The Votator Process for Chilling and Aerating Oils and Fats

By L. L. Dawson

In considering the process which is the subject of this paper, I should like to direct your attention first to a general description of the process, secondly, to a specific application of it, and thirdly, to a description of the type of equipment used to carry out the process.

In the first place the process may be briefly described as one in which heat transfer changes the state and concurrent agitation makes a homogeneous mass of the material being passed through a confined space. The Votator carries out this process in a closed system, thereby affording protection to the material being processed and preventing refrigeration losses by radiation.

A few of the outstanding features of the process as carried out by the Votator are:

1. High efficiency of the heat transfer principle employed resulting in a high rate of chilling and rapid formation of crystals.
2. Complete exclusion of air and moisture from the product to be chilled.
3. The introduction of any desired kind of gas.
4. Uniformity of product due to complete control over materials, temperature and pressures.

The high efficiency of heat transfer is the result of the high ratio of the heat transfer surface to the volume of material coming in contact with the surface at any time and the continuous scraping of the film from the heat transfer surface. The material to be cooled is pumped through a relatively small tube in which there is an agitator. The agitator almost fills the tube, leaving only a small annular space through which the material passes. Confining the material to this small space is unique in this process and is one of the reasons for the high heat transfer efficiency. The refrigerant (in most cases liquid ammonia) is circulated around the outside of the tube. A congealed film is constantly being formed and removed from the wall of the tube by blades on the agitator, which scrape the thin film from the heat transfer surface and constantly expose new material to the surface as it passes through the tube. The scraper blades touch the wall of the tube so slightly, if at all, that there is no appreciable friction. As there is only a thin tube wall separating the hot oil or fat and the refrigerant, the rate of heat transfer is very rapid. In fact, with only ten square feet of heat transfer surface approximately 60 degrees of heat may be extracted from oil or fat at the rate of about seven thousand pounds per hour in commercial production. Such rapid chilling forms minute crystals, which give unequaled smoothness to the product. To help us visualize this principle of heat transfer suppose we look at a cross section view of the processing tube.

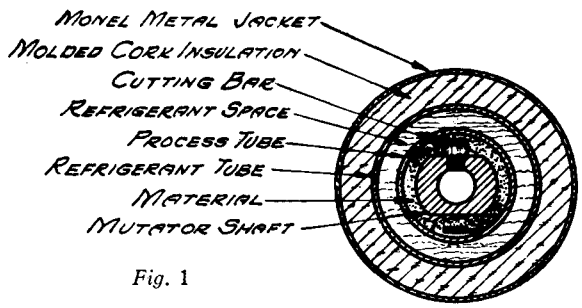
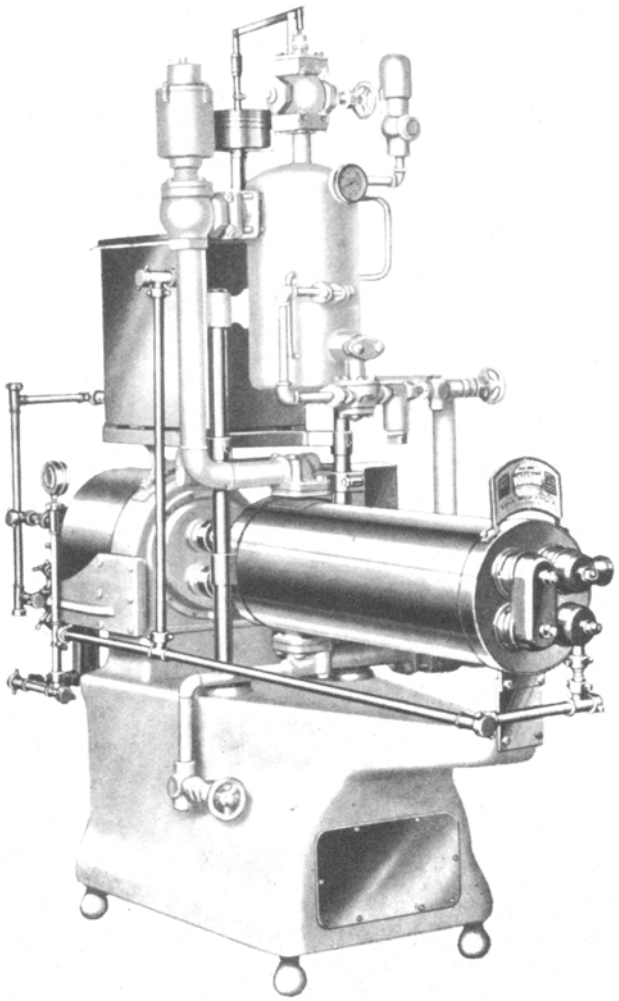


