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Veröffentlichung im Amtsblatt ~~Ja~~/Nein
Publication in the Official Journal ~~Yes~~/No
Publication au Journal Officiel ~~Oui~~/Non

000485

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Aktenzeichen / Case Number / N° du recours : T 114/84

Anmeldenummer / Filing No / N° de la demande : 79 300 369.0

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0004191

Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Chloralkali electrolytic cell and method for operating same

Klassifikation / Classification / Classement : C25B 1/46

ENTSCHEIDUNG / DECISION
vom / of / du 12 November 1985

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent / Titulaire du brevet : ELTECH Systems Corporation (Appellant)

Einsprechender / Opponent / Opposant : I HOECHST AKTIENGESELLSCHAFT (Respondent)
II THE DOW CHEMICAL COMPANY (Respondent)

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Articles 52(1), 56
"Inventive Step"

Leitsatz / Headnote / Sommaire

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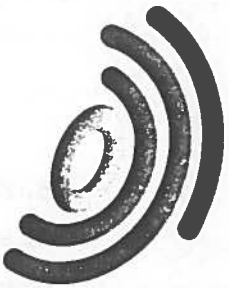

Case Number: T 114 / 84

DECISION

of the Technical Board of Appeal 3.4.1

of 12 November 1985

Appellant: (Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the European Patent Office dated 16 April 1984 revoking European patent No. 0 004 191 pursuant to Article 102(1) EPC

Composition of the Board:

Chairman: O. HUBER
Member: J. ROSCOE
Member: P. FORD

SUMMARY OF FACTS AND SUBMISSIONS

I. European patent No. 0 004 191 was granted to Diamond Shamrock Corporation (predecessors in title to the present Applicant) on 5 May 1982 on European patent application No. 79 300 369.0, filed on 9 March 1979 and claiming priority from a prior application (US 885 754) made in the United States of America on 13 March 1978.

II. The maintenance in force of the European patent was separately opposed in due time and form by both Respondents (hereinafter Respondent I and Respondent II, respectively).

III. By a decision dated 16 April 1984 the Opposition Division revoked the patent on the grounds that the subject-matter of Claims 6 to 9 was not novel having regard to the disclosure in US-A-4 035 254, and that that of Claims 1 to 5 did not involve an inventive step in view of US-A-4 035 254 and articles by F.T. Bacon, and A.A. Wragg et al. numbered (4) and (5) respectively in the list below.

In the opposition proceedings the following documents were cited by one or other of the Respondents:

(1) US-A-3 926 769.
(2) US-A-3 864 236.
(3) F. von Sturm in Abhandlungen der Sächs. Akad. Wiss Leipzig, Bd. 49 (1968) Heft 5, pages 176-177 and 180.
(4) F.T. Bacon, Proc. R. Soc. Lond. A 334 (1973), 427-452.

.../...

(5) A.A. Wragg et al, Electrochimica Acta, Volume 19 (1974), 503-510.

(6) DE-A-2 627 142.

(7) US-A-4 035 254.

(8) Mrha et al., Coll Czech Chem. Comm., Volume 36 (1971), pages 641, 645.

(9) Handbook of Fuel Cell Technology, Prentice Hall, New Jersey, 1968, page 469.

(10) US-A-3 124 520.

(11) M. Eisenberg "Advances in Electrochemistry and Electrochemical Engineering", Volume 2 (1962), 253.

(12) I. Solacolu et al. Journal Electrochem. Soc. Volume 122 (1975), 1417-21.

(13) A.J. Hartner et al in "Fuel Cell Systems" ACS Advances in Chemistry Series 47 (1965) 141-152.

(14) H.A. Liebhafsky in "Fuel Cell Systems" ACS Advances in Chemistry Series 47 (1965), 116-137.

IV. On 12 May 1984 the Diamond Shamrock Corporation lodged an appeal against the decision to revoke the patent and simultaneously paid the appeal fee. The Statement of Grounds was filed on 22 August 1986. Respondents I and II filed submissions in answer thereto on 24 January 1985 and 21 December 1984 respectively. In the submissions of Respondent I the following additional documents were referred to:-

(15) Chemie-Ing-Technik 34 (1962) 346.

(16) Berger, Handbook of Fuel Cell Technology, Prentice Hall, 1968, page 405, Figure 25.

(17) DE-B-1 671 496.

(18) US-A-3 471 336.

(19) US-A-3 134 697.

