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D E C I S I O N
of 18 December 2000

Case Number: T 0141/99 - 3.3.5

Application Number: 93910504.5

Publication Number: 0642375

IPC: B01D 33/44

Language of the proceedings: EN

Title of invention:

A device for separation of solid particles from a liquid mixture

Patentee:

CAUSTEC AB

Opponent:

A. Ahlstrom Machinery Corporation

Headword:

Filter/CAUSTEC

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0141/99 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 18 December 2000

Appellant: A. Ahlstrom Machinery Corporation
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 2 December 1998
rejecting the opposition filed against European
patent No. 0 642 375 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: R. K. Spangenberg
Members: B. P. Czech
J. H. van Moer

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the opposition division to reject the opposition against patent No. 0 642 375 and to maintain the patent in unamended form. The contested patent was based on application No. 93 910 504.5, filed on 3 May 1993 and claiming a priority of 15 May 1992.

II. Independent claim 1 of the patent as granted reads as follows:

"1. Apparatus for separating solid particles from a liquid mixture in a causticization process, comprising a hollow filter body (2,24) with a wall (3,25) of filter material, a container (5,26) for the liquid mixture which is to be separated, the filter body being arranged partially immersed in the liquid mixture, a drive member (10,30) being designed to rotate the filter body about a horizontal axle, so that the wall of filter material is rotated up and down through the surface of the liquid mixture, means (7,28) being designed to generate a higher pressure on the outside of the filter body than on the inside of the filter body, so that a fine fraction of the liquid mixture is forced through the filter material, while a cake of solid particles is deposited on the filter material and accompanies the latter up over the liquid mixture during rotation of the filter body, a cake-removal member (11,31) being designed to take off a layer of the cake from the filter material above the liquid mixture, so that a liquid-permeable coating of solid particles is left on the filter material which is moved down into the liquid mixture during rotation of the filter body, a discharging member (12) for discharging

the said removed cake layer from the apparatus, and means (13-17;22,23;32,34-38;40-43) for spraying off a strip of the filter material with jets of liquid for the purpose of removing the said coating of solid particles for renewal of the coating,

characterized in that the said spraying means (13-17, 22,23;32,34-38;40-43) is designed to spray jets of liquid in at least one spray zone (18;33;41) above the liquid mixture, through which a part of the wall (3,25) of filter material passes upwards during rotation of the filter body (2,24), and that the spraying means is arranged such that a narrow strip of the cake of coarse particles, including the said coating, is removed from the said wall part of filter material by the said jets of the liquid, when the spraying means is actuated during rotation of the filter body."

III. The opposition was filed against the patent as a whole and based on Article 100(a) EPC. Lack of inventive step was alleged, based *inter alia* on documents

D1: EP-A-0 454 392

D2: US-A-3 521 751

D4: US-A-1 804 934

and on a "Declaration" by Mr Keskinen.

The following document was cited by the proprietor:

D5: WO-A-94/23821 (claiming a priority of 8 April 1993, published 27 October 1994).

In the contested decision, the opposition division considered D1 to represent the closest prior art, and that the objective problem which the patent in suit seeks to overcome is the difficulty of removing the pre-coat layer on the filter as it comes under the scraper position in D1, a difficulty which arises due to the pre-coat hardness at this position. The opposition division held that it was highly unlikely that a skilled person would have combined the teachings of D1 and D4, since the latter referred to an apparatus which for various reasons was not suitable for use in a causticisation process. The opposition division also held that D4 lacks any positive motivation to modify the closest prior art in a way leading to an apparatus according to claim 1 of the patent, since D4 neither refers to the problems associated with the removal of dry cake nor to the possibility of having variable jet pressures depending on their position. Moreover, giving some additional reasons, the opposition division came to the conclusion that even if the skilled person were to combine the teachings of D1 and D4, he would have to be inventive in order to arrive at an arrangement whereby the pressure drop across the filter drum may be maintained.

IV. The appellant submitted further documents, among them

D8: Kraft Recovery Operations Short Course Notes, 1992, TAPPI PRESS, pages 29 to 57,

supposed to show that pre-coat removal using sprays in the upwardly moving zone of a rotating vacuum filter was also known.

He requested that the decision under appeal be set

aside and the patent be revoked in its entirety.

