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Datasheet for the decision of 26 June 2009

Case Number: T 1116/06 - 3.2.06

Application Number: 97951565.7

Publication Number: 0958098

IPC: B23K 35/38

Language of the proceedings: EN

Title of invention:
Multi-purpose, multi-transfer, multi-position shielding gas for arc welding

Patentee:
AIR PRODUCTS AND CHEMICALS, INC.

Opponents:
L'AIR LIQUIDE, S.A. A DIRECTOIRE ET CONSEIL DE SURVEILLANCE
LINDE AKTIENGESELLSCHAFT Zentrale Patentabteilung

Headword:
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Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 54, 56

Keyword:
"Novelty and inventive step (yes)"

Decisions cited:
T 0666/89

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1116/06 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 26 June 2009

Appellant: (Patent Proprietor)
AIR PRODUCTS AND CHEMICALS, INC.
7201 Hamilton Boulevard
Allentown, PA 18195-1501 (US)

Representative:
Marx, Lothar
Patentanwälte Schwabe, Sandmair, Marx
Stuntzstrasse 16
D-81677 München (DE)

Respondents: (Opponent 0I)
L'AIR LIQUIDE, S.A. A DIRECTOIRE ET CONSEIL DE SURVEILLANCE POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE
75 Quai d'Orsay
F-75321 Paris Cedex 07 (FR)

Representative:
Pittis, Olivier
L'L'AIR LIQUIDE, S.A.
Direction de la Propriété Intellectuelle
75 Quai d'Orsay
F-75321 Paris Cedex 07 (FR)

(Opponent 0II)
LINDE AKTIENGESELLSCHAFT
Zentrale Patentabteilung
Dr.-Carl-von-Linde-Straße 6-14
D-82049 Höllriegelskreuth (DE)

Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 15 May 2006 revoking European patent No. 0958098 pursuant to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: W. Sekretaruk
Members: M. Harrison
G. Pricolo

Summary of Facts and Submissions

I. The appellant (patent proprietor) filed an appeal against the opposition division's decision revoking European patent number 0 958 098.

In the opposition division's decision, the subject matter of claim 1 of the main request was found to lack novelty with respect to:

D2: US-A-4 871 898

and the subject matter of claim 1 of the first and second auxiliary requests was found to lack an inventive step when starting from D2 as the closest prior art, whereby claim 1 of the first auxiliary request corresponded to granted claim 6, and claim 1 of the second auxiliary request corresponded to granted claim 8.

II. Together with its appeal, the appellant filed a main request and an auxiliary request, each with amended claims upon which maintenance of the patent in an amended form should be based.

III. The respondents OI and OII (opponent OI and OII) each requested dismissal of the appeal.

IV. Subsequent to summoning the parties to oral proceedings, the Board issued a communication stating its provisional opinion in respect of *inter alia* Article 123 EPC and Article 84 EPC 1973.

V. In its letter of 1 April 2009, respondent OI informed the Board that it would not attend oral proceedings.

VI. With its letter of 25 May 2009, the appellant replaced its previous requests by amended requests.

VII. During the oral proceedings of 26 June 2009 before the Board, and in the absence of respondent OI (as announced), the appellant requested that the decision under appeal be set aside and that the patent be maintained in an amended form on the basis of its request filed during the oral proceedings. This sole request consisted of three claims, corresponding to independent claims 6 and 8 and dependent claim 9 as granted and an amended description containing page 1 (containing an insert for use on page 2), and pages 2 to 5 of the granted patent containing handwritten amendments.

Respondent OII requested dismissal of the appeal.

VIII. Since respondent OI did not attend the oral proceedings, its request remained as stated in its written submissions, namely that the appeal be dismissed.

IX. Claims 1 and 2 of the request read as follows:

"1. A flux cored arc welding process wherein an arc is maintained between a continuous filler metal electrode consisting essentially of a metal enclosing fluxing materials and a weld pool the improvement comprising: shielding said arc with a gas mixture consisting of 68% by volume argon, 20% by volume helium and 12% by volume carbon dioxide.

2. A composite cored arc welding process wherein an arc is maintained between a welding electrode and a base metal the improvement comprising: shielding said arc with a gas mixture consisting of 68% by volume argon, 20% by volume helium and 12% by volume carbon dioxide."

X. The appellant's arguments may be summarised as follows:

The subject matter of claims 1 and 2 was novel compared to D2 since this disclosed neither a fluxed cored arc welding process nor a composite cored arc welding process. Furthermore, D2 failed to disclose the specific mixture of gases claimed as it was necessary to make a selection of gas volumes within the disclosed ranges, noting that all examples used a mixture of 8% carbon dioxide, 25% helium with the balance of 67% being argon, whereby the extreme end points of two broad ranges had to be combined.

Concerning inventive step, claim 1 defined a fluxed core welding process. Such a process was disclosed generally in

D4: EP-A1-0 584 000.

However, D4 disclosed shielding gas mixtures with a maximum of 15% helium. D4 was concerned with reducing fume emissions. Whilst D2 disclosed ranges which were wide enough to encompass a gas mixture with the specific gas volumes claimed, nothing taught the use of the range claimed, let alone in respect of a mixture appropriate for a fluxed core process.

As regards claim 2, D2 contained no disclosure of such a process, nor a teaching of any gas mixture suitable for the process. Thus D2 could not be used to arrive at the subject matter of claim 1.

XI. The arguments of respondent OI may be summarised as follows:

D2 represented the closest prior art for considering inventive step. Claim 1 differed over D2 in that the electrode was a filled wire. The use and advantages of such wires were however known from

D8: "Lichtbogenschweißtechnik", Schweißverfahren, Energiequellen, Zusatzwerkstoffe, 1992, pages 49 to 63,

and so it would be obvious to use these with the gas of D2.

The same considerations applied to claim 2 since this also involved a process using a filled wire. Claim 2 differed over claim 1 only in that a composite cored wire was used and this was also known from D8. The subject matter of claims 1 and 2 was therefore obvious.

XII. The arguments of respondent OII may be summarised as follows:

The subject matter of claims 1 and 2 lacked novelty over D2. First, whilst D2 did not explicitly disclose a fluxed core or composite core welding process, there were only three types of consumable wire, so it was implicit that D2 concerned these when disclosing gas metal arc welding with consumable wire electrodes.

Composite cored arc welding and fluxed core arc welding were also both forms of spray arc welding, which was the preferred mode used in D2. This was not a matter of selection, since only three wire types were possible. In regards to the gas used in claims 1 and 2, D2 disclosed gas ranges with end points being at 12% for carbon dioxide and 20% for helium, whereby the balance was 68% argon; this was not a selection because end points were specific disclosures in accordance with T 666/89 and the gas mixture claimed was not specifically chosen but was a random selection, and showed no improved effect compared to the general gas ranges in D2. Furthermore, when considering D2, the skilled person would seriously contemplate using the gas mixture as defined in claim 1, because it was the cheapest and D2 aimed at reducing cost.

The subject matter of claim 1 lacked inventive step when starting from D4 which disclosed a fluxed core arc welding process. Although 15% carbon dioxide was used as one gas, D4 also taught that reduced carbon dioxide resulted in reduced emissions and that quantities down to 10% were acceptable with good welding results, so that a value of 12% carbon dioxide was obvious. The problem to be solved was to reduce fumes and increase weld speed. The use of 20% helium was an end value known from D2 and clearly suitable for the purpose, because D2 covered all types of welding, and fluxed core welding was just one type; D2 also disclosed in column 4, lines 47 to 55, the shielding gas being a solution to the problem of providing increased speed.

The subject matter of claim 2 lacked inventive step starting from D2. The problem to be solved was finding

a suitable gas for composite cored arc welding. The ranges of gas quantities in D2 were applicable to all welding methods and the values of 12% carbon dioxide and 20% helium defined in claim 2 were not special. To arrive at these values it merely involved about a hundred tests involving varying the quantities of carbon dioxide and helium each time and balancing with argon. To arrive at the subject matter of claim 2, the skilled person merely had to select the composite core welding process from those processes covered by D2 and then test different gas quantities among the limited number possible in D2 until a good compromise was found.

Since D2 involved spray arc welding, the skilled person would also have considered

D9: "MAG-Hochleistungsschweißen, zum Einfluss der Schutzgase auf der Schweißergebnis", der Praktiker, Schweißtechnik und mehr 10/97, pages 480-485,

as this taught the use of helium, carbon dioxide and argon shielding gases, whereby shielding gases with 8 to 18% carbon dioxide with helium at 20 to 30% were advantageous.

The values given in the Table 1 in the patent showed "good" results for some of the composite core tests, but did not describe how the value "good" was judged; no evidence of any improvement was present.

Reasons for the Decision

1. *Novelty*

1.1 Claim 1

1.1.1 With respect to the features of claim 1, D2 does not disclose a "flux cored arc welding process" using a "continuous filler metal electrode consisting essentially of a metal enclosing fluxing materials", nor does it disclose shielding an arc with a "gas mixture consisting of 68% by volume argon, 20% by volume helium and 12% by volume carbon dioxide".

1.1.2 Instead, D2 discloses in column 1, line 14 to 31 only gas metal arc welding (GMAW) or metal inert gas (MIG) welding optimally using a spray arc, but without any reference to fluxed core welding. In column 2, lines 41 *et seq* a disclosure is given with reference to the Figure concerning a consumable wire electrode which is a wire being fed from a rotating package. No mention is made of the type of wire involved. Nor is it implicit from D2 that a fluxed cored wire is intended for any reason. Of the wires quoted in D2 in column 2, lines 47 to 51, no evidence has been provided which shows that such wires are anything but simple steel wires. Whilst nothing may prevent fluxed cored wires/rods being used, this is far from being a disclosure of a process using such.

In regard to the argument of respondent OII that only very few wires were possible so that no selection was required, the Board finds this unconvincing. Merely because very few possibilities might be available does

not provide a specific disclosure of any one particular wire type when it is evident that others may indeed be used. Expressed differently, a general disclosure (as in D2) does not anticipate a narrower term (as in the claim), since a selection process is involved.

Likewise, merely because spray arc welding is disclosed as the optimum mode of metal transfer used in D2 (see e.g. column 1, lines 23 to 32) does not imply that composite cored or fluxed cored welding processes are necessarily involved as simple steel wires are also used in this optimum process.

1.1.3 D2 only discloses a shielding gas having a composition within the following general ranges:

(i) 2 to 12% carbon dioxide
(ii) 20 to 45% helium
(iii) balance argon.

In all examples (see e.g. column 4, lines 13 to 18, lines 30 to 32 and lines 42 to 44 *et seq*), a gas mixture is used consisting of 8% carbon dioxide, 25% helium and 68% argon.

1.1.4 The gas defined in the process of claim 1 is a gas which is indeed encompassed by the broad ranges disclosed in D2, but such a gas would be a specific selection when compared to those ranges, combining not only carbon dioxide at one end point of one given range, but also helium at another end point of a second given range. Nothing in D2 however indicates that such a selection is to be made. It is true that D2 in column 1, lines 42 to 53 is concerned with using a cheap

shielding gas which therefore does not require the presence of a large concentration of helium, but D2 in solving this issue uses not 20% helium but 25% helium and not 12% carbon dioxide but 8% carbon dioxide. Thus, the desire to provide a cheap gas suitable for various MGAW or MIG welding processes clearly did not lead the inventors mentioned in D2 to use a gas containing e.g. only 20% helium, nor is there any indication in D2 that a lower percentage of helium necessarily requires a correspondingly larger amount of carbon dioxide, since the balance is simply made up using argon. Thus, contrary to the finding of the opposition division, the skilled person would not, based on the disclosure in D2, seriously contemplate using the specific gas defined in claim 1, let alone use it for the specific arc welding process type defined in claim 1.

1.1.5 The argument of respondent OII that D2 disclosed the claimed gas specifically because the end points of disclosed ranges should be understood as individual disclosures of such gas concentrations, is also not found convincing since in D2 it is not a single point in a single range that needs to be considered, but the combination of a single point from one range with a single point from another range. Nothing in D2 therefore discloses the specific combination of a gas using one end point at 20% helium with another end point at 12% carbon dioxide and the balance argon.