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V. In a letter filed on 23 October 1985 in response to a communication of the Board pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal the Appellant requested leave to submit amendments according to three auxiliary requests in the event that the Board was unwilling to maintain the patent in unamended form. The second and third of these requests involved the replacement of the claims of the granted patent by sets of claims designated A and B respectively, each set consisting of an independent Claim 1 and two appendant claims.

VI. At the opening of the oral proceedings held on 12 November 1985 the Appellant requested leave to withdraw the main and auxiliary requests referred to in V above and submitted manuscript amended versions of the sets of claims designated A and B (motions 2 and 3) as the basis of new main and auxiliary requests respectively. The proceedings were briefly adjourned to enable the Respondents to study the new claims and the resumed proceedings conducted on the basis of these claims.

VII. The Appellant's representative explained that the manuscript amendments, which were in substance confined to the generic (prior art) part of the respective Claim 1, for which no novelty was claimed, were designed to restrict the claims to operation with the catholyte and type of oxygen cathode of particular practical interest and with which the results shown, for example, in Figure 2, had been achieved. During the oral proceedings he sought to show on the basis of information from the examples in document (7) and from Figure 2 of the patent in suit that greatly superior results were obtainable according to the invention.

.../...

When the cathode was supplied with oxidising gas at atmospheric pressure as in document (7), optimum depolarisation and hence electrical efficiency could be achieved only at gas flow rates well above the range quoted in Claim 1. The results plotted in Figure 2 alone showed that when supplying air at atmospheric pressure the cathode potential, which was a measure of the degree of depolarisation, could not be reduced to the same level as when pressures in the claimed range were used and that the attainable optimum cathode potential was closely approached at much lower flow rates, indeed below 10 times stoichiometric, when using such pressures. In fact the measures set out in the characterising part of the two Claims 1 mutually supported each other to provide a much higher electrical efficiency than had hitherto been available and than could be foreseen on the basis of the prior art documents cited by the Respondents.

On the large industrial scale on which the method would be used in practice, the lower flow rate possible meant a substantial reduction in pumping costs. When using air as a source of oxygen, since this could not be recycled to the oxygen compartment because of its lowered oxygen content, a lowering of the cost of carbon dioxide removal and heating the air to the working temperature of the cell was also achieved.

The proposals in document (7) to increase electrical efficiency were to circulate the catholyte and maintain a catholyte head at least equal to the anolyte head. There was no discussion of the rate at which air or oxygen was fed to the cathode nor any proposal to supply it at above atmospheric pressure. The remaining

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citations which discussed these parameters related to conditions prevailing in fuel cells and/or when using cathodes differing in construction from those to which Claims 1 were now limited. They represented isolated teachings which would not lead the skilled person to adopt the combination of features listed in those claims, and in particular the supplying of oxygen (or air) at the pressure and flow-rate claimed in the expectation of high performance.

VIII. Respondent I contended that no meaningful comparison was possible between the efficiency of the process described in the patent and that disclosed in document (7) since the voltage values quoted in table I of document (7) and those plotted on Figure 2 of the patent related to different parameters not related to one another in a straightforward way. Even if the results quoted in the patent could be shown to be better the improvement could not be directly attributed to the features claimed in Claims 1 of the main and auxiliary requests since the cathode with which the results shown in Figure 2 were achieved was different from that for which table I applied and exhibited features e.g. special catalyst and pore construction which were not requirements of these claims.

Though there were substantial differences between fuel cells and chlor-alkali cells the conditions obtaining and reactions taking place at the oxygen cathode when using aqueous alkali hydroxide electrolyte (catholyte) were essentially the same in both and independent of what happens at the anode. This was illustrated by the fact that the properties of such cathodes were normally investigated in half cells (as in documents (3) and (8) and also in the patent in suit itself). Also cathodes

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of the same construction were used in both types of cell: see document (15), page 346; document (18), column 7, lines 35-44, and document (19), column 13, lines 1-22. Therefore, teachings relating to such cathodes in one application would be seen by the skilled man to be directly applicable to the other. Document (1) (equivalent to (7)) disclosed in essence all the features claimed in Claim 1 of the main request apart from the pressure range and it was known that a certain pressure must be maintained in the oxygen compartment to maintain the three-phase boundary equilibrium which was essential to proper operation of the cathode. Moreover, from document (3); document (7), column 3, line 9; and document (16), Figure 25 it was known to supply oxygen above atmospheric pressure to the cathode. The requisite pressure when using a cathode of any particular construction could be determined by routine experiments on the part of the skilled man. Therefore there was no inventive step to be seen in the combination of features claimed.

