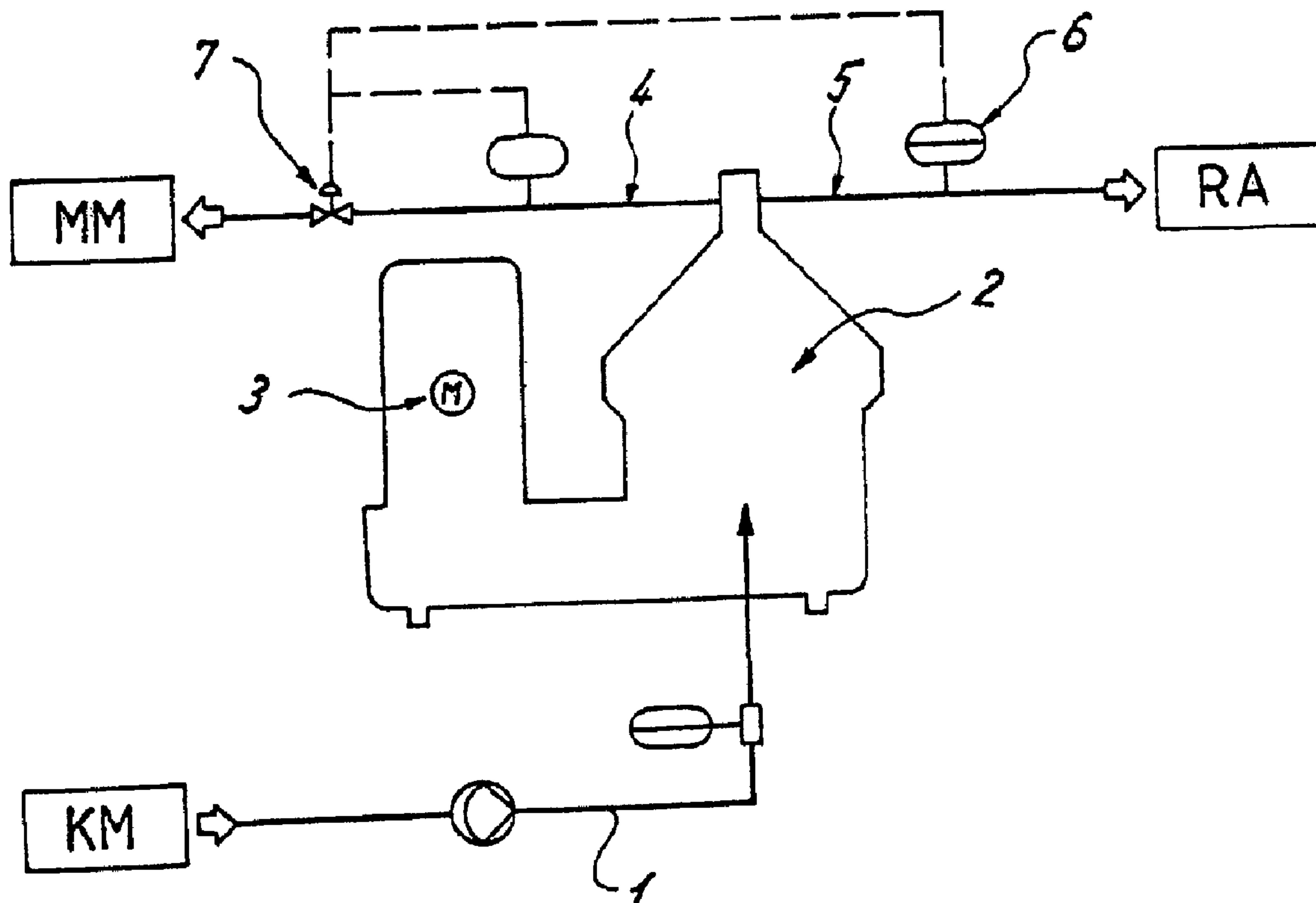




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D'ÉCOULEMENT D'UN SEPARATEUR  
 (54) Title: METHOD AND DEVICE FOR PREVENTING BLOCKAGES IN THE FLOW PATHS OF A SEPARATOR



(57) Abrégé/Abstract:

A method and device for preventing blockages in the flow paths of a separator during the processing of a fat-containing initial product, particularly milk, determine, in order to identify an impending blockage, the concentration of the fat content of an outflowing product phase. When a predetermined fat content limit value is reached or exceeded, the separating zone in the separator drum is then shifted away by modifying the operating parameters whereby preventing a blockage over a predetermined minimum period of time.