Fig. 1

A cross section of the processing tube.

Complete exclusion of air and moisture from the product during the chilling operation is possible, because the system is entirely enclosed. If it is desired, air may be admitted uniformly in predetermined quantities. The introduction of air is controlled mechanically and the amount to be introduced may be changed at will. The same feature of the closed system which makes it possible to exclude air also provides a way in which to introduce any desired kind of gas. An inert gas such as nitrogen has been successfully used with oils and fats instead of air.

The closed system also makes it possible to apply



Votator.

pressure during the chilling and agitation of the material. Pressure not only propels the congealed material through the tube, but it has an important effect upon the incorporation of gas in the product, as the solubility of gases in liquids varies directly with the pressure of the gases. Where air or preferably an inert gas such as

nitrogen, is to be mixed with the material being cooled, and the material is held under pressure during the crystallizing stage, it has been found that upon release of the pressure some of the dissolved gases are released from solution with the material in the form of very minute globules which, due to their minuteness, are retained in the "set" mass, thus giving a uniformity of opacity not otherwise obtainable.

By handling relatively small quantities of material at any one time, but operating continuously in a closed system, accurate control of both product and operating conditions can be obtained. This results in unequaled uniformity of product. The color, texture and weight of the product remain constant unless operating conditions change. So much for a general description of the process.

Our second consideration is a specific application of the process, and in this connection I should like to refer to the cooling of fats and oils in the making of lard and vegetable shortenings.

The Votator process is particularly well adapted to the production of these products as the essential features such as quick chilling, complete incorporation of air or gas and continuous operation are carried out with a higher degree of efficiency in the closed system than in any other method. Instantaneous chilling of oils or fats forms small crystals, pressure on the material dissolves much of the gas instead of whipping it in, and constant agitation mixes the small crystals more intimately, resulting in a very much smoother and more homogeneous product than can be secured by other means.

Both lard and vegetable shortening produced commercially contain varying amounts of air. In some instances air is added intentionally by the manufacturer for the purpose of giving the product a certain fluffiness, and to increase its degree of whiteness, but in other instances, although undesirable, it is found to be present because the open system of cooling and whipping now in general use provides no means for completely excluding it. While the desired results are obtained by whipping in air, certain disadvantages are unavoidable. The air which improves the appearance of the product also injures its keeping qualities, as it causes oxidation of the fats or oils, thereby hastening the development of rancidity.

Therefore, the stability or keeping qualities of both lard and vegetable shortening can be greatly improved by the exclusion of air from the product. But in order to exclude air the system through which the product passes must be completely enclosed. As stated previously, the Votator employs such a closed system, this being one of its exclusive and most valuable features. It offers not only a means of excluding air from the product during the chilling process, but also provides a way in which to introduce an inert gas such as nitrogen, instead of air. Such a gas, when incorporated into the product, has the same whitening effect as air, and gives equal fluffiness to the product, without injuring its stability. The closed system has the added advantages of protecting the product from picking up moisture or any impurities from the air during the cooling operation. This has the further effect of improving the stability of the product. Another interesting and important feature is that a given degree of whiteness in lard or vegetable shortening can be obtained with a smaller volume of air or inert gas when incorporated by means of this process than can be obtained with air incorporated in the open type of process which has been in general use for many years.

