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NOTICE OF ENTITLEMENT

We, ALFA LAVAL AGRI AB of FARM CENTER, P.O. BOX 39, 5-147 21 TUMBA SWEDEN
being the applicant in respect of Application No. 66615/94 state the following:-

The Person nominated for the grant of the patent has entitlement from the actual inventors
Magnus Lidman, and Guido marzotto by way of employment agreement.

The person nominated for the grant of the patent is the applicant of the application listed in
the declaration under Article 8 of the PCT.

The basic application listed on the request form is the first application made in a
Convention country in respect of the invention.

ALFA LAVAL AGRI AB
By our Patent Attorneys,
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Registered Patent Attorney

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METHOD FOR CONTINUOUS PRODUCTION OF MILK WITH A PREDETERMINED FAT CONTENT

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(56) Prior Art Documents
US 5137738
WO 90/00862
US 4144804

(57) Claim

1. Method for continuous production of milk with a predetermined fat content, at which whole milk is divided into a cream fraction and a skim milk fraction in a centrifugal separator, after which a part of the cream fraction is remixed into the skim milk fraction in order to achieve a mixed fraction of milk with desired fat content, characterized in that the whole flow of cream fraction which has been obtained from an outlet from the centrifugal separator during a certain period is remixed with the flow of skim milk fraction from a second outlet from the centrifugal separator by way of a valve means in the outlet for cream fraction, while the whole flow of cream fraction is diverted for separate collection by way of said valve means, during a second intermediate period, at which the periods mentioned above are so short that the fat content and flow per time unit of the mixed fraction may be regarded as homogenous.

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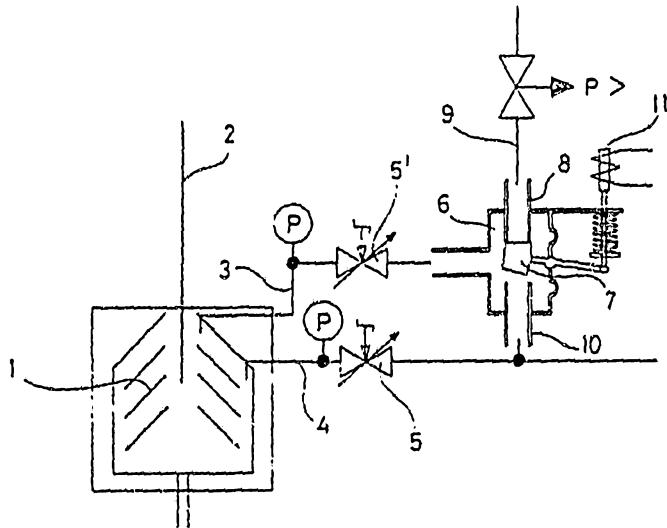
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(54) Title: METHOD FOR CONTINUOUS PRODUCTION OF MILK WITH A PREDETERMINED FAT CONTENT



(57) Abstract

In a method for continuous production of milk with a predetermined fat content the whole milk is divided into a cream fraction and a skim milk fraction in a centrifugal separator. A part of the cream fraction is remixed into the skim milk fraction in order to obtain a mixed fraction of milk with desired fat content. According to the invention the whole flow of cream fraction which has been obtained from an outlet from the centrifugal separator is remixed with a flow of skim milk fraction from a second outlet from the centrifugal separator by way of a valve means in the outlet for cream fraction during a certain period. During a second intermediate period the whole flow of cream fraction is discharged by said valve means for separate collection. The periods mentioned above are so short that the fat content and the flow per time unit of the mixed fraction may be regarded as homogenous.

Method for continuous production of milk with a predetermined fat content.

The present invention relates to a method for continuous
5 production of milk with a predetermined fat content. Whole milk is divided into a cream fraction and a skim milk fraction in a centrifugal separator. A part of the cream fraction is remixed into the skim milk fraction in order to obtain a mixed fraction of milk with a desired
10 fat content.