Respondent II essentially supported the arguments of Respondent I and in addition at the oral proceedings for the first time raised questions as to the relationship existing between the Appellant, the original patentee and the representative. Doubts were also expressed as to whether the appeal was filed in due time.

IX. The Appellant requests:-

(1) that the decision under appeal be set aside and the patent maintained on the basis of either

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(a) the amended version of the set of claims designated "A" submitted during the oral proceedings and an appropriately amended description (main request); or

(b) the amended version of the set of claims designated "B" submitted during the oral proceedings and an appropriately amended description (auxiliary request); and

(2) that the appeal fee should be reimbursed.

Both Respondents request that the appeal be dismissed.

X. Claim 1 of the main request reads as follows, the designations (i) to (iv) having been inserted by the Board to facilitate later references to the features identified by them.

1. A method for operating a chlor-alkali electrolytic cell having an anode compartment, a cathode compartment divided from the anode compartment by a separator and an oxygen compartment divided from the cathode compartment by an oxygen cathode of the type comprising a corrosion-resistant metal current collector carrying a coating of porous carbon containing a catalyst and a hydrophobic material which method comprises feeding a sodium chloride solution to the interior of the anode compartment feeding an aqueous sodium hydroxide solution to the cathode compartment, feeding a gas containing molecular oxygen and saturated with water vapour to the interior of the oxygen compartment, applying an electrical potential between the cathode and the anode, removing chlorine gas from the anode compartment,

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removing sodium hydroxide solution from the cathode compartment and removing an oxygen-depleted gas from the oxygen compartment, characterised in that (i) CO_2 - depleted and humidified oxygen - containing gas is fed to the cathode (ii) at a positive pressure in the range of from 100 to 200 grams per square meter (40 to 80 inches of water) and (iii) with an oxygen flow rate from 1.5 to 10 times the theoretical stoichiometric amount necessary for the reaction, (iv) the humidified oxygen - containing gas being supplied at a temperature in the range 40°C to 90°C, with its dew point below the skin temperature of the cathode.

Claim 1 of the auxiliary request differs from this only by the replacement of oxygen-containing gas at lines 19 and 24 by "air".

The word "meter" at line 21 should obviously read centimeter for consistency with the pressure range expressed in inches of water and with the original Claim 4 from which this feature is derived. This is therefore assumed in what follows.

XI For the text of the claims and description of the granted patent and of the application as originally filed reference should be made to the publications EP-B-0 004 191 and EP-A-0 004 191 respectively.

Reasons for the Decision

1. The appeal complies with Articles 106 and 108 and Rule 64 EPC and is therefore admissible.

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The matters raised by Respondent II concerning the admissibility of the appeal have been investigated by the Board of its own motion. This investigation established that the representative was, at the time when the appeal was filed, an authorised representative of the original patentee and is an authorised representative of the present Appellant, to which the patent was assigned during the course of the appeal proceedings. It further showed that all the relevant procedural steps were taken by the relevant patentee acting through its authorised representative within the time limits laid down in the EPC and the Implementing Regulations thereto.

2. There is no formal objection to the claims of either the main or the auxiliary request. Claims 1 of both requests lie entirely within the scope of Claim 1 of the granted patent, which is itself fully supported by the description as originally filed as are the appendant claims. Therefore no objection arises under Article 123(2) or (3) EPC. As the claims are rejected for lack of inventive step in their subject-matter for the reasons set out in detail hereafter it is considered unnecessary to go into this matter in detail.

Since the two-part formulation of the Claims 1 takes due account of the disclosure in document (7), which is, in the opinion of the Board, the closest prior art, the requirements of Rule 29(1) EPC are also satisfied.

.../...

3. Before the issues of novelty and inventive step are considered it is pointed out that the Board takes the view, contrary to that expressed by the Opposition Division in the appealed decision, that in the light of the description, especially page 7, lines 7 to 34 and example 3 of the granted patent, the expressions "a gas containing molecular oxygen" and "an oxygen-depleted gas" used in Claim 1 are to be construed to include pure oxygen and residual pure oxygen respectively, and this is to be taken as read in what follows.

4. Following a thorough examination of all the documents in the proceedings the Board is satisfied that the method according to Claim 1 of the main request and that of the auxiliary request is novel. As the novelty of the method is not disputed by either Respondent it is deemed unnecessary to justify this conclusion in detail.

