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PROCESS OF CENTRIFUGALLY SEPARATING REFRIGERATED INGREDIENTS AND CENTRIFUGAL BOWL USED IN SUCH PROCESS

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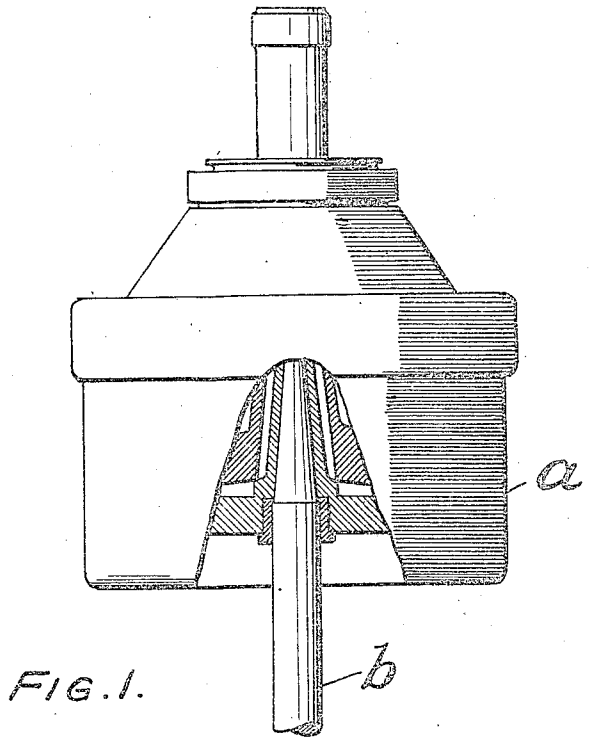


FIG. 1.

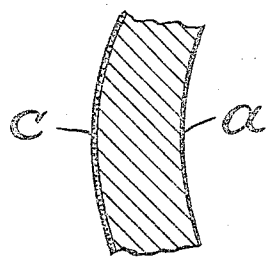


FIG. 2.

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UNITED STATES PATENT OFFICE.

CYRUS HOWARD HAPGOOD, OF NUTLEY, NEW JERSEY, ASSIGNOR TO THE DE LAVAL SEPARATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

PROCESS OF CENTRIFUGALLY SEPARATING REFRIGERATED INGREDIENTS AND CENTRIFUGAL BOWL USED IN SUCH PROCESS.

Application filed October 22, 1921. Serial No. 509,670.

To all whom it may concern:

Be it known that I, CYRUS HOWARD HAPGOOD, a citizen of the United States, residing at Nutley, county of Essex, and State of New Jersey, have invented a new and useful Improvement in Processes of Centrifugally Separating Refrigerated Ingredients and Centrifugal Bowls Used in Such Processes, of which the following is a full, clear, and exact description.

In the centrifugal separation of certain mineral oil derivatives, it is known to subject certain solutions of such derivatives to a temperature sufficiently low to solidify one of the ingredients and to then subject the mixture to centrifugal force for the purpose of separating the liquid ingredient from the solid ingredient. One such process involves the separation of wax (paraffine) from wax distillates. In this process a temperature of from twenty degrees to thirty-five degrees F. is required to crystallize the wax. Another process involves the blending of cylinder stock or bright stock (a residue of successive distillations of crude oil) with naphtha and the refrigeration of the blended stock to throw out of solution the petrolatum (amorphous wax). In this process a temperature of about zero F. is usually recommended. Recent experiments with the process have shown that to secure a +25 F. pour test, the temperature of refrigeration should not be over about —5° F.

In the centrifugal separation of such refrigerated mineral oil stock, particularly when the temperature of refrigeration is low, certain difficulties have developed, one of the most serious of which is the frequent burning out of the electric motor used to drive the centrifugal bowl. This result is obviously due to an excess of work imposed upon the power; specifically, to the development of an abnormal resistance to rotation of the bowl. One of the phenomena which I observed was developed in the practice of the process was the formation upon the outer wall of the bowl of a multitude of irregularly distributed lumps of ice due to condensation of atmospheric moisture upon the cold bowl surface. I became convinced that the presence of these ice lumps was a primary, if not the sole, cause of abnormal resistance to rotation, it being clear to me that the atmosphere exerts a pronounced resistance (windage) to high speed rotation of any body of matter extending above the exterior, and otherwise smooth, wall of the bowl. I therefore addressed myself to the problem of maintaining the exterior surface of the bowl in its normally smooth condition, either by preventing the condensation of moisture upon such surface, or by throwing off the moisture immediately after condensation, or by throwing off any lumps of ice that might form from such condensed moisture before the same had attained a number or bulk sufficient to create substantail air resistance. I succeeded in solving this problem by applying to the outer wall of the bowl a coating of a substance repellant to water, that is: a substance which has no capacity of adhesion to water or ice sufficient to resist the centrifugal force tending to throw the same off the bowl surface. I found that I obtained the most satisfactory results by applying to the bowl surface a solution of paraffin in benzol and then allowing the benzol to evaporate, leaving the bowl coated with a smooth and practically permanent film of paraffin. Petrolatum and vaseline are satisfactory substitutes for paraffin. Other solvents of paraffin, such as benzine, naphtha and gasoline, have been found available. It is clear, also, that the substance of the invention is not limited to the employment of any particular coating ingredient, nor even to the application of the coating ingredient by dissolving it in a solvent and then evaporating the solvent, although this method of application of the coating medium and the particular coating media specified have advantages.

