EUROPEAN PATENT SPECIFICATION

Date of publication of patent specification: 13.01.93
Int. Cl.: C11B 3/00

Application number: 88201541.5

Date of filing: 15.07.88

The file contains technical information submitted after the application was filed and not included in this specification

Method and apparatus for refining oils or fats.

Priority: 24.07.87 NL 8701760

Date of publication of application: 15.02.89 Bulletin 89/07

Publication of the grant of the patent: 13.01.93 Bulletin 93/02

Designated Contracting States: AT BE CH DE ES FR GB GR IT LI LU NL SE

References cited:
WO-A-88/07821
GB-A- 2 160 437
US-A- 3 415 181

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Description

The invention relates to a method for refining oils or fats which are used in a container in the heated condition for cooking an edible product therein, which refining is carried out by passing the oil or the fat from the container continuously through a filter system and back into the container simultaneously while edible products are being prepared therein.

A method of this type is known from US-A-3,415,181.

According to said prior art publication oil or fat from the container is pumped into a filter bag and after having passed the wall of the filter bag returned into the container.

In cooking edible products in hot oil or fat, such as frying or deep-frying potato chips (French fries), croquettes, pancake rolls, etc., the problem arises that the oil becomes contaminated in a relatively short time. This contamination is dependent on the nature of the product processed in the oil, and depending on the product, consists of contamination with a varying size range and clogging-up capacity. The burning of said contamination results in the generation of fatty acid oxidation products which lead to smoke and deposits on the products, while the microscopically small particles produce the typical frying smell. In the case of installations which are in operation for prolonged periods this means a very unpleasant working atmosphere for the staff, while the product to be delivered rapidly becomes bad. Furthermore, as a result of heating the oil is subject to oxidation which is promoted by the oxygen introduced along with the product to be deep-fried.

The oxidation and the microscopic product contamination are the cause of the formation of fatty acid oxidation products. Furthermore, hydrolysis occurs due to the introduction of water with the product to be deep-fried, as a result of which free fatty acids are formed.

A limit is imposed in relation to the fatty acid content by the Keuringdienst van Waren (Food Inspection Department).

With the filter system known from the above-mentioned US-A-3,415,181 it is not possible to prevent the formation of substances which generate free fatty acids and fatty acid oxidation products. Coarse particles can be separated by means of the filter bag but not the very fine particles, so that the fatty acids or fatty acid oxidation products will be formed and will remain in the oil.

Object of the invention is to provide an effective solution for this problem and to appreciably prolong the service life of the oil or the fat content of the container and prevent the formation of products which are injurious to health.

According to the invention this object is achieved in that the complete oil or fat contents of the container is passed through a filter system comprising a series of filter stages with decreasing pore size and matching flow capacity, wherein said oil or fat is sucked through the first filter stage, said complete passage through the said filter system taking place within a time period which is less than the time within which fatty acid oxidation products are formed.

The invention is based on the surprising insight that no fatty acid oxidation products are formed by oxidation and micro-contamination, in particular, as a result of removing from the oil in good time injurious substances which are introduced and formed during frying, as a result of which the latter are unable to affect the quality and the stability of the oil or the fat adversely.

It is observed that from WO-A-8807821 a method is known for refining frying oil during its use, in which oil is continuously led through a filter material which carries away coarse substances and upon which absorbent particles are applied which reduce the surfactants in the oil below the level of such surfactants normally produced during the frying process to increase the useful lifetime of the oil which absorbent particles preferably are porous rhyolithic materials containing water as well as a food compatible acid.

This document, which belongs to the non-published prior art, aims at a method which also in a very short time prevents the formation of free fatty acids etc., but solves this in a manner which requires the continuous movement of the filter and the continuous supply of the absorbent particles. It has the disadvantage that the oil is gradually contaminated by particles which fall from the moving filter paper belt and by the acids which although compatible with food are not desirable for maintaining the desired quality and taste of the products.

In the case of edible oils or fats care has to be exercised since saponification occurs if pressures are too high and vortice currents are too strong. Increasing fineness of the filter therefore requires a large surface. This is the reason why the oil is fed through the first stage by suction. Preferably the first stage has a pore size which is less than 30 µm (micrometer), preferably even less than 25 µm, while the final stage still has to separate off 0.1 µm particles.

