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The invention relates to a method for preventing blockages of the flow paths and lines of a separator when processing a fatty starting product.

In many companies involved in food processing, separators are used for various applications and performance spectra. The construction and the design of these separators generally have to be adapted to these different requirements. As a result, they can be used within the predefined field or process, but they react to any deviations from the preset framework – for example to changes in output or changes in the composition of the products to be processed – in a sensitive manner, often by malfunctioning.

From DE 100 36 085, a method is known wherein, when degerming whey, the raw whey is separated into the components cream whey, skimmed whey (skimmed milk) and solids (sludge with germs), the centrifugal separation in the separator being performed in such a way that the fat content of the cream whey is more than 45%. The skimmed milk is then degermed and fed back into the cream whey, which has not been subjected to degerming, and the cream/skimmed milk mixture generated by reintroducing the skimmed milk into the cream is pasteurised. This method does not require heating to the high temperature of up to 135°C.

From DE 198 07 294 is known a skimming station comprising a clarification separator and a downstream skimming separator, wherein a recirculation line for skimmed whey – i.e. for the component having a reduced fat content – leads from the outlet of the skimming separator to the inlet of the clarifying separator (a bypass line), in order to keep fat loss low and to improve the quality of the cheese powder obtained in this process.

DE 198 20 870 proposes the return of a partial quantity of 0.5% to 2% of the discharged whey cream – i.e. the fattier component – into the raw whey fed to the separator while skimming the whey by means of a separator, in order to improve product quality.

US 4 151 950 discloses a clarification separator. In this clarification separator, the clarified liquid phase is diverted via passages and a shearing disc. The concentrated

solid phase is conveyed to the shearing disc via a passage of a valve and transported on from there via a line and a valve. In this process, a control device with a valve effects a constant viscosity of the product.

DE 691 386 discloses a centrifuge by means of which cream with a specific fat content can be separated from skimmed milk. The aim of DE 691 386 is the provision of milk with a specific fat content.

US 2 682 023 discloses a separator for processing milk into cream and skimmed milk. In this process, the electrical resistance of the skimmed milk is measured by a cell and the electrical resistance of the cream is measured by another cell, whereby the fat content can be determined in both phases. The device delivers skimmed milk and cream of a constant quality and a specified fat content, the fat content being adjusted by means of a control unit arranged on the side of the cream outlet.

When separating milk into skimmed milk and cream by means of separators, an excessively high fat concentration in the cream whey can lead to a blockage of the drum, i.e. to a blockage of some or all of the flow paths of the separator. In general, cream blocks the distributor chamber and/or the pans and/or the cream discharge in the centre of the drum and/or the cream outlet downstream of the separator.

If a blockage occurs, such blockages of the flow paths in the separator – these being the internal lines and flow paths as well as the discharge lines leading away from the separator – can, according to prior art, only be dissolved by

a) adding hot water via the inlet and
b) a simultaneous restriction of the skimmed milk discharge or an increase of the feed power,

which leads to production losses and to cost disadvantages.

Further prior art includes DE 101 35 073 C2, DE 36 01 814 C2, US 27 17 119, DE 100 36 085 C1, EP 0 427 750 B1, DE 44 07 061 C2 and DE 200 10 743 U1.

In view of this background, the invention is based on the problem of creating a method whereby imminent blockages of the flow paths can be detected early and avoided.

The invention solves this problem by the subject matter of claim 1.

Advantageous further developments can be derived from the dependent claims.

According to claim 1, the invention creates a method for preventing blockages of the flow paths of a separator when processing a fatty starting product, in particular milk or whey, wherein the concentration of the fat content of a current product phase is determined during operation, and if a preset fat content limit value is reached or exceeded, the separating zone in the separator drum is, by changing the operating parameters, preferably automatically, displaced in order to prevent a blockage.

In this way, imminent blockages can be detected early and avoided by the simplest of means, so that the flushing processes required in prior art and the product and time losses involved in the production process can be avoided.