The natural fat content of the milk varies with feeding and time of the year, but has usually an average value of about 4 % fat. Consumer milk is usually for sale with
15 a lower fat content 3,0, 1,5 or 0,5 % fat. In smaller production scale it is possible to carry through the standardization in batches by dividing the whole milk into cream and skim milk in a centrifugal separator. Quantities of skim milk and cream which have been
20 calculated in advance are led from the separator to a common collection vessel. After analysis of the fat content and a possible adjustment of the same the milk is packaged.

25 In modern dairies the standardization takes place as a continuous process by automatic direct standardization. In this process the whole milk is divided into two flows, cream and skim milk with constant fat contents in respective flow. In an "in-line"-system directly after
30 the separator a controlled amount of cream is remixed with the skim milk in such a way that standardized milk with the desired fat content is obtained.

35 In the earliest processes for direct standardization the separator was provided with two manually operated

control valves in the outlet for cream. One of the valves was connected to the outlet for skim milk and controlled the amount of cream which should be brought back to the skim milk. The second valve controlled the flow of surplus cream. The fat content in the cream was determined by how much the both valves were open altogether. The fat content of the standardized milk was determined by the fat content of the returned cream and the adjustment of the return valve. The adjustment of the position of the valves demanded skilled personnel. The exact fat content could be measured only by means of analysis at a laboratory.

In the processes for standardization which are used today in the dairies two control circuits are used. One circuit controls the flow of cream out from the separator. This circuit comprises flow meter for the cream flow, density transmitters which measure the fat content in the cream and a control valve arranged after the flow meter and the density transmitter. A second circuit controls the amount of cream which is remixed with the skim milk in order to give a standardized milk with a desired fat content. The flow of standardized milk is monitored as well as the flow of cream for remixing.

When using dairy processes in small scale on the farm the earlier method for standardization of fat makes too high demands on the personnel. The latter automatic method demands on the other hand too an expensive investment for a small scale production.

According to the method of the invention a standardization method is suggested which to low investment and operating costs may be used for milk standardization

also in a smaller scale. The method according to the invention is mainly characterized in that the whole flow of cream fraction which has been obtained from the centrifugal separator during a certain period is remixed 5 with the flow of skim milk fraction from the centrifugal separator by way of valve means arranged in the outlet for cream fraction, while the whole flow of cream fraction during a second intermediate period is diverted for separate collection by way of said valve means. The 10 said periods are so short that the fat content and flow per time unit of the mixed fraction may be regarded as homogenous.

By way of the proposed method a satisfactory standardization 15 may be obtained with only a time controlled valve arrangement, which results in a drastic reduction of the costs to obtain a standardization of the milk. Any monitoring equipment or complicated routines are not necessary for the personnel which handles the standardization. 20

In order that the fat content and flow per time unit of the mixed fraction shall be regarded as homogenous the periods for remixing and diverting must be kept short. 25 Preferably the total time for the two periods mentioned above is maximally one or a few minutes.

The length of time for the cycle which may be allowed depends on the equipment which is located after the 30 centrifugal separator. If some kind of balance vessel for a short intermediate storage is arranged after the separator but in front of for example a packaging machine the cycle time may be longer than if the standardized milk should be pasteurized directly after 35 the centrifugal separator.

The cycle time may with advantage be kept as short as 1-60 seconds.

5 The valve means which is used according to the method of the invention suitably consists of a three-way valve with a change over time of 100 - 150 ms. Another arrangement which may be used consists for example of two cut off valves.

10 The movement of the valve means between the positions of the valve is with advantage obtained by controlling the time, at which the cycle time is kept constant while the period during which cream is remixed varies depending on desired fat content of the mixed fraction.

15 The centrifugal separator is with advantage provided with valves which keep the flow constant in both outlets in such a way that the centrifugal separator works under constant conditions independently if the cream fraction 20 is remixed or led away, which valves are arranged upstreams of the mentioned valve means.