Preferably the suction should not exceed 0.5 bar.

The suction is of importance since a pressure drop exceeding 1 bar cannot then occur. With a pressure pump, the pressure will be able to increase excessively if the filter clogs up. As a result of the suction, separation of water, air and oil also takes place. In the said first filter stage, which is
preferably constructed in the form of a rotating filter, the separation is then carried out of the non-mutually adhering coarse granular particles which are collected in a type of filter known per se to the person skilled in the art in a tank situated at the bottom of the housing of the filter and can be removed therefrom. Removal of the granular particles means that particles which could in fact adhere to each other are able to pass through the filter and do not give rise as a result of settlement to clogging up of the filter surface or reduction thereof.

In the final stage, the pressure is higher but does not exceed 5 bar. There the very small particles are consequently separated off and here a separate pressure pump which forces the oil through the very fine filter (microfilter) is preferably used. In said microfilter, the water may remain behind. The oil passes therethrough along with the air and the air can be separated from the oil during the return to the oven.

Between the first and final stage, one or more filters are used which have a pore size not exceeding 5 μm with a pressure not exceeding 3 bar, which filters are connected to the pressure side of the pump which sucks the oil to be purified out of the oven and through the rotating filter.

The apparatus for carrying out the method according to the invention comprises a heatable container, a filter system, a conduit connecting the container with the filter system, a conduit for returning filtered oil or fat back into the container and a pump for circulating the oil or fat from the container through the filter system and back, which apparatus according to the invention is characterized in that the first stage of the filter system comprises a rotating filter which via a suction line is in communication with the liquid content of the container, a suction pressure pump downstream of said filter, in that the second stage comprises one or more surface filters arranged in series downstream of the suction pressure pump, and in that the final stage comprises a microfilter with a pressure pump in the line between the second stage and the final stage.

In this connection, it may be of benefit that at least the microfilter of the final stage can be heated and this heating can be brought about electrically by heating the container of said microfilter or can be obtained by constructing said container with a double wall and passing the hot oil which originates from the second stage into said double wall before it enters the filter. The electrical heating or heating by means of a part of the hot oil may be switched on and off with the aid of a thermostatic switch placed in said microfilter. Said heating serves to obtain the required viscosity which is necessary to force the oil through the microfilter.

The purified oil which emerges from the final stage is fed back to the container in which the deep-frying is carried out. According to the invention, this preferably takes place via a bell jar which projects into the liquid along with the mouth of the return line above the level of the liquid and has an air removal pipe. Air which could be present in the oil can then be liberated and escape.

The entire system may virtually be considered as a closed system because oxygen can no longer enter during the filtration.

The various particles which are separated off in the filters are no longer able to burn because they do not return to the oven.

The contamination introduced into the oil with the products to be treated therefore no longer come into contact with the products as a combustion organism.

As a result of this purification, the oil has a better heat transfer capacity, as a result of which overheating of the oil no longer takes place when the latter flows past the heating elements.

The invention will now be explained in more detail with reference to the drawings.

Figure 1 shows diagrammatically the general design of the apparatus for applying the method according to the invention,

Figure 2 shows diagrammatically the first filter stage,

Figure 3 shows diagrammatically a filter of the second stage, and

Figure 4 shows diagrammatically the microfilter.

In Figure 1, 1 indicates a container filled with deep-frying fat, the level of which is indicated at 2.

Situated at 3 is a suction bell jar which is connected to the housing 5 of a rotating filter via a line 4. The filter unit is indicated by 6 and may comprise segments rotating with respect to each other and stationary segments, of which the rotating segments are driven by a motor 7. Dirt particles are collected on the outside wall of the filter unit 6 and drop down into the base section 8.

Oil passing through, the filter is sucked via the interior of the filter and the line 9 in communication therewith by a pump 10, in particular with a vacuum of 0.5 bar, which pump 10 forces oil via the line 11 into a series of surface filters 12 and 13 in which the filter body is diagrammatically shown by the line 12'. Two surfaces filters 12 and 13 are shown, but the number of filters to be used is in this case dependent on the required flow capacity, allowance being made for the pore size of the filter units. The filter cartridges in said filters 12 and 13 have to be replaceable. The line connections such as 14 and 15 connected at the base have shutoff valves 16 for removing oil and dirt remaining behind in the housings 12 and 13 when cleaning of the installation and replacement of the filter car-
trigges is necessary.