A method for monitoring and for the open- or closed-loop control of the operation of a centrifuge is known from DE 101 35 073. According to the method disclosed in this patent specification, skimmed milk is taken at the outlet of the centrifuge by means of a measuring cell, whereupon the transparency of the skimmed milk sample and its fat content are determined. Depending on the detected fat content, the setting of the centrifuge is then – for example cyclically – monitored and controlled in an open or closed loop, and the centrifuge is in particular cleaned. However, the possibility of using this automated method for avoiding blockages has not been recognised so far, nor has the possibility of counteracting imminent blockages in the simplest way possible by automatically displacing the separating zone in the separator drum been recognised.

Surprisingly, the method also enables the separator to be operated closer to its “limit range”, i.e. in normal operation a fat concentration in the cream of up to 44% can be preset.

In a particularly preferred embodiment, the method is used for separating cold milk into cream and skimmed milk, wherein the cold milk is separated into cream with a fat content of 28% to 45% and skimmed milk at a temperature of 2°C to 15°C, in particular 4°C to 10°C. In cold milk separation, the cream phase in particular tends to develop a butter-like consistency, leading to a blockage of at least a part of the flow paths, the removal of which involves a lot of effort and time loss in production. This clogging is determined by the parameters of cold milk separation. These parameters in particular include the product temperature, the production output and the machine design (such as plate diameter, plate thickness, link plate thickness). Clogging typically occurs in the processing of cold milk at a temperature T = 4°C, for example at a fat content of 45% in the cream. By means of the invention, this problem can be solved simply and cost-effectively.

According to a first variant, the separating zone in the drum is displaced inwards if a limit value is reached or exceeded, preferably by restricting a valve in the skimmed milk discharge. Using a timer, this restriction can be made effective over a preset period of time.

Alternatively and/or optionally, it is conceivable that the blockage of the drum is prevented by increasing the feed power. In this variant, too, a clogging or blockage of the drum of the separator by butter-like solid cream is prevented by simple but effective means. In an advantageous development, the feed power is increased within a period of time of 5 to 60 seconds, in particular 5 to 20 seconds. Even such a short change of the operating parameters can effectively prevent blockages. This in particular applies to situations in which the feed power is increased by 5% to 40%, in particular by 5% to 20%.

Various measuring methods are conceivable in principle for determining fat content. The fat content may for example be determined by means of a mass-flow meter, in particular with a separate density output. Such measuring instruments are for example offered by the Micro Motion company.

A device for carrying out the method according to the inventioncomprises a measuring and control unit which is designed for detecting an imminent blockage by determining the concentration of the fat content of a current product phase and for changing the operating parameters if a preset fat content limit value is reached or exceeded, in such a way that the separating zone in the separator drum is displaced for a preset minimum period of time. The separator preferably is a cold milk separator having an inlet for cold milk, a skimmed milk outlet and a cream outlet, a measuring cell being provided in the cream outlet for determining the cream concentration – the fat content of the cream. According to two particularly simple and easily implemented variants, the measuring cell is connected either to a control input of a control valve in the skimmed milk outlet or to a device for controlling the cold milk feed into the separator.

Advantageous further developments can be derived from the remaining dependent claims.

The method according to the invention is described in greater detail below with reference to the drawing, of which:

Fig. 1 is a diagrammatic representation of a device for cold milk separation which operates with the method according to the invention; and

Fig. 2 is a diagrammatic representation of a separator for the device from Fig. 1

In a first embodiment, cold milk KM which is fed via an inlet 1 into a separator 2 (or a separator drum) having a drive 3 is, by means of a separator having a vertical axis, separated in the separator 2 into the components skimmed milk MM and cream RA and discharged from the separator 2 through a skimmed milk outlet 4 and a cream outlet 5.

In the outlet 5 for cream RA, a measuring cell 6 is installed or mounted, by means of which the cream concentration – the fat content of the cream RA – can be determined.

The measuring cell 6 is preferably connected to a control unit of the separator 2 (not shown here) or directly to a control input of a control valve 7.
If a set limit value – e.g. a fat content of 43% - is exceeded in the cream RA as detected by the measuring cell 6, the control valve 7 in the skimmed milk outlet 4 is closed to a preset position.

This set value preferably corresponds to an outlet pressure of 0.5 bar below the overflow limit of the separator 2. At the same time, in this embodiment of the method a variably adjustable timer which holds the control valve in the above position is running.