Continuous operation and even flow of the material makes the Votator process especially suitable for filling small packages such as cartons and cans.

Now let us consider the type of equipment which has been developed to carry out this process effectively. The equipment which does the cooling and agitating is known as the Votator. So that we may understand just what takes place in the whole operation, suppose we follow the course of the oil through the entire system.

The oil is fed by gravity from the holding tank located on the floor above to the Votator supply tank which in this installation is placed on the floor immediately behind the Votator. A valve through which air or an inert gas may be admitted is placed in the pipe line leaving the supply tank. In the installation described here nitrogen is used instead of air. A pump on the rear of the machine delivers the oil and air from the supply tank through sanitary piping to the inlet of the processing or cooling tube at this point.

As the oil passes through the tube the heat is removed through the wall of the tube by means of liquid ammonia refrigerant surrounding the tube. In each tube there is an agitator or "mutator" shaft as it has been named. On the shaft there are blades which prevent a film of congealed material from being formed on the wall of the tube. This principle of preventing a film from forming which would have an insulating effect is largely responsible for the quick rate of chilling attained and the economy in refrigeration which is effected. Simultaneously the action of the revolving mutator shafts distribute the finely formed crystals equally throughout the mass of the product passing through the tube, and help to further effect a more complete incorporation of air or inert gas in the product. The pressure developed by the pump which delivers the hot oil to the processing tube is sufficient to advance the chilled material through the tube.

From the Votator the material passes to a secondary chamber or "B" unit which is equipped with an agitator but free from outside refrigeration. The purpose of this unit is to hold the material a sufficient length of time to complete the formation of crystals. In the Votator the material is chilled so rapidly that the desired number of crystals do not have time to form. Therefore, the Votator rapidly chills the entire mass below the required crystallizing temperature and then the mass is held in the "B" unit under agitation until the desired crystals are formed. The excess quantity of heat removed in the Votator is exactly equal to the heat of crystallization developed in the "B" unit. The product delivered from the "B" unit is at exactly the right temperature and contains exactly the right kind and quantity of crystals.

It has been found that the extrusion of the material under high pressure after chilling insures its homogeniety. Therefore, by means of a separate pump the pressure in the "B" unit is built up to approximately three hundred pounds by means of a pump and a hold-back valve, and this pressure delivers the material to the filling station where it can be packaged at either high or low pressure.

The Votator is built as strong and as well as modern materials and skilled workmanship can make it. It permits very exact control of materials and processing, and is sensitive, sturdy and serviceable. Operation is simple but very flexible. Special patented control systems automatically regulate the quantity of materials, the quantity of air (if aeration is used), the degree of heat transfer desired and the speed with which the material is processed. This assures constant uniformity of product. One motor operates the pump on the Votator and drives the agitators. On the large machines a second motor is

used to drive the high pressure pump and "B" unit agitator.

Both the refrigerant and power systems are fully equipped with protective and safety devices which preclude all possibility of injury to the machine or to the operator. All metal parts which come in contact with the material being processed are stainless, excepting the process tubes, which are pure nickel seamless tubes, gun bored to .001½ inch accuracy. Molded cork jackets are cemented to the refrigerant tubes, making the process tube block a compact and efficiently insulated unit. This eliminates losses by radiation and effects substantial economies in refrigeration.

The sanitary piping is seamless tubing and like the sanitary fittings, is tinned or nickel plated. All exposed metal parts are chromium or nickel plated and buffed to facilitate cleaning.

Summing up it can be said that the Votator is a revolutionary new development in processing equipment. It is an automatic unit that continuously processes fluids or materials requiring intimate mixing and chilling, congealing, or freezing, with or without aeration. It is compact, efficient, economical in operation, and above all, it makes a better product.

Spanish Technical Publication Reviews North American Methods

A series of articles on current vegetable oil refining methods in the United States, entitled "Metodes corrientes de desodoriazcionde aceites Vegetales Comestibles en America del Norte," is now appearing in "Aceites Technica Revista," of Barcelona, Spain, by John P. Harris, vice president and chairman of the Membership Committee of The American Oil Chemist Society.