The oil emerging from the last filter unit of the second stage is forced with the aid of the pump 10′ into the microfilter 17, which may have a heatable wall 18 and is so constructed that it retains particles measuring less than one micron.

Purified oil emerging from said last stage returns via the line 19 to the vessel 1 and debouches into a bell jar 20 at a point situated above the liquid level 2. Said bell jar has an air removal pipe 21.

The rotating filter 5, 6 indicated diagrammatically in Figure 2 with drive motor 7 has a removable collection tank 22 in the bottom section and a funnel-shaped guide 23 above it. In said tank dirt particles may be collected which drop off the filter unit 6 and can be removed with the tank. The tank also has a drainage line 24 with stop cock 25.

Figure 3 shows diagrammatically a filter unit of the second stage. The filter 12′ may comprise a filter sleeve of non-woven acrylic fibres wound round a support which provides a hollow core so that oil passing through the filter sleeve can enter the drainage line 27 via the funnel 26. The lines 14 and 15 again have shutoff valves 28 and 29 which are necessary for cleaning the system. Said filter units have a cover 30 to which the filter cartridge 12′ is attached and by means of which replacement is possible.

Figure 4 shows diagrammatically the microfilter of the last stage. The inlet line 27 from the last filter unit 13 (Figure 1) is fed to the double wall 18.

The oil entering the double wall is able to leave the latter via the outlet or return line 19. If the pump 10′ starts to operate, then it sucks approximately three quarters of the oil supplied and forces the latter through the line 33 into the housing of the microfilter and through the filter 17. The oil which has passed through the filter returns via the line 32 to the jacket 18 and proceeds to the discharge 19.

In the jacket there is a temperature sensor which switches on the pump 10′ on reaching the correct temperature, for example 120 °C.

The filter cartridge 17, which must be able to retain particles measuring 0.1 micrometer may in this case comprise a piece of fibre material for example also acrylic fibres, wrapped round a support.

With the method and apparatus according to the invention, an appreciably longer oil or fat service life is achieved, and in particular a multiple of the usual service life. A finer edible product is obtained which has a better taste and does not have the often bitter taste of products which have been treated with dirty oil. The product is therefore healthier. The smoking (generation of smoke) from the fat no longer occurs so that the working atmosphere is improved and the deep-frying smell no longer occurs.

Obviously, the entire installation, including the various filter stages, should be matched to the product to be treated and consequently to the degree of contamination which may occur, and obviously, in designing the various filter stages account should be taken of the liquid content which has to have been completely circulated at least within the time in which fatty acids can be formed. Obviously, the various filters should be regularly replaced.

It is important that it is possible for the first time, as a result of the method and apparatus according to the invention, to avoid deep-fried foodstuffs being unhealthy as a result of the previously excessive content of fatty acid oxidation products (mutagenic compounds), something against which the Keuringsdienst van Waren (Food Inspection Department) and other authorities which are concerned with public health have always warned.

This applies also to oxidation products which are growth-inhibiting and are harmful to the functioning of the liver.

Claims

1. Method for refining oils or fats (2) which are used in a container (1) in the heated condition for cooking an edible product therein, which refining is carried out by passing the oil or the fat from the container (1) continuously through a filter system (5 to 18) and back into the container (1) simultaneously while edible products are being prepared therein, characterized in that the complete contents of the container (1) is passed through a filter system (5-18) comprising a series of filter stages with decreasing pore size and matching flow capacity, wherein said oil or fat is sucked through the first filter stage, said complete passage through the said filter system taking place within a time period which is less than the time within which fatty acid oxidation products are formed.

2. Method according to claim 1, characterized in that the oil or the fat is sucked through the first filter stage (6) with a vacuum not exceeding 0.5 bar.

3. Method according to claim 1 or 2, characterized in that in the first stage (6) the pore size is less than 30 μm and in the last stage (17) does not exceed 0.1 μm.