- V. The respondent (proprietor) submitted a further document and requested that the appeal be dismissed. During oral proceedings before the board, he filed two auxiliary requests each comprising an amended set of claims.
- VI. The appellant considered D1 to represent the closest prior art and - in the oral proceedings before the board - agreed with the technical problem as formulated in the contested decision. However, he argued that the skilled person would indeed consider the contents of D4 and combine its teaching with the one of D1 and thereby arrive at the claimed apparatus. He objected to the reasons for not combining D1 with D4 given in the contested decision arguing that the apparatus of D4 would be suitable for use in a causticization process and that D4 would show that a filter cake can be entirely removed from a rotating vacuum filter by means of a single low pressure spray nozzle located in the upwardly moving zone, where the cake is wet and soft. He further submitted that the vacuum pumps of rotating vacuum filters are usually over-dimensioned, and that the vacuum leaks resulting from the removal of the solids coating from the filter surface would not be so substantial as to deter the skilled person from opting for the claimed solution. In this connection he argued that in view of the description, column 5, lines 47 to 50, granted claims 6 and 7 and Figure 5 of the contested patent, claim 1 must be construed to cover embodiments such as the one of Figure 5 wherein all but one of the neighbouring nozzles are operated at the same time, spraying off several strips and leaving most of the filter surface fully exposed, hence leading to a

substantial adverse effect on the pressure difference.

VII. The respondent, referring to D5 as an expert opinion originating from the appellant himself, indicated several advantages which altogether made the apparatus claimed more reliable than the ones of D1, in particular that no high pressure equipment was required. He reviewed the known pre-coat removal methods, including the ones disclosed in D8 and D2, and indicated that the skilled person would have been prejudiced against the claimed positioning of the spraying means since he/she would have expected unacceptable vacuum leaks and filter cake loss. Indicating various differences of the filter apparatus disclosed in D4 over the claimed apparatus, he argued that since D4 belonged to a different field of application its teaching would not even have been considered by the skilled person. He underlined the importance of minimising the loss of pressure differential over the filter wall. He also submitted that D4 did not refer to cake hardness and did not teach that one position for cake removal was better than the other, or that lower pressure was used in one position relative to the other. In rejecting the appellant's arguments based on D4, and concerning the appellant's reference to the embodiment of Figure 5, to claims 6 and 7 and to the description of the patent, he submitted that the skilled person would understand that "several" nozzles would only be actuated simultaneously in the case of very large filter surfaces.

Reasons for the Decision

1. *Interpretation of claim 1*

- 1.1 A "narrow strip" in the sense of claim 1 is to be considered as an elongated, cake and pre-coat free zone which is narrow in comparison to the width of the coated filter surface, and which is generally oriented in the direction of the motion of the filtering surface. See e.g. column 4, lines 34 to 36 and the schematic Figures 2, 3 and 5 of the patent in suit.
- 1.2 It emanates from the patent as a whole that the apparatus of claim 1 must be able to perform the renewal of the pre-coat layer whilst running in the cake filtration mode. Since only a "small part" of the filter material is without coating during the renewal thereof, the pressure difference necessary for cake filtration can be maintained during the renewal. "Normal operation" of the filter (cake filtration) is not affected during the pre-coat renewal. See e.g. column 4, lines 46 to 53 of the patent.
- 1.3 Concerning the apparatus according to Figure 5 of the patent, the simultaneous removal of 11/12, thus of more than 90% of the cake and pre-coat layer width, is certainly not a possibility envisaged by the skilled reader of the patent. A cake free zone of such a width can certainly not be considered as "narrow" or as a "small part". A skilled person would thus not consider such an operating mode as simultaneous cake filtration and renewal of the pre-coat. Moreover, if the claimed apparatus was to be operated in such a way, a substantial impact on the vacuum pump performance or energy requirements would have to be expected during renewal of the pre-coat. The "normal operation" of the filter would definitely be affected in terms of substantially higher vacuum pump performance or energy requirements during the pre-coat renewal.

1.4 Accordingly, the board accepts the respondent's view that claim 1 should not - based on a literal reading of claim 7 - be understood as encompassing alternatives wherein all but one of a series of stationary nozzles are activated simultaneously, and that the reference to "several such strips together" (column 5, line 49 of the patent) only applies to filter drums of very large dimensions, where the "several such strips together" would still only represent a "small part" of the filter surface.

2. *Novelty*

The board is satisfied that the claimed apparatus is novel over the cited state of the art. Novelty of the claimed subject-matter has not been challenged. The differences between the claimed apparatus and the disclosures of the cited prior art will more clearly appear from the following assessment of inventive step.