By the fast closure of the control valve, the separating zone in the separator or the separator drum is displaced inwards. At the same time the accompanying pressure increase at the skimmed milk outlet displaces the cream from the centre of the drum.

On expiry of the timer, the control valve 7 in the skimmed milk outlet 4 returns to a position which corresponds to the preset cream fat content of e.g. 40%.

By this control via the skimmed milk outlet in combination with a preset limit value for a blocking or clogging of the drum, the following parameters can be compensated:

- an increased cream fat content in the inlet,
- a temperature reduction and
- a reduction in feed power.

The perfect function of the device depends on a corresponding structural design of the drum and gripper of a cold milk separator. A suitable embodiment is shown in Fig. 2.

The separator shown in this figure is used for cold milk separation. Its inlet 1 for the cold milk KM leads from below through a spindle 8 and a distributor 9 into the separator drum 10, in which a plate packet 11 with a separating plate 12 is arranged.

In a first embodiment, cold milk KM which is fed via an inlet 1 into a separator 2 having a drive 3 is, by means of a separator, separated in the separator 2 into the compo-

nents skimmed milk MM and cream RA and discharged from the separator 2 through outlets 4 and 5.

In or at the outlet 5 for the cream RA, a measuring cell 6 is provided, by means of which the cream concentration – the fat content of the cream RA – can be determined. The measuring cell 6 is preferably connected to a control unit of the separator 2 (not shown here) or directly to a control input of a control valve 7.

A swirl chamber 13 in a discharge line 16 for skimmed milk MM at a separating plate 12 and a regulating disc 14 with a relatively large diameter compared to the overflow diameter in the gripper chamber cover 15 in the skimmed milk outlet have a beneficial effect, in particular by enabling the cream concentration to be preset to approximately 44% and by enabling the skimmed milk outlet to be restricted.

A suitable drum construction further ensures a great bandwidth for the control of the skimmed milk pressure.

A shearing disc 17 is used for discharging the skimmed milk MM, and a centrally placed manifold 18 in the axis of rotation is used for discharging the cream RA.

The larger the diameter differential between the regulating disc 14 and the overflow edge 15 at the gripper cover, the more the separating zone can be changed by suddenly closing the skimmed milk control valve in order to expel the cream at a higher pressure.

In a further embodiment of the control and of the method for preventing the blockage of the separator drum in the manner of an anti-blocking system, the “anti-blocking control” is based on increasing the feed power and the accompanying expulsion of the cream.

If the limit value of 43% cream fat content is exceeded, the feed power is increased by a minimum of 5000 l/h, for example instantaneously. This dilutes the cream by approximately 10%, and the cream is once again displaced from the drum by the fluid level change in the drum.

In this process, the system can once again operate with a previously fixed cream concentration of e.g. 40%. The cream concentration is preferably adjusted by way of the regulating disc 14, i.e. purely by a change in feed power independent of the discharge pressure of the skimmed milk.

Control by way of feed power is particularly allowable when processing cold milk if there is no plate apparatus which would have to operate at constant power. Control by regulating the cream discharge becomes unnecessary in this case. There is no longer any need for restricting the cream quantity.

List of Reference Numbers

Cold milk	KM
Skimmed milk	MM
Cream	RA
Inlet	1
Separator	2
Drive	3
Outlets	4 and 5
Measuring cell	6
Control valve	7
Spindle	8
Distributor	9
Separator drum	10
Plate packet	11
Separating plate	12
Swirl chamber	13
Regulating disc	14
Gripper chamber cover	15
Discharge line	16
Shearing disc	17
Manifold	18

Patentkrav

1. Fremgangsmåde til hindring af tilstopning af en udskillers strømningsveje ved forarbejdning af et fedtholdigt udgangsprodukt, især mælk, hvilken fremgangsmåde omfatter følgende trin:

A) fedtkoncentrationen af en udløbende produktfase bestemmes for at registrere en truende tilstopning, og

B) hvis en forudsat fedtholdighedsgrænseværdi nås eller overskrides, forskydes udskillerzonen i udskillertromlen ved ændring af driftsparametrene i et forudbestemt mindste tidsrum for at hindre en tilstopning.

2. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at** den anvendes til at skille kold mælk i fløde og skummetmælk.