4. Method according to claim 1, 2 or 3, characterized in that the oil or the fact is forced through the final stage (17) with a pressure not exceed-
5. Method according to one or more of the preceding claims, characterized in that between the first stage (6) and the final stage (17), the oil or the fat is passed through one or more filters (12, 13) with a pore size not exceeding 5 μm and a pressure not exceeding 3 bar.

6. Method according to one or more of the preceding claims, characterized in that the oil is returned to the container via an air separator.

7. Apparatus for carrying out the method according to one or more of the preceding claims, comprising a healable container (1), a filter system (6 to 17), a conduit (4) connecting the container with the filter system, a conduit (19) for returning filtered oil or fat back into the container (1) and a pump (10) for circulating the oil or fat back into the container (1) through the filter system and back, characterized in that the first stage (6) of the filter system comprises a rotating filter (6, 7) which via a suction line (4) is in communication with the liquid content (2) of the container (1), a suction pressure pump (10) downstream of said filter (6), in that the second stage comprises a rotating filter (6, 7) downstream of the suction pressure pump (10), and in that the final stage comprises a microfilter (17) with a pressure pump (10) in the line (15) between the second stage (12, 13) and the final stage (17).

8. Apparatus according to claim 7, characterized in that at least the microfilter (17) of the final stage can be heated.

9. Apparatus according to claim 7 or 8, characterized in that an air separator (20) is provided at the end of the return line (19) from the final stage of the filter system towards the container (1) which air separator comprises a bell jar (20) which projects into the liquid content (2) of the container (1) along with the mouth of the return line (19) above the level of the liquid (2) and has an air escape pipe (21).

Patentansprüche

1. Verfahren zum Raffinieren von Ölen oder Fetten (2), die in einem Behälter (1) im erhitzten Zustand zum Kochen eines essbaren Produkts darin verwendet werden, welches Raffinieren ausgeführt wird, indem das Öl oder das Fett von dem Behälter (1) kontinuierlich durch ein Filtersystem (5 bis 18) und zum Behälter (1) zurückgeleitet werden, während gleichzeitig die essbaren Produkte darin zubereitet werden, dadurch gekennzeichnet, dass der vollständige Inhalt des Behälters (1) durch ein Filtersystem (5 bis 18) geleitet wird, umfassend eine Reihe von Filterstufen mit abnehmender Porengröße und angepasster Durchflussmenge, bei welcher das Öl oder Fett durch die erste Filterstufe gesaugt wird, wobei der vollständige Durchlauf durch das Filtersystem innerhalb einer Zeitspanne stattfindet, die kürzer ist als die Zeit, innerhalb welcher Oxidationsprodukte der Fett säuren gebildet werden.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass das Öl oder Fett durch die erste Filterstufe (6) mit einem Unterdruck angesaugt wird, der 0,5 bar nicht überschreitet.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass in der ersten Filterstufe (6) die Porengröße kleiner ist als 30 μm und in der letzten Stufe (17) 0,1 μm nicht überschreitet.

4. Verfahren nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, dass das Öl oder Fett in der Endfilterstufe mit einem Druck durchgedrückt wird, der 5 bar nicht überschreitet.

5. Verfahren nach einem oder mehrerer der vorangehenden Ansprüche, dadurch gekennzeichnet, dass zwischen der ersten Stufe (6) und der letzten Stufe (17) das Öl oder Fett durch ein oder mehrere Filter (12, 13) mit einer Porengröße von nicht mehr als 5 μm und mit einem Druck von nicht mehr als 3 bar durchgeleitet werden.


7. Vorrichtung zur Durchführung des Verfahrens nach einem oder mehreren der vorangehenden Ansprüche, umfassend einen beheizbaren Behälter (1), ein Filtersystem (6 bis 17), eine Leitungsrohr (4), das den Behälter mit dem Filtersystem verbindet, ein Leitungsrohr (19), um das filtrierte Öl oder Fett in dem Behälter (1) zurückzuleiten, und eine Pumpe (10) zum Zirkulieren des Öls oder Fets vom Behälter (1) durch das Filtersystem und zurück, dadurch gekennzeichnet, dass die erste Stufe (6) des Filtersystems ein rotierendes Filter (6, 7) umfasst, das über eine Saugleitung (4) in Verbindung mit dem flüssigen Inhalt des (2) Behäl-
8. Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, dass mindestens das Mikrofilter (17) der Endstufe beheizt werden kann.