With a bowl so coated, the motor never burned out, and after the bowl is operated for a substantial length of time, its surface remains in its initially smooth condition.

The burning out of the motor is not the only serious objection to the centrifugation of refrigerated ingredients. It is observed, in the separation of petrolatum wax from cylinder stock, that the outlet for the heavier ingredient—wax and naphtha, (naphtha being carried out with both separated ingredients)—frequently becomes throttled or even altogether stopped up by the formation and accumulation of ice adjacent the outlet. This phenomena is not so plausibly explicable on the theory of direct condensation of

atmospheric air at the locus of ice formation. The more probable explanation is that the ice forms from water outflowing with the wax and naphtha and that such water is either present in the stock or is condensed from moisture carried by such atmospheric air as enters the bowl inlet with the mixture to be centrifuged. The origin of such water is, however, of no essential importance, inasmuch as the phenomena of ice formation at the discharge outlet is effectually prevented by coating the surface of the bowl at the locus of discharge with the water repellant substance hereinbefore mentioned.

By means of my invention, it is possible to carry out the centrifuging process continuously for an indefinite time and without danger of burning out the motor or clogging the discharge for the heavier separated ingredient.

In the drawings: Fig. 1 is an elevation, partly in section, of a centrifugal bowl adapted to receive the coating above described. Fig. 2 is an enlarged cross-section showing the bowl wall, with a coating of paraffin applied thereon.

a is the bowl rotatable on a spindle *b*. *c* is the coating of paraffin on the bowl's exterior surface, the thickness of the coating being magnified.

It is clear that the invention is not limited in its application to the process of centrifugally separating mineral oil derivatives or to centrifugal bowls used in such processes, but that it is also applicable to the centrifugal separation of any refrigerated liquids, whether the same be a mixture of liquids or a mixture of liquids and solids, and to bowls used in such processes. Where the temperature of the ingredients, whatever they may be, undergoing centrifugal separation is sufficiently low to produce, under ordinary operating conditions, the phenomena specified, the use of my invention will effectually prevent the phenomena and the obstructions to successful centrifugation which such phenomena develop.

While I am convinced that in the use of my invention condensed water will not adhere to the bowl surface for a length of time sufficient to form even minute ice crystals, it cannot with certainty be affirmed that this phenomena does not occur, followed by the immediate throwing off of the ice; and therefore, in the claims, I have referred to H_2O as the substance to which my coating material is repellant as described.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In the process of centrifugally separating ingredients at a temperature below the freezing point of water, the step of covering parts of the bowl on which lumps of ice tend to form by a material to which, during the rotation of the bowl, H_2O will not adhere and build up into lumps.

2. In the process of centrifugally separating ingredients at a temperature below the freezing point of water, the step of covering parts of the bowl exposed to atmospheric air with a substance repellant to H_2O, thereby preventing the building up on said exposed areas of lumps of ice resulting from condensation and freezing of atmospheric moisture.

3. In the process of centrifugally separating ingredients at a temperature below the freezing point of water, the step of applying to the outer surface of the bowl exposed to atmospheric air a layer of material adapted to maintain said surface in a smooth condition and with which H_2O has no capacity of adhesion sufficient to resist the centrifugal force created by the rotation of the bowl, thereby preventing the building up on said exposed surface of lumps of ice that would create substantial atmospheric resistance to rotation of the bowl.

4. In the process of centrifugally separating ingredients at a temperature below the freezing point of water, the step of applying, to the outer surface of the bowl and to the surface over which a separated ingredient flows during discharge, a substance providing a smooth surface and to which, during rotation of the bowl, H_2O will not adhere and build up into lumps.

5. In the process of centrifugally separating ingredients at a temperature below the freezing point of water, the step of applying to the parts of the bowl on which lumps of ice tend to form, a substance repellant as described to H_2O and a solvent therefor and evaporating the solvent.

6. A centrifugal separating bowl having parts thereof on which, in the separation of the constituents of a refrigerated mixture, lumps of ice tend to form, coated with a material to which, during the rotation of the bowl, H_2O will not adhere and build up into lumps.

7. A centrifugal separating bowl having parts thereof exposed during rotation to atmospheric air and on which, in the separation of refrigerated ingredients, lumps of ice tend to form, coated with a substance repellant to H_2O, thereby preventing the building up on said exposed areas of lumps of ice resulting from condensation and freezing of atmospheric moisture.

8. A centrifugal separating bowl having its outer surface coated with a layer of material presenting a smooth surface and with which H_2O has no capacity of adhesion sufficient to resist the centrifugal force created by the rotation of the bowl, thereby, when the bowl is used for the separation of refrigerated ingredients, preventing the building up on said surface of lumps of ice that

would create substantial atmospheric resistance to the bowl's rotation.

9. A centrifugal separating bowl having its outer surface and also the surface over which a separated ingredient flows during discharge covered with a substance providing a smooth surface and to which, during the centrifugal separation of refrigerated ingredients, H_2O will not adhere and build up lumps.

In testimony of which invention, I have hereunto set my hand, at Philadelphia, on this 21st day of October, 1921.

CYRUS HOWARD HAPGOOD.