3. *Inventive step*

3.1 It is undisputed that the disclosure of D1 corresponds to the state of the art referred to in column 1, lines 3 to 54 and in the preamble of claim 1 of the patent. More particularly, D1 discloses a continuously operating, partially immersed rotating vacuum drum filter for thickening lime sludge. The apparatus of D1 is operated in a pre-coat filtration mode, a scraper removing and discharging the filter cake deposited on the pre-coat layer. In order to continuously renew the pre-coat layer during the cake filtration mode of the apparatus, high pressure nozzles (50 to 100 bar) are provided which reciprocate in the longitudinal direction of the drum and which spray liquid jets onto

the filter surface, thereby removing a narrow (10-50 mm) strip of the solid material comprised on the filter surface. See D1, Figures 1 and 2, column 1, line 47 to column 3, line 31. Moreover, in the apparatus according to D1, the spraying nozzles are located above the liquid level (as according to the characterising part of claim 1 of the patent), but below the scraper (see D1, column 1, lines 52 to 55, claim 7 and Figure 1), in a downwardly moving zone of the filter surface. Their purpose is to remove the pre-coat layer remaining on the filter surface after the passage thereof under the cake-removing scraper (see column 3, lines 21 to 23).

3.2 D1 is thus undisputedly to be considered as the closest prior art for the purpose of assessing inventive step. The sole differentiating constructional feature of the apparatus of claim 1 of the patent in suit is the location of the spraying means in the upwardly moving zone of the filter surface, and hence upstream (in terms of the filter material movement above the liquid level) of the cake removal means. During operation of the claimed filter apparatus, the liquid jets thus remove a strip of the pre-coat layer, together with the cake layer deposited thereon during passage of the filter surface through the suspension to be filtered.

3.3 According to the contested patent (column 1, lines 43 to 54), an apparatus of the type disclosed in D1 allegedly has the disadvantage of requiring two spraying means operating at high pressure, and does still not lead to an entirely reliable removal of the entire coating. The aim of the invention as stated in the patent is to provide an arrangement of the type in question here, by means of which the renewal of the

said coating of solid particles can be effected with the aid of a single spraying means in a reliable manner (column 2, lines 7 to 11).

- 3.4 Claim 1 explicitly referring to jets (plural form), it does not exclude the possibility of having two spray heads operating in parallel to remove a single narrow strip. Hence, the alleged disadvantage of the prior art concerning the necessity for two jets cannot be taken into consideration.

The alleged unreliability in terms of solids removal from the filter surface (see contested patent, column 1, lines 53 to 54) of the high pressure jets disclosed in D1 has not been substantiated by any kind of technical evidence. The appellant contested the allegation by means of the "Declaration" of Mr Keskinen. The board is not, therefore, in a position to take this alleged unreliability into consideration.

- 3.5 However, the text of the patent application as originally filed (see page 2, lines 8 to 13 and page 8, last paragraph) and of the granted patent indicates implicitly that a reduction in spraying pressure was also desirable. As plausibly pointed out by the respondent during the oral proceedings, the expression "in a reliable manner" has to be considered more generally as relating not only to the extent of the solids removal from the filter surface, but also to the following aspects, most of them linked to the lower pressure that can be used in spraying:

- (i) Simpler and cheaper components (pumps, conduits and nozzles) may be used, which generally operate in a more economic (energy saving) and

reliable way and are less prone to servicing.

- (ii) The impact of the jets on the filter medium is less severe, resulting in reduced wear of the filter medium and therefore reduced maintenance requirements.
- (iii) The pressure level required to guarantee a full removal of the coating at all times can be selected at a much lower level.
- (iv) Not being positioned under the scraper, the accessibility of the nozzles for maintenance is improved.

3.6 The technical problem to be solved by the claimed invention can thus be considered to consist in providing a further pre-coat filtration apparatus for use in a causticisation process, which may be operated in a generally more reliable way than the one disclosed in D1.

3.7 It is implicitly clear from the patent (see column 1, lines 43 to 48 and column 5, lines 53 to 58) that a reduction in the required spraying pressure is achieved by the present invention, in comparison with the pressures used according to D1. The fact that, as pointed out by the appellant, the low spraying pressure values (feature relating to the use of the apparatus) are not referred to in claim 1 is not relevant to the assessment of inventive step, since the apparatus claimed can be operated at such lower spraying pressures due to the constructional feature of the spraying means location in the upwardly moving zone.