9. Vorrichtung nach Anspruch 7 oder 8, dadurch gekennzeichnet, dass am Ende der Rückführleitung (19) von der Endstufe des Filtersystems zum Behälter (1) ein Windsichter (20) vorgesehen ist, der einen Rezipienten umfasst, welcher in den flüssigen Inhalt (2) des Behälters (1) ragt zusammen mit der Mündung der Rückführleitung (19) über dem Füllstand der Flüssigkeit (2) und einem Luftablassrohr (21) ragt.

Revendications

1. Procédé pour raffiner des huiles ou des graisses (2) qui sont utilisées dans un récipient (1) à l'état réchauffé pour y cuire un produit comestible, le raffinage étant réalisé en faisant passer l'huile ou la graisse depuis le récipient (1) en continu à travers un système de filtres (5 à 18) et en retour dans le récipient (1) simultanément à la préparation des produits comestibles dans le récipient, caractérisé en ce que le contenu complet du récipient (1) passe par un système de filtres (5-18) comprenant une série d'étages filtrants à dimension de pores décroissants et à capacité d'écoulement correspondante, dans lequel ladite huile ou ladite graisse est aspirée à travers le premier étage filtrant, ladit passage complet à travers ledit système de filtres ayant lieu pendant un laps de temps inférieur au temps au cours duquel des produits d'oxydation d'acides gras se forment.

2. Procédé selon la revendication 1, caractérisé en ce que l'huile ou la graisse est aspirée à travers le premier étage filtrant (6) avec un vide qui ne dépasse pas 0,5 bar.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce que, dans le premier étage (6), la dimension des pores est inférieure à 30 µm et dans le dernier étage (17), elle ne dépasse pas 0,1 µm.

4. Procédé selon la revendication 1, 2 ou 3, caractérisé en ce que l'huile ou la graisse est forcés à travers l'étage final (17) avec une pression ne dépassant par 5 bar.

5. Procédé selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que, entre le premier étage (6) et l'étage final (17), l'huile ou la graisse passe à travers un ou plusieurs filtres (12, 13) dont la dimension de pores ne dépasse pas 5 µm et avec une pression ne dépassant pas 3 bar.

6. Procédé selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que l'huile est renvoyés au récipient via un séparateur d'air.

7. Appareil pour mettre en œuvre le procédé selon l'une ou plusieurs des revendications précédentes, comprenant un récipient (1) qui peut être chauffé, un système de filtres (6 à 17), un conduit (4) reliant le récipient au système de filtres, un conduit (19) pour envoyer l'huile ou la graisse filtrés en retour dans le récipient (1) et une pompe (10) pour faire circuler l'huile ou la graisse provenant du récipient (1) à travers le système de filtres et en retour, caractérisé en ce que le premier étage (6) du système de filtres comprend un filtre rotatif (6, 7) qui, via un conduit d'aspiration (4), se trouve en communication avec le contenu liquide (2) du récipient (1), une pompe de pression par aspiration (10) en aval dudit filtre (6), en ce que le deuxième étage comprend un ou plusieurs filtres superficiels (12, 13) montés en série en aval de la pompe de pression d'aspiration (10) et en ce que le dernier étage comprend un microfiltre (17) avec une pompe de pression (10') dans le conduit (15) entre le second étage (12, 13) et l'étage final (17).

8. Appareil selon la revendication 7, caractérisé en ce qu'on peut chauffer au moins le microfiltre (17) de l'étage final.

9. Appareil selon la revendication 7 ou 8, caractérisé en ce qu'un séparateur d'air (20) est prévu à l'extrémité du conduit de retour (19) provenant de l'étape finale du système de filtres en direction du récipient (1), le dit séparateur d'air comprenant un récipient en forme de cloche (20) qui fait saillie dans le contigu liquide (2) du récipient (1) conjointement avec l'embouchure du conduit de retour (19) au-dessus du niveau du liquide (2) et qui comporte un tuyau d'échappement d'air (21).
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