25 According to the method of the invention there is obtained an accurate standardization which only considerably is effected of how the cream flow is led. For a separator with paring discs the outer characteristic of constant working conditions is that the counter pressures on the paring disc are constant. Surprisingly it has been found that the counter pressure on the 30 paring disc may be kept satisfactorily constant during short cycle times without an accurate control of the outer counter pressure. The aim is of course to keep the same pressure in the conduit for surplus cream as in the return conduit connected to the conduit for skim milk 35 but variations may occur. It leads to a complicated

controlling problem if the pressures always must be exactly the same. For a separator which together with a pasteurizer works with 1000 l. milk/hour and with a cycle time of 40 seconds and a remixing of 50 %, there
5 was measured a pressure variation at the paring disc of 30 kPa, when the cream flow was 1/10 of the supplied milk flow. At a cycle time of 5 seconds the pressure variations were less than 5 kPa during in other respects constant conditions, which may be considered as satisfactory.
10

If the pressures in both positions of the valve are experienced as so equal that the levels in the separator do not change, the fat content in the standardized milk
15 will only depend on the fat content of the supplied milk and on the distribution of the time of the valve means in the respective open condition.

The fat content in the unseparated milk is depending
20 among all of the feeding of the cows. This is something that the milk producer is well aware of and may control each week or with still longer intervals of time.

With the method according to the invention the milk may
25 be obtained with different fat contents only by adjusting a timer which within the set cycle time controls the length of the time during which cream is remixed. A certain time then corresponds to a certain fat content of the standardized milk.

30 If the surplus cream is discharged with a fat content of 40 % the cream flow is about 10 % of the supplied milk flow. The product flow of standardized milk will then consequently vary between 90 and 100 % of the supplied
35 milk flow.

The method according to the invention is described further with reference to the attached drawings. Fig 1 shows a centrifugal separator provided with valve means chosen as example on an arrangement for production of 5 milk with a predetermined fat content. Fig 2 shows how the centrifugal separator according to fig 1 may be a part of a pasteurizing plant. Fig 3. shows an alternative to the arrangement of fig 1.

10 Whole milk is led to a centrifugal separator 1 by way of a conduit 2. In the separator the milk is divided into two fractions, a cream fraction which is led away by way of the outlet 3 and a skim milk fraction which is led away by way of the outlet 4. In both of the outlets there are valves 5, 5' which control the flow out from 15 the separator. After this valve 5' there is in the cream conduit a three-way valve 6. The latter comprises a valve body which in one of its positions seals an outlet 8 to a conduit for discharge of surplus cream, which 20 valve position is shown in the drawing. In its second position the valve body seals an outlet 10 which is connected to a conduit for return of cream to the skim milk conduit 4. The valve body is kept in one of its positions by a spring and is actuated by an electro- 25 magnet 11 to take its second position. The standardized milk with the desired fat content is discharged by way of the conduit 12.

30 In fig 2 there is shown an example on how a separator with the valve arrangement may be arranged in a pasteurizing plant. Whole milk is led to a balance vessel 13 and is transported by means of a pump 14, a valve 15 which gives the correct flow of product and a milk filter 16 to a first regenerative section 17 in a 35 plate heat exchanger. In this the milk is preheated by

product which already has been treated in the pasteurizing plant to a suitable temperature of 40-65° C for the separation in the centrifugal separator 1. As has been described above the whole milk is divided into two fractions, a cream fraction which during a certain period is remixed with the skim milk fraction 4 and which during a second period is discharged by way of a conduit 9. The mixed fraction of skim milk and cream is by way of the conduit 12 led to a second regenerative section 18 in the plate heat exchanger. After a further preheating the pressure of the mixed fraction is increased with a booster pump 19, before the milk is heated to a pasteurizing temperature by a heating medium in a final heating step 20. The milk is kept at pasteurizing temperature in a holding cell 21 during a predetermined time. The temperature of the standardized milk after the holding cell is sensed by a temperature meter 22 and if the temperature is too low the milk is returned to the balance tank 13 by a three way valve 23.

If the temperature is correct the milk is directed to the regenerative sections 17, 18 in the heat exchanger in order to be cooled by entering product to a suitable storing temperature.

In an arrangement according to fig 2 a part of the cream fraction is led away without having been pasteurized. The pasteurization of the cream may then take place in a separate step separated from the milk pasteurizing.