The feasibility of the proposed solution is further confirmed by the appellant's own application D5, which does not belong to the prior art, relating to an apparatus of the claimed type, and wherein spraying means for removing a strip of the pre-coat and cake are likewise located in the upwardly moving zone of the filter surface (see claim 1 and Figures 2 and 3). D5 states that the pre-coating is "hardest under the scraper" (see page 3, lines 21 to 23), and that - in comparison to the technology of D1 referred to under the number of the corresponding US patent - the pre-coat layer is "easier" to remove by spraying means located in the upwardly moving zone, since the pre-coat is not hard in this zone (see page 3, lines 32 to 36). D5 also confirms some of the mentioned further advantages related to the location of the spraying means according to present claim 1 (see page 4, lines 1 to 4).

- 3.8 The board is aware of the fact that the positioning of the spraying means in the upwardly moving zone of the filter surface also has certain effects that could be considered as drawbacks, in particular a necessity to remove newly formed cake and a certain impact on the pressure difference over the filter medium and/or on the required capacity of the vacuum pump (see the respondent's submission dated 20 August 1999, page 3, item 3), as well as item 3.13 below, referring to D2). In view of the proper construction of claim 1 (see item 1. above), this impact is, however, negligible, since only a small part of the cake and pre-coat is removed as narrow strip(s) and since the vacuum pumps used in the industry usually have a capacity substantially exceeding the capacity required during filtration (see e.g. appellant's submission dated

20 November 2000, page 2, 4th paragraph and page 3, 1st and 2nd paragraphs).

- 3.9 The idea underlying the present invention, namely the removal, after emersion from the liquid level and upstream of the cake removal device, of a narrow strip of pre-coat together with the cake deposited thereon, leads to the advantages referred to under item 3.5 here above. This idea has not, however, occurred to the skilled person before the priority date of the present patent. The prior art cannot suggest to solve the above-identified technical problem by the claimed modification of the known apparatus for the following reasons.
- 3.10 As mentioned above, the apparatus disclosed and claimed in D1 requires high-pressure nozzles to be located below the scraper in a downwardly moving zone above the liquid level. D1 does not address the issue of cake hardness after the scraper, nor does it consider reducing the nozzle pressure required by changing the location of the nozzles to any other zone of the filtering surface. D1 cannot, therefore, suggest by itself the transfer of the spraying means to an upwardly moving zone above the liquid level, in view of achieving a more reliable pre-coat removal, with a reduction in the required spraying pressure.
- 3.11 D4 discloses rotating vacuum filters of the drum or disk type for unspecified separations. Concerning possible fields of application, D4 only generally mentions "filter pulp" (page 1, line 80), the use of the filter "in a paper making mill", and that the cake may be "conveyed to a repulper" (page 2, lines 98 to 99). In order to reduce the wear of the filter medium

and to reduce the frequency of any filter medium washing, the usual scraper or roller dischargers for removing the cake are replaced by nozzles which generate gaseous or liquid jets (page 1, lines 6 to 36 and page 3, lines 77 to 91). According to Figures 1 to 5 pertaining to disc filters, the cake removing jets are oriented in a direction generally perpendicular to the direction of the filter surface movement. According to Figures 6 and 7 pertaining to drum filters, a series of stationary nozzles is positioned along the width of the drum, all of these nozzles being activated at the same time. In both cases, the fluid jets as described act as fluid blades for removing the entire depth of the cake, over the whole width of the moving filter surface, and hence not as narrow strips. The suggested water pressure to be used for the jets is in the range of about 85 to 100 psi (6 to 7 bar). See page 2, lines 121 to 125. Figures 3, 5 and 6 of D4 disclose embodiments, wherein the entire cake (depth and width) is removed in the upwardly moving zone of the rotating filter surface. On page 2, lines 73 to 80, D4 states that the positioning of the nozzle will depend "on whether the cake is to be removed in wet or dry condition" and "the more rotation, the more the cake will dry".