## ABSTRACT

A method and device for preventing blockages in the flow paths of a separator during the processing of a fat-containing initial product, particularly milk, determine, in order to identify an impending blockage, the concentration of the fat content of an outflowing product phase. When a predetermined fat content limit value is reached or exceeded, the separating zone in the separator drum is then shifted away by modifying the operating parameters whereby preventing a blockage over a predetermined minimum period of time.

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METHOD AND DEVICE FOR PREVENTING BLOCKAGES IN THE FLOW  
PATHS OF A SEPARATOR

The invention relates to a method of preventing blockages of the flow paths and flow pipes of a separator when processing a fat-containing initial product and to a device for implementing the method.

In numerous food-processing enterprises, separators are used for many different applications and performance spectrums. The separators generally have to be adapted to these different requirements with respect to their construction and design. Although, as a result, they can be used within the predefined task field or process, they react sensitively and often as disturbances to performance changes or changes of the composition of the products to be processed.

With respect to the sterilization of whey, it is known from German Patent Document DE 100 36 085 to separate the raw whey into cream whey, skimmed whey (skimmed milk) and solids (sediment with germs) constituents. In the case, the centrifugal separation in the separator takes place such that the fat content in the cream whey amounts to more than 45%. The skimmed milk is sterilized and is then returned into the cream whey which was subjected to no further sterilization, and the cream/skimmed milk mixture forming when the skimmed milk is returned to the cream is pasteurized. A high-temperature heating to up to 135°C is not necessary by means of this method.

From German Patent Document DE 198 07 294, a skimming station is known which has a clarification separator and a skimming separator connected to the output side of the clarification separator, a recirculation pipe for skimmed whey - thus, for the portion with the reduced fat content - leading from the outlet of the skimming separator to the inlet of the clarification separator (a bypass piping) in order to minimize the loss of fat and improve the quality of the obtained cheese powder.

German Patent Document DE 198 20 870 suggests that, during the skimming of the whey by means of a separator, a partial quantity of from 0.5 to 2% of the outflowing whey cream - thus of the portion containing more fat - be returned into the raw whey fed to the separator, in order to improve the quality of the product.

During the separation of milk into skimmed milk and cream by means of separators, blockages of the drum, that is, a clogging of at least one portion of the flow paths or of all flow paths of the separator, may occur because of an excessive fat concentration in the cream whey. Generally, the buttered-out cream clogs the distributor space and/or the disks and/or the cream outlet in the center of the drum and/or the cream discharge connected behind the separator.

If this blockage occurs, the clogging of the flow paths in the separator - these are the internal flow pipes and flow paths as well as the discharges leading away from the separator - according to the state of the art, can be unclogged only by

23724-288

a) a hot-water feeding by way of the inlet and

b) a simultaneous throttling of the skimmed milk outflow or an increase of the inflow output, which leads to product losses and thus to disadvantages with respect to cost.

5           With respect to the state of the art, reference is also made to German Patent Documents DE 101 35 073 C2, DE 36 01 814 C2, U.S. Patent Document 27 17 119, German Patent Document 100 36 085 C1, European Patent Document EP 0 427 750 B1, German Patent Document DE 44 07 061 C2 and German Patent Document DE 200 10 743 U1.

10           Based on this background, the invention first has the object of providing a method by which a threatening clogging of the flow paths can be detected early and can be prevented.

          In accordance with this invention, there is provided a method of preventing blockages of flow paths of a separator, the separator being set to  
15   achieve a desired fat content during processing of a fat-containing product such as milk, the method steps comprising: determining a concentration of the fat content of an outflowing product phase from the separator to detect an imminent clogging; shifting a separation zone in a separator drum of the separator for a defined minimum time period by changing operating parameters when a defined  
20   fat content limit value, which is greater than the desired fat content, is one of reached and exceeded to prevent blockages of flow paths of the separator; and after the defined minimum time period is reached, the separator is returned to the desired fat content setting.

23724-288

In this manner, an imminent clogging can be detected early and can be prevented in a very simple fashion, so that the rinsing operations required according to the state of the art and the resulting losses of product and time are avoided during the production.

Although a method of monitoring, controlling and regulating the operation of a centrifuge is known from German Patent Document DE 101 35 073, according to the method disclosed in this document, skimmed milk is removed at the outlet of the centrifuge by means of an analyzer; the transparency of the skimmed milk sample is then determined and the fat content is determined. As a function of the determined fat content, the adjustment of the centrifuge is monitored, controlled and regulated, particularly cleaned, for example, periodically. However, the possibility of utilizing this automated method for preventing clogging had not been recognized; neither had the possibility of counteracting an imminent clogging in the simplest manner by an automatic shifting of the separation zone in the separator drum.