1.1.6 Lastly, the argument of respondent OII that the selection of the specific combination of gas concentrations defined in claim 1 is nothing more than a random selection, is also not found convincing since the disclosure in Table 1 of the patent states that

"very good" or "excellent" results were obtained and this finding has not been challenged by providing any form of evidence to the contrary.

1.2 Claim 2

1.2.1 With respect to the subject matter of claim 2, this differs with respect to claim 1 essentially in that a "composite cored" arc welding process rather than a "fluxed cored" arc welding process is defined. The shielding gas used is the same.

1.2.2 Therefore, for the same reasons as apply to claim 1 in regard to a fluxed cored welding process, D2 also does not disclose a composite cored arc welding process, and also not one using the specific gas mixture claimed. Table 1 of the patent does differ with regard to the results obtained for the composite cored welds in that these were judged as "good" or "very good". However, as also stated for the fluxed cored results obtained according to the method of claim 1, no evidence was supplied by the respondents which would put into doubt the correctness of these results.

1.3 The subject matter of claims 1 and 2 is therefore novel with respect to D2 (the only prior art cited in this particular regard). The requirements of Article 54 EPC 1973 are therefore met.

2. *Inventive step*

2.1 Claim 1

2.1.1 Respondent OI argued that the subject matter of claim 1 lacked an inventive step when starting from D2 because the only difference of claim 1 with respect thereto was the use of a fluxed core arc welding process. However, in accordance with the foregoing analysis concerning novelty, the specific composition of the welding gas is also a difference compared to the disclosure in D2.

2.1.2 In agreement with respondent OII, the Board finds that D4 is a closer state of the art than D2 for considering inventive step, because D4 (contrary to D2) discloses not only a fluxed cored arc welding process but also shielding gas mixtures for use with fluxed core arc processes consisting of the three components defined in claim 1, namely carbon dioxide, helium and argon.

However, in the three-component gas mixtures disclosed in D4, namely 75% Ar/15% He/10% CO_2 and 75% Ar/10% He/15% CO_2, the maximum level of helium is 15%. This is also confirmed as being the "upper helium limit" (see page 5, line 1) while noting that reduced welding performance was already present at 15% compared to 10% helium. Nothing in D4 therefore indicates that the quantity of helium should be raised above 15%, let alone raised significantly up to 20% by volume. Nor is there any indication that a higher level of helium would be useful with a concentration of carbon dioxide lying specifically at 12% by volume.

2.1.3 Respondent OII argued that the objective problem to be solved when starting from D4 was to reduce the smoke generation and to increase the speed of welding, and that a reduction to 12% CO_2 was beneficial for fume reduction, while an increase to 20% He helped increase weld speed. However the Board does not find this argument convincing since, first with regard to the quantity of helium present, D4 teaches that 15% helium is the maximum amount and that improvement is, if anything, to be expected when reducing the amount of helium. No motivation for a skilled person can be found to consult D2 at all when considering the fluxed core welding process of D4, since D2 firstly discloses helium amounts lying well outside the highest limit for the fluxed core welding disclosed in D4 and secondly because nothing in D2 mentions or is even specifically directed to fluxed cored welding processes. Merely because the method in D2 is not stated as being unsuitable for fluxed cored welding processes and merely because D2 gives a general statement (see column 4, lines 47 to 58) to the effect that spray arc gas welding can be performed at higher deposition rates with other known gas metal arc welding methods, is not a teaching that the quantity of helium should be adapted in such a way that it exceeds the maximum level disclosed in D4 to provide any desired result such as increased welding speed for a fluxed core welding process, even less so when using a specific quantity of carbon dioxide.

2.1.4 Even if D2 were taken as the closest prior art (in accordance with the argument of respondent OI) despite the fact that it does not disclose fluxed cored welding at all, the Board concludes that the teaching of D8

would not bring the skilled person closer to the invention defined in claim 1 unless inventive skill were used, because nothing is stated in D8 about a combination of fluxed cored arc welding with a shielding gas comprising all three gases, let alone there being any indication towards combining a specific concentration of the three gases for a particular purpose.

2.1.5 The subject matter of claim 1 therefore involves an inventive step in respect of the prior art cited.

2.2 Claim 2

2.2.1 Both the respondents OI and OII identified D2 as being the closest prior art starting point from which to consider inventive step. However, the Board disagrees because D2 discloses nothing about composite cored arc welding methods whatsoever, nor the specific gas composition as defined, let alone about a combination of composite core arc welding with a particular shielding gas composition. It thus appears that the most appropriate starting point for considering inventive step is the standard known method of composite cored arc welding such as known e.g. from D8.

2.2.2 Starting with this known method, the skilled person would have the problem of finding a suitable shielding gas for use therewith. D2 provides no teaching to solve such a problem, because it does not mention composite cored arc welding processes at all. Beyond the three broadly disclosed ranges of helium, carbon dioxide and argon, D2 merely discloses observations from using a particular concentration level of each of these three

components, namely a helium level at 25% and carbon dioxide at 8% with the balance argon. Any teaching to alter the volume percentages of these gases, in particular so as to arrive at the gas mixture claimed, let alone for a composite cored method using such a gas mixture, is entirely lacking.

2.2.3 Starting with D2 as the closest prior art, as proposed by the respondents, would not produce a different conclusion. Whilst the gas concentration in claim 1 is not disclosed in D2, respondent OII argued that it was merely a matter of trial and error as to which gas would be suitable for which welding method and that there were only about one hundred tests that needed to be performed within the ranges available in D2 to find a suitable gas mixture. However, the Board finds this argument unconvincing since the mere existence of a broad range of gases does not indicate, even as a first step, that within these ranges a gas might be found which would be suitable for composite cored arc welding. Nevertheless, even assuming it did, the number of possibilities for varying the gas concentration is vast. The use of changed amounts by 1% for each gas involved might involve some 100 individual tests, but this is irrelevant since nothing indicates that a change of 1% must be used; changes of far smaller intervals may be chosen. Furthermore, nothing indicates to a skilled person how he should alter various values to achieve a gas mixture suitable for the process involved.

2.2.4 Neither D8 nor D9 as cited by the respondents, brings the skilled person closer towards the invention when starting from D2. D8 discloses (see pages 58 to 62) various composite cored electrodes and, in the

following section (pages 62 and 63), albeit incompletely since the section presumably continues on page 64 which was not supplied, shielding gases are mentioned giving as the only specific example of a gas mixture 82% Ar and 18% CO_2, without however making any reference to a specific process. Such a disclosure gives no teaching towards the gas mixture used in the specific process defined in claim 1.

2.2.5 Similarly, whilst D9 discloses spray arc welding which is a transfer method used in composite cored arc welding, nothing within D9 relates to a particular gas mixture for such a process. D9 furthermore mentions many possibilities for gases which may be used generally in arc welding, whereby (see e.g. page 482, right column) quantities ranging from 8 to 18% CO_2 are seen as useful for low requirements on weld quality, and whereby improvements may be found when using between 20% and 30% helium mixtures. Other mixtures are also disclosed in D9 containing oxygen. However, nothing is disclosed concerning selection of a gas having 68% by volume argon, 20% by volume helium and 12% by volume carbon dioxide, let alone indicating that a particular gas mixture (even if helium and carbon dioxide should be used together without oxygen) which would be suitable for composite cored arc welding.

2.2.6 Thus, based on the prior art cited, only hindsight would lead the skilled person to a composite cored arc welding process using the specific gas defined in claim 2.

2.2.7 The respondent's argument that Table 1 of the patent does not prove that the values in claim 2 are "special"

in some way, such that an inventive selection occurred, is not found convincing. In all five examples using composite cored arc welding, "good" or "very good" results were reported and no evidence has been supplied which would suggest any doubts about such results.

2.2.8 Thus, the lack of any cited prior art concerning the combination of a composite cored arc welding process together with a particular shielding gas composition leads the Board to the conclusion that only in hindsight could the subject matter of claim 2 be regarded as obvious by a skilled person.

2.2.9 The subject matter of claim 2 therefore involves an inventive step.

2.3 Since the subject matter of claims 1 and 2 involves an inventive step in light of the cited prior art, the requirement of Article 56 EPC 1973 is therefore fulfilled.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the following documents:

   claims 1, 2 and 3 and description pages 1 - 5, all of 26 June 2009.

The Registrar: The Chairman:

M. Patin W. Sekretaruk