3. Fremgangsmåde ifølge krav 2, **kendetegnet ved, at** kold mælk skilles i fløde med et fedtindhold på of 28% til 45% og skummetmælk ved en temperatur på 2°C to 15°C, især 4°C til 10°C.

4. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at** skillezonen i tromlen forskydes indad, hvis en grænseværdi nås eller overskrides.

5. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** fedtindholdet bestemmes ved hjælp af en massestrømsmåler.

6. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** der anvendes en massestrømsmåler med en separat tæthedsudgang ved bestemmelse af fedtindholdet.

7. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** skillezonen i tromlen forskydes indad ved at neddrosle en ventil i skummetmælksudløbet.

8. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** ventilen i skummetmælksudløbet drosles ved hjælp af et tidsur for den forud indstillede tid eller mindstetidsrummet.

9. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** skillezonen forskydes ved at øge tilførselseffekten.

10. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** tilførselseffekten øges inden for en tidsperiode på 5 til 60 sekunder.

11. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** tilførselseffekten øges inden for en tidsperiode på 5 til 20 sekunder.

12. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** tilførselseffekten øges med 5% til 40%.

13. Fremgangsmåde ifølge ethvert af de foregående krav, **kendetegnet ved, at** tilførselseffekten øges med 5% til 20%.

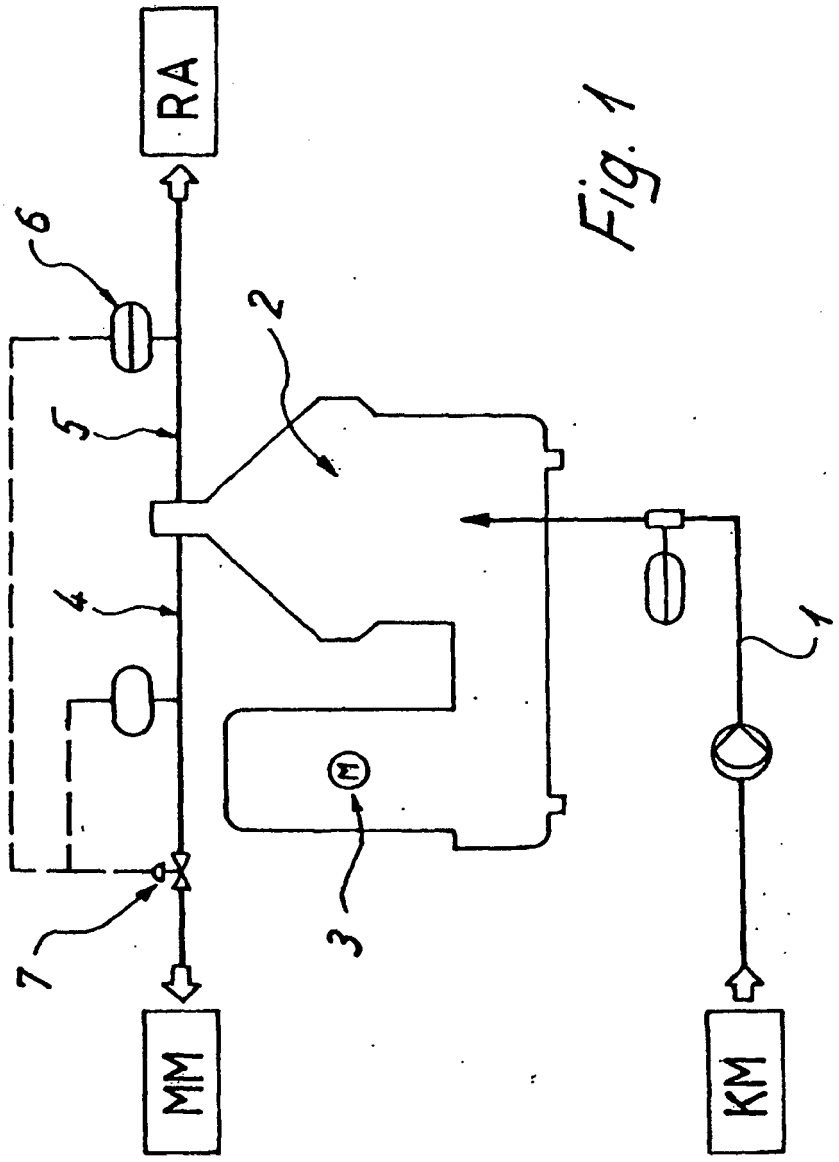

Fig. 1

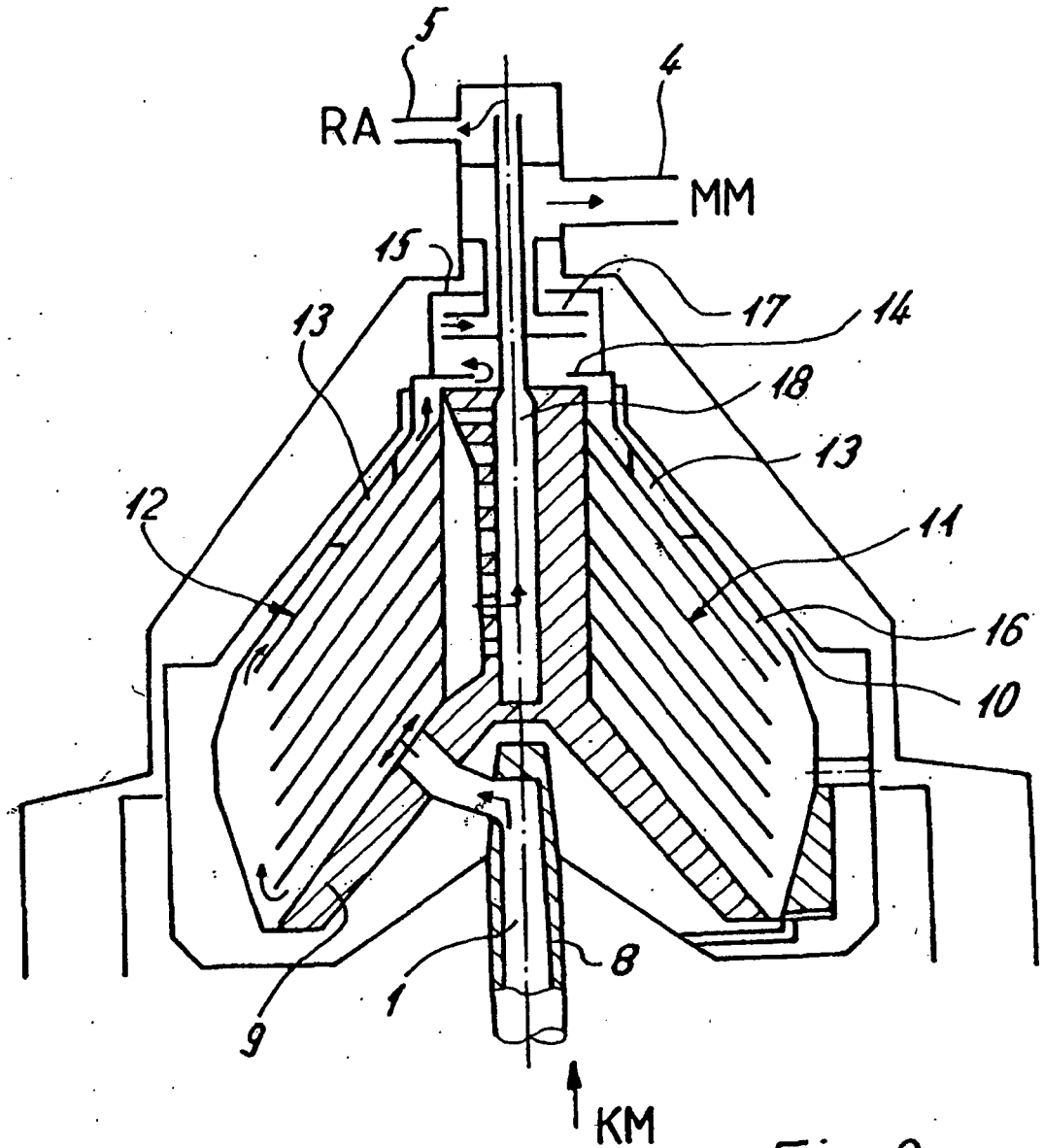

Fig. 2