Surprisingly, by using the method, it also becomes possible to operate the separator closer to its "limit range"; that is, it becomes possible to carry out a preadjustment of the fat concentration in the cream of up to 44% during the normal operation.

The method is particularly preferred when separating cold milk into cream and skimmed milk, the cold milk of a temperature of 2-15°C, particularly 4-10°C, being separated into cream having a fat content of from 28-45% and into skimmed milk. During the cold milk separation, particularly the cream phase tends to assume a consistency similar to butter and will then cause a clogging of a least a portion of the flow paths which can be eliminated only at high expenditures and with a loss of time during the production. In this case, the closing occurs as a function of the parameters of the cold milk separation. These include particularly the product temperature, the driven capacity and the machine construction (including the disk diameter, the disk thickness, the cover plate thickness). The blockage typically occurs when processing cold milk of a temperature  $T = 4^{\circ}\text{C}$ , for example, in the case of a fat content of 45% in the cream. This problem can easily and cost-effectively be solved by means of the invention.

According to a first variant, the separation zone in the drum is shifted toward the interior when the limit value is reached or exceeded, specifically, preferably by a throttling of a valve in the skimmed milk outlet. This throttling can take place by means of a timing unit for a given time period.

As an alternative and/or optionally, it is conceivable that the blockage of the drum is prevented by increasing the inflow performance. Also by means of this variant, a "closing" or a clogging of the drum of the separator by a cream having the firm consistency of butter is prevented in

a simple manner. In this case, it is advantageous for the inflow rate to be increased within a time period of 5-60 seconds, particularly 5-20 seconds. Even such a short change of the operating parameters can effectively prevent the clogging. This particularly applies when the inflow rate is increased by 5 - 40%, particularly 5 - 20%.

In principle, different measuring methods are conceivable for determining the fat content. Thus, the determination of the fat content can take place by means of a mass flow meter, particularly with a separate density output. Such measuring devices are offered, for example, by Micro Motion Company.

The invention also provides a device for implementing the method according to the invention, which has a measuring and control device designed for detecting an imminent clogging by means of a determination of the concentration of the fat content of an outflowing product phase and for changing the operating parameters when a given fat content limit value is reached or exceeded, particularly such that a shifting of the separation zone in the separator drum takes place for preventing a clogging for a defined minimum time period. Correspondingly, the separator preferably is a cold milk separator which has an inlet for cold milk as well as an outlet for skimmed milk and a cream outlet, an analyzer being arranged in the cream outlet, by means of which the cream concentration - the fat content of the cream - can be determined. According to two particularly simple variants, which can be implemented in an uncomplicated manner, the analyzer is connected either with a control input of a control valve in the skimmed milk

23724-288

outlet or with a device for controlling the inflow quantity of cold milk into the separator.

In the following, the method according to the invention will be described in detail with reference to the drawing.

Figure 1 is a schematic representation of a device for the separation of cold milk, which operates according to the method of the invention; and

Figure 2 is a schematic representation of a separator for the device of Figure 1.

In a first example, by means of a separator with a vertical axis of rotation, cold milk KM, which is guided by way of an inlet 1 into a separator 2 (or a separator drum) having a drive 3, is separated in the separator into the skimmed milk MM and cream RA constituents and is discharged from the separator 2 by way of a skimmed milk outlet 4 and a cream outlet 5.

In the or on the outlet 5 for the cream RA, an analyzer 6 is inserted or mounted by means of which the cream concentration - the fat content of the cream RA - can be determined. The analyzer 6 is preferably connected with a control device of the separator 2 (not shown here) or is connected directly with a control input of a control valve 7.

When a defined limit value of a fat content of, for example, 43% in the cream RA is exceeded on the analyzer 6, the control valve 7 in the skimmed milk outlet 4 is closed into a defined position.

This adjusted value preferably corresponds to an outflow pressure of 0.5% bar below the overflow limit of the separator 2. In this embodiment of the method, a variably adjustable timer or time unit is running simultaneously, which holds the control valve in the above-mentioned position.

As a result of the fast closing of the control valve, the separation zone in the separator or the separator drum is shifted toward interior. Simultaneously, the resulting pressure increase on the skimmed milk outlet pushes the cream away from the center of the drum.

