable, a little water should be introduced before driving off the solvent.

In order to displace and remove the last trace of solvent from the oil or fat in the tank or still 9 an inert gas like carbon dioxid may be introduced into the bottom of the said tank or still through a tube 21. The solvent is condensed in the condenser 14 by means of a condensing coil 22. From the condenser tank 14 the solvent is returned by means of a pump 25 through pipe 3 to the crushing and grinding apparatus or mill 1. The pure oil, after the solvent has been expelled, may be withdrawn from the still or tank 9 through a pipe 26 into a container 27 from which it may be withdrawn through pipe 28.

As an example of the operation of my new and improved process, I will give the results of an experimental extraction of rape-seed oil from rape-seed: 200 grams of the dry rape-seed from which the oil or fat is to be extracted are slowly introduced into a grinding apparatus or mill of the character above described. Simultaneously with the introduction of the seed 200 grams of carbon disulfid are slowly introduced. The size of the stream of solvent is regulated by the rate of discharge of the mill. After grinding, the mill on being opened will be found clean and free of all adhering material. The liquid mass is filtered and the clear solution of oil in carbon disulfid is distilled. After removal of the solvent, the rape-seed oil is left as a light straw-colored oil. The yield was found to be 45 per cent. or 90 grams from the 200 grams of seed taken. The residue, after slight washing,

was introduced into a revolving cylinder fitted with longitudinal shelves, which cylinder was fitted in a small oven well insulated. As the axis of the cylinder is hollow, on the application of heat, the vapors can pass off to be condensed and at the end of the heating, the last portion of vapors can be displaced by a current of carbon dioxid gas. The yield of oil-cake freed from all solvent was 100 grams or 50% of the weight of seed taken. I refer to this form of apparatus, illustrated diagrammatically in my drawing, merely as an illustration, but do not wish to be understood as confining myself to it. Any other form found suitable for carrying out the essential features of my process, viz., grinding in the presence of the solvent, so that as the oil cells are crushed and opened, the solvent immediately takes up the liberated oil or fat and so continuously during the time the two are in contact, will operate successfully in carrying out my improved process.

Having thus described my invention, I claim:—

1. The method of extracting oils and fats from vegetable oil and fat containing substances, which consists in the subjection of such substances to alternate pressure and release of pressure to crush the same and in simultaneously subjecting the said substances to the action of a solvent.

2. The method of extracting oils or fats from vegetable oil or fat-containing substances, which consists in simultaneously introducing the said substances and a solvent into an apparatus for reducing the said substances to a finely divided state, subjecting the said substances to alternate pressure and release of pressure to reduce them to such state in such apparatus and thereafter separating the said oil or fat in solution in the solvent from the solid matter of such substances.

3. The method of extracting oil or fat from vegetable oil or fat containing substances which consists in reducing said substances to a finely divided state in the presence of a solvent, separating the oil or fat in solution in the solvent from the solid portions of the said substance, leaving the latter as a residue, and thereafter placing the said residue in a closed chamber and subjecting the same to the action of heat to remove therefrom substantially all of the remaining solvent and also subjecting said residue to the action of an inert gas to remove the last trace of solvent and the solvent being finally separated from the oil or fat solution.

4. The method of extracting oil or fat from vegetable oil or fat containing substances which consists in crushing and grinding the same to a finely divided state in the presence of a solvent to form a semi-liquid mass, separating the oil or fat and solvent solution from such mass, placing the residue in a closed chamber and subjecting to heat to drive the remaining solvent therefrom, condensing the same, and finally separating the solvent from the oil or fat solution.

5. The method of extracting oils or fats from vegetable oil or fat containing substances which consists in subjecting said substances to a crushing and grinding action in the presence of a solvent, which action includes alternate pressure and release of pressure upon the said substances, thereafter subjecting the combined mass of the said substances and the solvent to pressure to express the solution of oil or fat therefrom, applying heat to the said solution to drive the said solvent therefrom, and thereafter introducing an inert gas into the said oil or fat to remove the last trace of solvent therefrom.

6. The method of extracting oils or fats from vegetable oil or fat containing substances which consists in subjecting the same to a crushing and grinding action in the presence of a solvent, thereafter subjecting the combined mass of substance and solvent to express the solution of solvent and oil or fat therefrom, applying heat to the residue to expel the solvent therefrom, applying heat to the said solution to expel the solvent therefrom and thereafter subjecting the said oil or fat to the action of an inert gas to remove the last trace of solvent therefrom.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 7th day of February, A. D. 1912.

ROBERT N. RIDDLE.

In the presence of—
JOHN B. LABAT,
MARY D. C. LABAT.