5. The matter now to be determined is thus whether the method according to Claim 1 of either request involves an inventive step.

5.1 A method according to the precharacterising part of Claim 1 of both requests represents the state of the art from which the invention proceeds, as was admitted by the Appellant when presenting the claims at the oral proceedings.

Such a method is described in document (7) the essential disclosure of which corresponds to that of document (1) referred to in the patent in suit. Figure 1 shows the cell construction with anode, cathode and oxygen compartments and separator designated 12,16,32,20 respectively; power source 36 applying the potential

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between anode 14 and oxygen cathode 18; pumps 22,26 and 34 feeding aqueous sodium chloride and hydroxide solutions and oxygen (see example I) to the respective compartments and pipes 24,28,40 for removal of chlorine, sodium hydroxide and oxygen-depleted gas from them. At column 4, lines 1-22 saturation of the oxygen-containing gas, which may be air, is referred to and the cathode construction described.

5.2 As emerges from the opening passages on page 1 and the later detailed description of the patent in suit the aim of the invention is to develop the methodology for operation of the oxygen electrode (cathode) in such a method so as to maximise its electrical efficiency. This is accomplished by the combination of measures set out in the characterising parts of the respective Claims 1.

To recapitulate, these measures are that the oxygen-containing gas (or air) supplied to the cathode compartment is:

(i) CO_2 depleted (i.e. essentially free of CO_2);
(ii) fed at a pressure within a stipulated range;
(iii) fed at a rate within a quoted range;
(iv) saturated with water and fed at a temperature within a specified range with its dew point below the surface temperature of the cathode.

The purposes served by these measures, as is explained in the specification of the patent in suit: see EP-B-4-191 at page 1, lines 5-16, where it is said they can be used singly or in combination and at page 7, lines 13-65 are as follows.

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Measure (i) is to deal with the problem arising from deposits of carbonate on the cathode. Such deposits, the formation of which has been found to be promoted by carbon dioxide, lead to a reduction in cathode lifetime and power efficiency.

Measure (ii) is said to assist in mass transfer of the oxidising gas into the cathode, thus preventing oxygen depletion at the reaction zone within the cathode. Measure (iii) also is stated to enhance mass transfer of oxygen to the reaction sites thus making it continuously available as it is consumed. When air is used as oxygen-containing gas it also reduces to a minimum the lack of activity caused by nitrogen molecules having to diffuse back out of the cathode pores.

Humidification, measure (iv) by reducing evaporation from the cathode, prevents it from drying out, hence reducing the risk of delamination of the porous material from its solid support, which would result in reduced mass transfer of gas; it also reduces the mass transfer of water from the cathode compartment which leads to obstruction of the pores by crystallisation of the electrolyte therein. Control of the dew point on the other hand ensures that condensation of water on the cathode surface, which can occlude oxygen mass transfer sites, does not occur. No reason is given for selection of the particular temperature range, but the range can be seen to embrace what is said to be the preferred operating temperature range of the cell.

5.3 In document (7) it is also proposed, in the interests of improving the cell efficiency, to control the moisture content and dew point of the oxygen-containing gas

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firstly to minimise drying and deposition of materials such as sodium chloride and hydroxide, both of which are present in the preferred catholyte, on the surface or in the pores of the cathode and secondly to eliminate accumulation of liquid water within the cathode compartment (see column 2, lines 22-24; column 3, line 55 to column 4, line 2). To these ends a degree of saturation up to 100% is advocated.

It is evident that condensation would occur on the cathode and thus lead to accumulation of water in the oxygen compartment, if the skin temperature of the cathode were below the dew point of the humidified gas. While the actual temperature of the gas is not stated in this document, in most of the examples the working temperature of the electrolyte is 70°C, which lies in the middle of the temperature range stipulated in measure (iv) of the claim. Therefore measure (iv) in Claim 1 of both requests can be seen only as a natural, if not inevitable, result of the endeavours of the skilled man to follow the instruction of document (7), producing only the result to be expected of it whether air, oxygen or other oxygen-containing gas is used.

5.4 Though the use of air as oxidising gas is also proposed in document (7), at column 3, line 42, oxygen is employed in the numbered examples and the skilled man would, in the absence of any indication to the contrary, assume this to be commercial oxygen which, as a result of its method of production, is essentially free of CO_2 (feature (i) of Claim 1 of the main request).