After the timer or the time unit has run out, the control valve 7 in the skimmed milk outlet 4 returns into a position which corresponds to the defined cream fat content of, for example, 40%.

As a result of the controlling by way of the skimmed milk outflow in connection with the defined limit value against a blocking or clogging of the drum, the following parameters can be addressed:

- an increased cream fat content in the inflow,
- a temperature reduction and
- an inflow rate reduction.

A corresponding constructive embodiment of the drum and gripper construction of a cold milk separator is advantageous for a perfect operation. A corresponding embodiment is illustrated in Figure 2.

The separator illustrated here is used for the cold-milk separation. Its inlet 1 for the cold milk KM leads from below through a screw 8 and a distributor 9 into the separator drum 10, in which a disk stack 11 is arranged which has a separating disk 12.

In a first example, by means of a separator, cold milk KM, which is guided by way of an inlet 1 into a separator 2 having a drive 3, is separated in the separator 2 into the skimmed milk MM and cream RA constituents, and is discharged from the separator 2 by way of outlets 4 and 5.

In the or on the outlet 5 for the cream RA, an analyzer 6 is inserted or mounted by means of which the cream concentration - the fat content of the cream - can be determined. The analyzer 6 is preferably connected with a control device of the separator 2 (not shown here) or is connected directly with a control input of a control valve 7.

A swirl space 13 in a discharge 16 for skimmed milk MM on a separating disk 12 and a regulating disk 14 with a relatively large diameter in comparison to the overflow diameter in the gripper chamber cover 15 in the skimmed milk outlet have an advantageous effect, particularly in order to permit a preadjustment of the cream concentration

of approximately 44% and a throttling of the skimmed milk outflow pressure.

Furthermore, a corresponding drum construction ensures a large bandwidth for controlling the skimmed milk pressure.

A centripetal pump 17 is used for discharging the skimmed milk MM and a centric collecting pipe 18 in the axis of rotation is used for discharging the cream RA.

The larger the diameter difference between the regulating disk 14 and the overflow edge 15 on the gripper cover, the more the separation zone can be changed by a sudden closing of the skimmed milk control valve and the cream can be pushed out with more pressure.

In another embodiment of the control and of the method for preventing a clogging of the separator drum in the manner of an antilock system, the "antilock control" takes place by way of an increase of the inflow rate and the resulting pushing-out of the cream.

When the limit value of a cream fat content of 43% is exceeded, the inflow rate is, for example, abruptly increased by at least 5,000 l/h. As a result, the cream is diluted by approximately 10% and, as a result of the liquid level shift in the drum, the cream is, in turn, pushed out of the drum.

In the case of this method of operation, the operation can again take place with a previously fixedly adjusted

cream concentration of, for example, 40%. The adjustment of the cream concentration preferably takes place by way of the regulating disk 14, thus independently of the skimmed milk outflow pressure purely by way of the inflow rate.

A controlling by way of the inflow rate is permissible particularly when processing cold milk KM, when no plate apparatus is present which would have to be operated at a constant rate. In this fashion, a regulating by way of a cream outflow control can be saved. The throttling of the cream quantity is no longer necessary.

## List of Reference Symbols

Cold milk	KM
Skimmed milk	MM
Cream	RA
Inlet	1
Separator	2
Drive	3
Outlets	4 and 5
Analyzer	6
Control valve	7
Screw	8
Distributor	9
Separator drum	10
Disk stack	11
Separating disk	12
Swirl space	13
Regulating disk	14
Gripper chamber cover	15
Discharge	16
Centripetal	17
Collecting pipe	18

23724-288

CLAIMS:

1. A method of preventing blockages of flow paths of a separator, the separator being set to achieve a desired fat content during processing of a fat-containing product such as milk, the method steps comprising:
  - 5 determining a concentration of the fat content of an outflowing product phase from the separator to detect an imminent clogging;
    - shifting a separation zone in a separator drum of the separator for a defined minimum time period by changing operating parameters when a defined fat content limit value, which is greater than the desired fat content, is one of reached
 10 and exceeded to prevent blockages of flow paths of the separator; and
      - after the defined minimum time period is reached, the separator is returned to the desired fat content setting.
  2. The method according to claim 1, wherein the fat-containing product is cold milk and the cold milk is separated into cream and skimmed milk.
  - 15 3. The method according to claim 2, wherein the cold milk has a temperature of 2-15°C. and is separated into cream having a fat content of 28-45% and into skimmed milk.
  4. The method of claim 2, wherein the cold milk has a temperature of 4°-10°C. and is separated into cream having a fat content of 28-45% and into
 20 skimmed milk.
  5. The method according to claim 1, wherein the separation zone in the drum is shifted toward an interior of the drum when the fat content limit value has been one of reached and exceeded.
  6. The method according to claim 1, wherein the determining of the
 25 concentration of the fat content takes place by a mass flow meter.

23724-288

7. The method according to claim 6, wherein the mass flow meter has a separate density output.
8. The method according to claim 1, wherein the separation zone in the drum is shifted toward an interior of the drum by a throttling of a valve in a skimmed  
5 milk outlet.
9. The method according to claim 8, wherein the throttling of the valve in the skimmed milk outlet takes place by a timer for a defined time period.
10. The method according to claim 1, wherein the separation zone is shifted by an increase of an inflow rate.
- 10 11. The method according to claim 10, wherein the inflow rate is increased within a time period of from 5-60 seconds.
12. The method according to claim 10, wherein the inflow rate is increased within a time period of from 5-20 seconds.
13. The method according to claim 10, wherein the inflow rate is increased  
15 by 5-40%.
14. The method according to claim 10, wherein the inflow rate is increased by 5-20%.

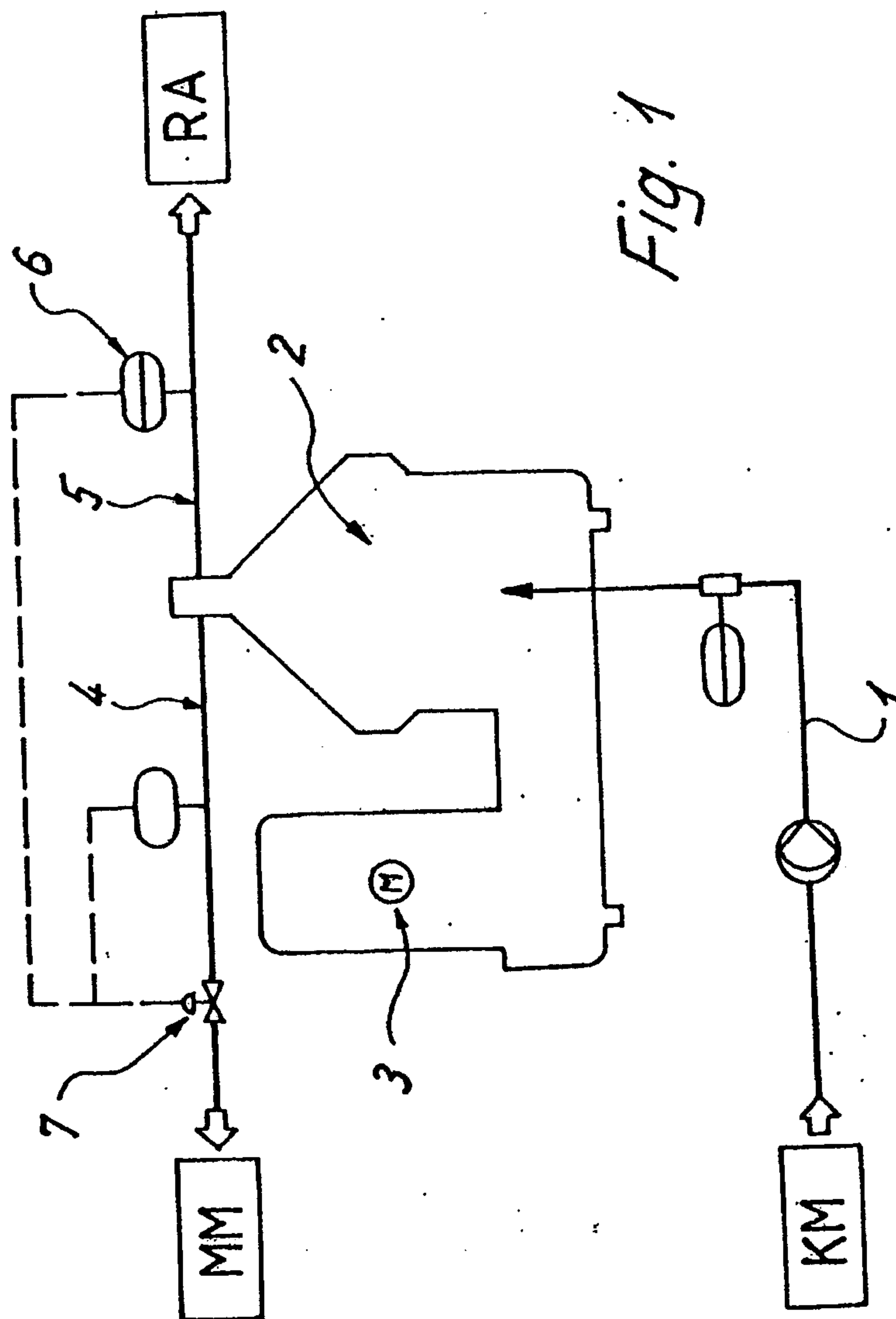


Fig. 1

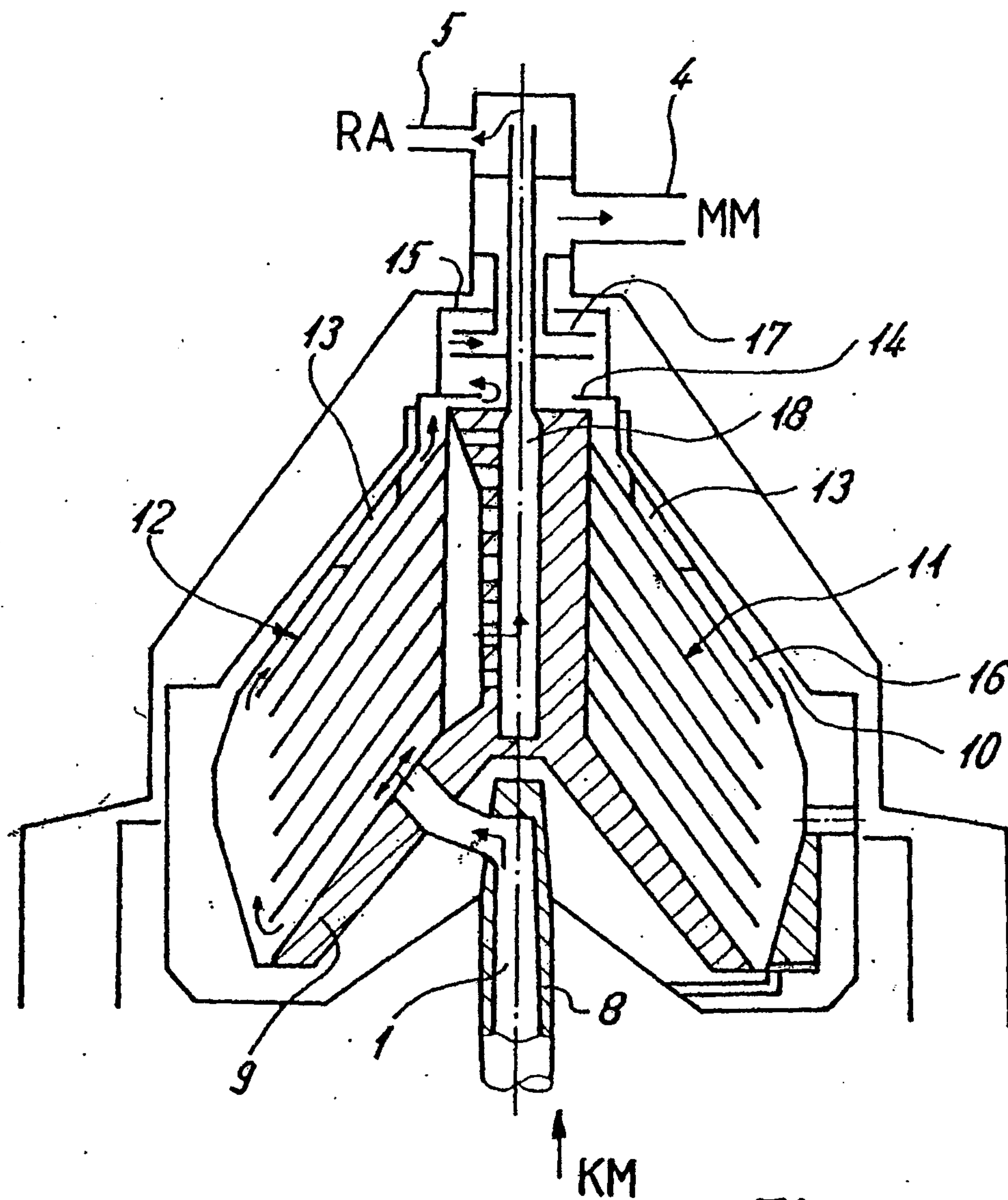


Fig. 2