Argentina—1932 Exports of Linseed

During the year 1932 there was exported from Argentina 2,026,245 metric tons of linseed. The principal ports of export were Rosario (594,880 metric tons), Santa Fe (416,710 metric tons) and Buenos Aires (227,352 metric tons), reports Assistant Trade Commissioner Smith at Buenos Aires.

Foreign Trade Opportunities

Further information is available at the Bureau or its District and Cooperative Offices to all duly registered American firms and individuals upon application by Opportunity Number.

Commodity	*T. O. No.*	*City and Country*	*Purchase or Agency*
Vegetable oils; such as cotton-seed oil, etc., prime quality	3,156	Hamburg, Germany	Agency
Fish oil and related products	3,156	Hamburg, Germany	Agency

United Kingdom—Tariff Modification Made Effective With India

Following upon the action by British India to make effective its part of the agreement, the United Kingdom, by Treasury order effective January 1, 1933, has put into force the tariff modifications embodied in the agreement entered into with British India at the Imperial Economic Conference, according to a cable from Commercial Attache Cooper at London.

The following is a list of certain articles upon which, when imported from sources other than the British Empire, new or increased duties are now imposed: Linseed, 10 per cent ad valorem (formerly duty free); castor, linseed, coconut, peanut, rape, and sesamum oils, 15 per cent ad valorem, all formerly dutiable at 10 per cent ad valorem.

Norway—Whale Oil Prices

There is available for loan to interested parties, a table of whale oil prices, of No. 1 oil, highest and lowest for the year, for the period 1888 to 1931. The above information was forwarded the Bureau from Oslo, Norway by Trade Commissioner Carlson.

Increased Production of Soya Beans in Java and Madoera

According to data released by the Central Statistical Office of Java, the 1932 soya bean acreage in that area increased by about 20 per cent when compared with 1931. Report from Assistant Trade Commissioner Boehringer at Batavia.

Don't Miss This New Orleans Meeting

Sure, we know that it's going to be harder than usual to jar loose and make the trip this year! Maybe it'll involve some personal sacrifice, but that's going to make it the more worth while to you!

Under the able leadership of Nick Hamner, prince of good fellows, you're assured of a program timely and constructive, and you're assured of a genuine warmth of personal welcome from Nick and from the New Orleans members, including Helm Sanchez, Stryker, Williams (golf shark), Williamson, Saint Pe, Shilstone, Trunzler, etc.

Of course, Texas must rally to bring along a worthy delegation with President Hamner; and you can always count on Memphis. Barrow, Agee, Smith, Hayes, Meehan, Daniel, Pless, etc., will be on hand. (Look out for them on the golf course, as well as Forbes and Hatter from nearby cities.) We've named just the nucleus of a wonderful bunch of fellows who you'll miss seeing and who will miss seeing you if you don't get down there.

And ladies—we understand that this is *really your* year. Besides the charming wife of our president, we understand that there'll be several ladies from the Lone Star state, and gossip says that there's a movement on foot for a flock of Chicagoans and Cincinnatians going to drive down to New Orleans and pick up a number of members and their wives enroute, at Decatur, Memphis, etc. This might include the Irwins, the Vollertsens, the Moores, the Sheeleys, the Reids, the Newtons, the Tolmans, the Dormitzers, the Putlands, the McGees, the Blakes, the Harris, the Duncans, the Richardsons, the Durkees, and the Birchs.

We hope that this isn't just idle gossip; anyhow, if anyone mentioned is hearing about this for the first time, we hope you'll join in and make it possible.

And there are some charming brides of members whom we all want to meet. This includes Mrs. G. Owen Daniel, Mrs. R. A. Duncan and Mrs. Andrew Schwartz. So come on down, fellows, and bring Mrs. Member with you, and let's all be a little chummier and appreciative of each other than we've ever been in the past.