It follows that D4 does not relate to pre-coat filtration and hence does not disclose the renewal of any pre-coat layer, let alone during an on-going cake filtration. On the contrary, the entire cake (depth and width) formed is constantly removed from the filter surface as it rotates above the liquid surface. It is thus at least questionable whether the skilled person trying to solve the above mentioned technical problem would consider this document at all. Assuming in the

appellant's favour that he/she would consider D4, the board is still convinced that D4 does not - for the following reasons - lead towards invention as claimed:

D4 confirms that a filter cake is generally wetter in the upwardly moving zone of such a filter and that at least some unspecified filter cakes may be entirely removed (depth and width) by means of jets of relatively low pressure (6 to 7 bar). According to D4, the position of the cake removing jet is merely chosen in function of the desired dryness of the cake material, and not in function of the cake's hardness. D4 does not address any relationship between the dryness or hardness of any specific type of filter cake and the pressure of the liquid jets required to remove it. The reasons for withdrawing a wet or dry cake are apparently dictated by the desired field of application and the further processing of the cake. However, it is not an aim of the present invention to provide a wetter cake. Therefore, D4 does not provide any incentive to modify the apparatus according to D1 in the way suggested by the present invention. Irrespective of whether the drawbacks mentioned under 3.8 above would or would not deter the skilled person from opting for the claimed solution, the skilled person - starting from the apparatus of D1 - would not, in view of D4 relating to the removal of the entire cake upon each rotation of the filter surface, and without having knowledge (ex post facto) of the possibility to remove a strip of pre-coat together with the cake layer deposited thereon, realise that the technical problem existing in respect of D1 could be solved by arranging the spraying means in the upwardly moving zone of the filter.

3.12 D8 discloses pre-coat filtration using rotating vacuum drum filters in the field of causticization. According to D8, an inwardly advancing blade is used to remove the filter cake and the uppermost layers of the pre-coat. Periodically, the entire (depth and width) innermost layer of pre-coat ("heel") is "dropped", i.e. removed. The spent pre-coat is thus not removed from the rotating filter surface as a narrow strip. Moreover, cake filtration is interrupted during this operation, which is followed by the step of building up a new pre-coat layer in a filtering mode. During the removal of the "heel", the vacuum is released, "sluice water showers" are used for removing solids from the filter surface. See page 53, Figure 4 and 1st paragraph. According to Figure 4, the "sluice water showers" are located next in an upwardly moving zone of the filter surface, above the liquid level.

Since D8 relates to a pre-coat renewal apparatus which - in contrast with the apparatus of D1 - requires an interruption of the cake filtering operation, and hence a radically different mode of operation, the skilled person would hesitate to consider it when seeking a solution for a problem specifically arising with an apparatus according to D1, more particularly in view of the disadvantages associated with the technology of the type disclosed in D8 (see e.g. D1, column 1, lines 7 to 44). Moreover, D8 does not refer to the dryness or hardness of the cake as a function of its position on the rotating filter surface, or to possibly varying corresponding energy requirements for the "sluice water showers". No particular reason is indicated for locating the "sluice water showers" in the upwardly moving zone. This document cannot, therefore, suggest the modifications necessary to the apparatus of D1 to

arrive at the claimed apparatus.

- 3.13 Document D2 discloses another type of rotating vacuum drum filter for pre-coat filtration (see claim 1 and Figures 1 to 3). The apparatus comprises a nozzle moving axially along the rotating drum for directing a liquid jet against the filter surface in order to remove and renew the pre-coat during ongoing filtration (column 1, lines 48 to 50). The nozzle is positioned under the cake removing scraper, but below the liquid level (see Figure 1), in order to avoid "vacuum leaks". Accordingly, the nozzle is positioned in such a way that a fresh pre-coat layer can be formed again before the cleaned strip emerges from the suspension (see column 2, lines 33 to 34 and lines 54 to 62). D2 cannot suggest the positioning of the nozzle above the liquid level either, since this would lead to the "vacuum leaks" to be avoided according to this document.
- 3.14 The board is convinced, and it was not disputed, that the other documents cited do not come closer to the invention and do not contain any more relevant information.
- 3.15 Therefore, since the apparatus of claim 1 cannot be derived in an obvious manner from the disclosures of any of the cited prior art documents taken alone or in combination, it is considered to be based on an inventive step as required by Article 52(1) and 56 EPC.
- 3.16 Claims 2 to 13 concern preferred embodiments of the apparatus according to claim 1 and are thus equally novel and inventive (Article 52(1) EPC).

4. In view of the above findings, there is no need to deal with the proprietor's auxiliary requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

S. Hue

R. Spangenberg