Moreover, it has long been known that carbon dioxide reacts with alkali hydroxide solutions to produce alkali carbonates, which can, under certain conditions, precipitate out. The cited art provides ample evidence

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that those familiar with the use of oxygen cathodes in contact with electrolyte containing alkali hydroxide which is the situation in the chlor-alkali cell of document (7), are well aware of the risk, when using air as oxidising gas, of this reaction leading to deposition of solid carbonate on or within the pores of the cathode with a consequent reduction of its ability to pass oxygen. Thus document (4) at page 441 points to the drop in performance in hydrogen/air fuel cells using aqueous alkaline electrolyte following its carbonisation by carbon dioxide in the air supply. It also describes the mechanical blockage with carbonate revealed by physical examination. One way of reducing the problem proposed is to remove the CO_2 from the supplied gas by scrubbing. Document (8) at pages 643 to 645 attributes blocking of the pores of an air-fed oxygen cathode (there referred to as air-cathode) in contact with aqueous alkali hydroxide to formation of solid hydroxide and alkali carbonate and indicates that the problem is particularly acute when the electrolyte is sodium hydroxide due to the low solubility of sodium carbonate. The dramatic effect of purging the entering air of CO_2 is shown. Awareness of the problem is also shown by Von Sturm (document (3), 4.2.6 on page 177) and Wragg (document (5), page 504, column 2, second paragraph). Document (2), which relates to chlor-alkali cells inter alia refers at column 5, lines 6-10 to removal of carbon dioxide from the oxidising air when carbonate cannot be tolerated in the alkali products. In the light of this evidence from authors using oxygen electrodes of diverse constructions, and bearing in mind that document (7) as indicated above itself draws attention to and takes measures to avoid, the consequences of deposition of certain solids from the catholyte, the removal of CO_2

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from the air (measure (i) of Claim 1 of the auxiliary request) has to be regarded as an obvious measure for the skilled man to adopt when following up the alternative proposal of document (7) to use air as the oxygen-containing gas, either in anticipation of, or in response to carbonate deposition.

5.5 The measures discussed so far are directed to ensuring that the porous structure of the cathode, which determines its ability to bring together the oxygen and electrolyte in the reaction zone is maintained over an extended period of working. On the other hand measures (ii) and (iii) serve to ensure that optimum use is made of this ability.

5.6 The reactions at the cathode which result in the undesired formation of hydrogen and its suppression in the presence of oxygen, referred to at page 1, lines 50 and 55 respectively of the specification of the patent in suit are:

(a) $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

and (b) $2H_2O + O_2 + 4e^- \rightarrow 4OH^-$

There is no dispute between the parties that it is the reaction (b) to which feature (iii) of Claim 1 refers and that this also takes place at the oxygen cathode of hydrogen oxygen fuel cells (see document (4), page 429).

Column 1, lines 10-14 and column 4, lines 41-51 of document (7) would lead the skilled man to believe that the oxidising gas serves to minimise the formation of gaseous hydrogen in the cathode compartment, i.e. to depolarise the cathode and thus reduce the electrical consumption thereby improving the efficiency of the cell.

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It has not been disputed by the patentee that the skilled man would have known when reading this document at the priority date that it was the above reaction (b) in which the oxidising gas was participating even though document (7) makes no reference to the reaction as such. In fact the reaction is described in a number of earlier documents as that responsible for the cathode depolarisation in chlor-alkali cells employing oxygen cathodes, see e.g. Figures 1 and 3 of document (15) and column 3, lines 15-40 of document (10) referred to in document (7). There can therefore be no doubt that the skilled man would have recognised that the elimination of hydrogen evolution at the cathode was contingent on oxygen being available at the catholyte bathed face of the cathode in an amount sufficient to sustain this reaction at the prevailing current at the expense of reaction (b), or, using the terminology of Claim 1, in at least the stoichiometric amount.