If the surplus cream is taken out with a fat content of 40 % the cream flow will be 10 % of the supplied whole milk. The flow of standardized milk which is returned to the pasteurizer varies in cycles between 90 and 100 % of the supplied milk flow. Also the fat content varies in the flow back to the pasteurizer. If the cycle time is

short, 5 - 10 seconds, both the fat content and the flow are rapidly equalized during the subsequent passage through the pasteurizer. If a shorter cycle time than 1 second is used differences in the change-over time of 5 the valve creates too great an influence. The change-over time should be 100 - 150 ms.

In the alternative arrangement shown in fig 3 a throttling 24 is arranged in the outlet 3 next to the centrifugal separator 1. There is also a constant pressure 10 valve 25 in the same outlet. With such an arrangement the fat content in the cream fraction may be kept constant at a desired level. The cream fraction is remixed with the skim milk fraction in the same way as 15 described above.

According to the method of the invention there is obtained a standardization of the milk with a simple and uncomplicated control by way of a simple valve arrangement. 20 The method does not demand any resetting after an adjustment of the shifting motors which may delay adjustment to the correct level of standardization and does not demand sensors for sensing the fat content values. Start and stop are simple both with manual 25 operation and when sequence control is used. If it is desired the separator may be connected to the outlet side of the pasteurizer such that the standardization is carried through firstly after the pasteurization. With such an arrangement also the cream is pasteurized.

30 It is also possible to use a small control means as an additional feature in order to adjust the fat content in the standardized milk. This control means actuate the period during which the cream is returned to the skim 35 milk. The following data must be supplied to the control

means; the fat content of the supplied, unseparated milk, the fat content of the cream fraction (controlled by the constant pressure valve) and the desired fat of the standardized milk.

Claims

1. Method for continuous production of milk with a predetermined fat content, at which whole milk is divided into a cream fraction and a skim milk fraction in a centrifugal separator, after which a part of the cream fraction is remixed into the skim milk fraction in order to achieve a mixed fraction of milk with desired fat content, characterized in that the whole flow of cream fraction which has been obtained from an outlet from the centrifugal separator during a certain period is remixed with the flow of skim milk fraction from a second outlet from the centrifugal separator by way of a valve means in the outlet for cream fraction, while the whole flow of cream fraction is diverted for separate collection by way of said valve means, during a second intermediate period, at which the periods mentioned above are so short that the fat content and flow per time unit of the mixed fraction may be regarded as homogenous.
2. Method according to claim 1, characterized in that the total time for the two periods mentioned above, the cycle time, is maximally one or a few minutes.
3. Method according to claim 1-2, characterized in that the cycle time is kept as short as 1-60 seconds.
4. Method according to claim 1, characterized in that the valve means consists of a three-way valve with a change-over time of 100 - 150 ms.

5. Method according to claim 1-2, characterized in that the valve means is actuated by time control, at which the cycle time is kept constant while the time for remixing cream varies in dependence 5 on the desired fat content of the mixed fraction.

6. Method according to claim 1, characterized in that valves are arranged in the outlet from the centrifugal separator in such a way that the 10 separator works with constant conditions independently if the cream fraction is remixed or discharged, which valves are arranged upstreams of said valve means.

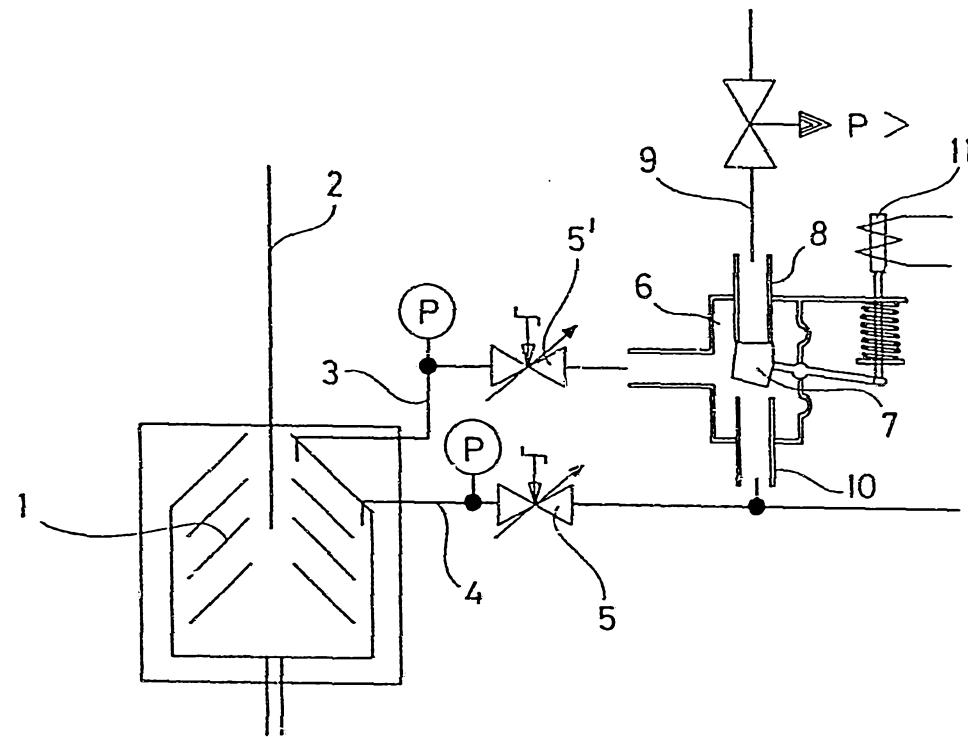


Fig.1

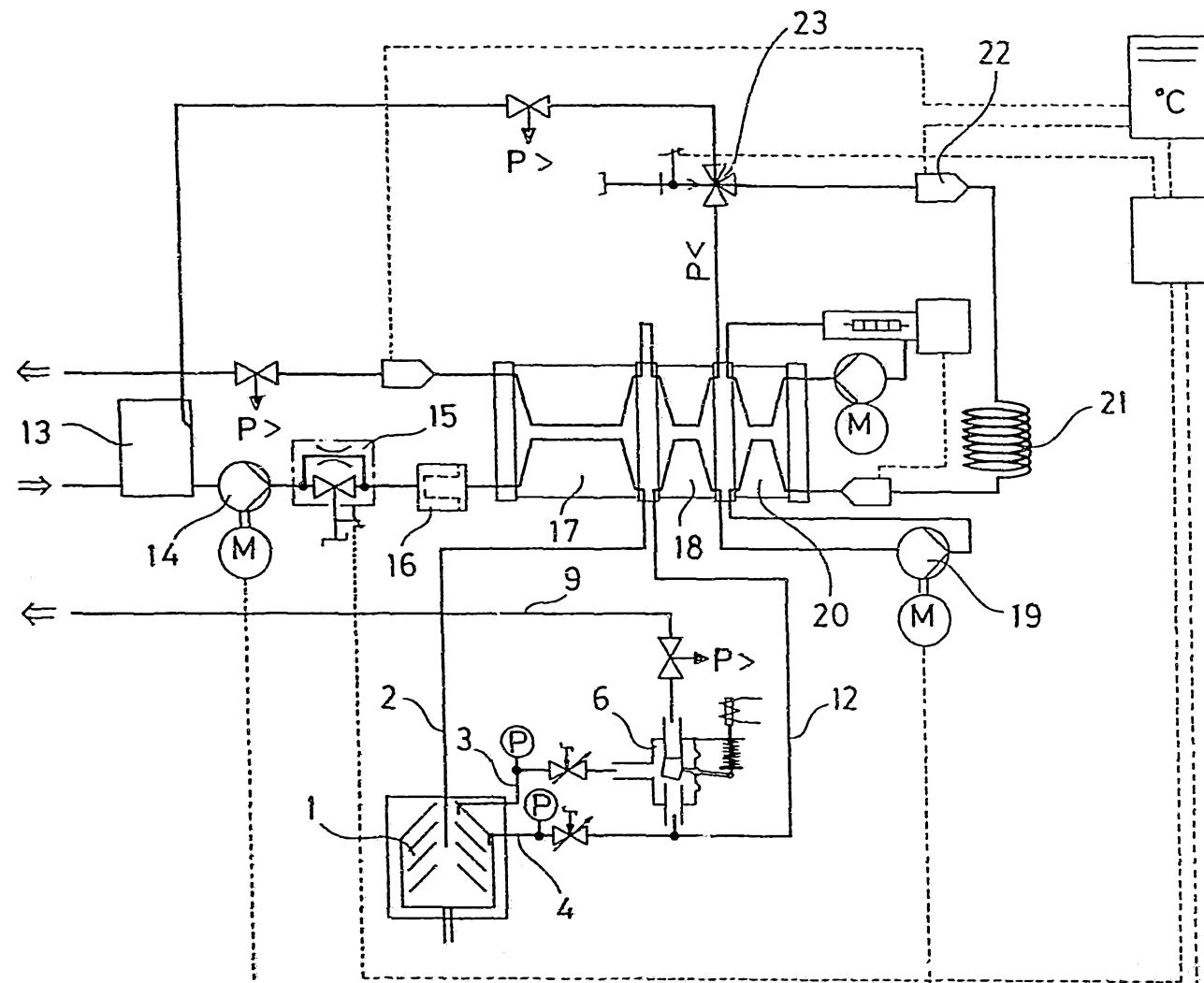


Fig. 2

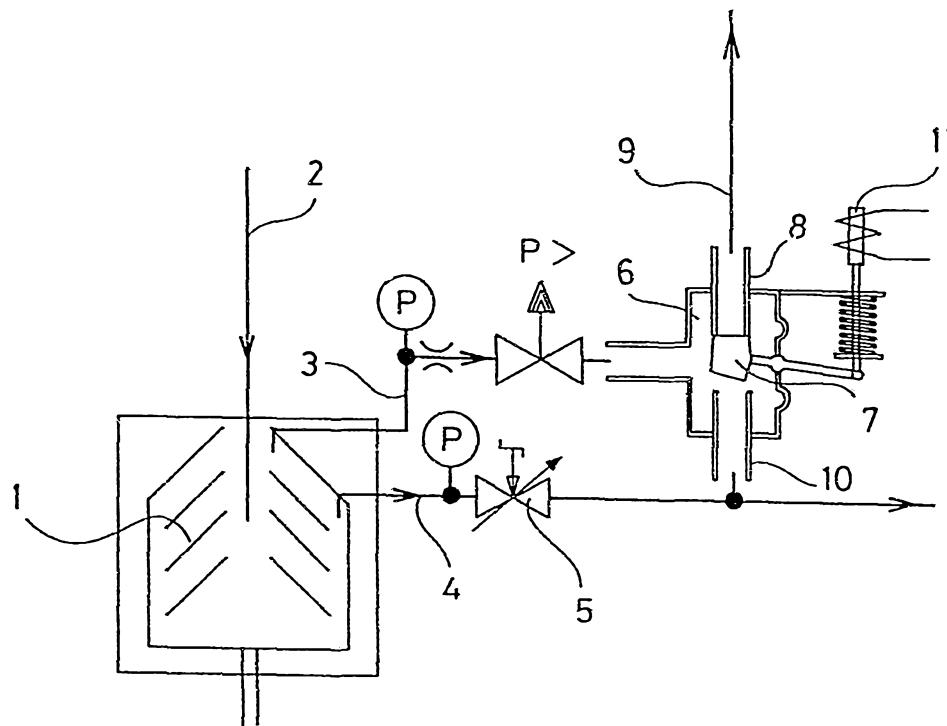


Fig.3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 94/00395

A. CLASSIFICATION OF SUBJECT MATTER

IPC : A23C 9/15, G05D 11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC : A23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO, A1, 9000862 (STORK AMSTERDAM B.V.), 8 February 1990 (08.02.90) --	1-6
A	US, A, 3983257 (ROLF MALMBERG ET AL), 28 Sept 1976 (28.09.76) --	1-6
A	US, A, 4144804 (MICHAEL G. O'KEEFE ET AL), 20 March 1979 (20.03.79) --	1-6
A	US, A, 5137738 (WILLIAM H. WYNN), 11 August 1992 (11.08.92) -- -----	1-6

 Further documents are listed in the continuation of Box C. See patent family annex.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "B" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
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- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- "&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT
Information on patent family members

02/07/94

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		SE-B, C-	374989	07/04/75
		SE-A-	7307559	02/12/74
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US-A- 5137738	11/08/92	US-A-	5009794	23/04/91