In the cell shown in Figure 1 of document (7) the only oxygen available for the reaction is that which passes through the porous cathode from the stream of gas flowed through the oxygen compartment, a considerable amount of which will inevitably leave without entering or perhaps even contacting the cathode. In these circumstances even though this document does not discuss the rate at which the gas is fed in terms of the demands of the reaction, it is self-evident that the complete suppression of hydrogen formation, seen as desirable in the above quoted passage and stated to be achieved in the Examples,(see column 6, lines 45-47; column 7, lines 1-3) can only be accomplished with a feed rate in excess of the stoichiometric amount. That such rates are in fact used in the examples when using oxygen can

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readily be confirmed by routine calculations from reaction (b) using the quoted values of current and oxygen pumping rate. Such a calculation submitted by Respondent I and made on the assumption that the oxygen is fed at N.T.P. shows the stoichiometric amount in example 1 to be 5.22ml. O_2/minute, corresponding to a fed/stoichiometric amount ratio of 12.6. Corresponding calculations based on examples 4 and 7 to 30 show a ratio ranging from about 2-7 , for example 30, to about 60 for example 9. While the assumption that oxygen is fed at atmospheric pressure seems justified an assumed feed temperature of 0°C would appear to be unrealistic bearing in mind that the electrolyte is at 70°C and the need to maintain a high degree of humidity in the chamber. On the more reasonable assumption of a feed temperature of up to 70°C although the ratios diminish (the 12.6 to about 10 at 70°C for example), all remain above the lower end of the range quoted in Claim 1 and many within it.

On the basis of the above, the Board considers that document (7) shows the need to feed oxygen (or air) at a rate well above stoichiometric to ensure that the effective depolarisation sought is achieved. The skilled person conscious of the desirability of avoiding a pumping rate greater than that achieving any substantial further improvement would thus be incited to perform routine experiments with a selected cell configuration, to determine the variation with flow rate of cathode potential, the measure of depolarisation to find an appropriate rate. Particularly since the cathode potential as plotted in Figure 2 of the patent specification shows a smooth variation both within and above the claimed rate to the optimum value nothing inventive is to be seen in this range.

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5.7 Turning to the remaining measure (ii) relating to the pressure at which the oxygen-containing gas is supplied the following observations are made. Document (7) does not mention pressure as such and contains no information which could lead to the conclusion that the gas is above atmospheric pressure. On the other hand, a number of the cited documents discuss the effect of pressure on the performance of oxygen electrodes of various types or propose the use of pressure with them. Thus document (4) in discussing access of reactants to the catalytically active interface (pages 436 and 438) in the two-layer porous electrodes of a fuel cell refers to use of a small pressure difference between gas and electrolyte and subsequently in connection with another form of electrode to use of a pressure difference of 0.07 to 0.2 atmospheres, a range which overlaps that of measure (ii) in the interests of preventing the electrolyte from flooding the gas side. In document (8) in experiments on two-layer carbon electrodes in alkali hydroxide an overpressure of 15cm. H_2O is used to prevent penetration of electrolyte to the gas side. Document (12) relating to silver gas electrodes investigates the effect of oxygen overpressure in a range of 200-600mm.Hg and shows its favourable influence on depolarisation in certain circumstances. Document (16) shows in Figure 25 the effect of pressurisation on polarisation voltage of sugar-bonded carbon type electrodes in aqueous alkali hydroxide in fuel cells. Finally document (13) which is concerned with improving the polarisation of oxygen cathodes used in alkali fuel cells concludes that in porous silver electrodes increased partial pressure of oxygen had an influence on polarisation voltage.

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While it is clear that the results quoted in these documents and others discussing pressure cannot be directly applied to the type of electrode specified in Claim 1 operating in a chlor-alkali cell the Board takes the view that the documents show the skilled person that when using an oxygen electrode in any situation the pressure is a parameter likely to exercise an important influence on polarisation. The skilled person seeking to improve depolarisation in chlor-alkali cells is therefore incited to perform routine experiments with the pressure whether using oxygen or air to achieve optimum results. The pressure range of Claim 1 of both requests would therefore in the Board's opinion be arrived at as a result of experiments motivated by the above knowledge without an inventive step being involved.

The Appellant has produced no convincing evidence that the measures (i) to (iv) in combination achieve more than the sum of the individual contributions to be expected of them from the teachings of the prior art.

6. Therefore the Board is satisfied that no inventive step is involved in the subject-matter of Claim 1 of either the main or the auxiliary request. Neither of these claims is therefore allowable.

7. Since Claims 2 and 3 are dependent on Claims 1 of the respective requests they are not allowable either.

8. Reimbursement of the appeal fee can be ordered only where the Board deems the appeal to be allowable. Since this condition is not fulfilled in the present case the application for reimbursement has to be refused.

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Order

For these reasons it is decided:

1. The appeal is dismissed.

2. The request for reimbursement of the appeal fee is refused.

The Registrar: The Chairman: