Title (en)

Process and device for cryogenic air separation

Title (de)

Verfahren und Vorrichtung zur Tieftemperaturzerlegung von Luft

Title (fr)

Procédé et dispositif pour la séparation cryogénique des constituants de l'air

Publication

EP 1067345 A1 20010110 (DE)

Application

EP 99121174 A 19991022

Priority

DE 19930731 A 19990705

Abstract (en)

A first side stream (26) is heated in the main heat exchanger (30) upstream of its extraction point (28) at the first intermediate temperature. An Independent claim is included for corresponding plant to carry out the process. Preferred Features: Before heating, the first side stream is introduced into the cold end of the heat exchanger (30). A cooling air flow (23, 24) is cooled down in the main heat exchanger (30). It is extracted (24) at the cold end of the heat exchanger. It is re-supplied, at least in part, to the cold end of the main heat exchanger, as the first side stream (26). The cooling air flow (24), following extraction from the cold end of the heat exchanger is supplied to a phase separator, in a variant design. Further variants based on the foregoing principles are described. A turbine airflow (23, 25) is cooled in the main heat exchanger (30) to a further intermediate temperature, then expanded (36) to produce mechanical energy driving cold compression (29).

Abstract (de)

Das Verfahren und die Vorrichtung dienen zur Tieftemperaturzerlegung von Luft. Verdichtete und gereinigte Einsatzluft (9, 10, 20) wird in einem Hauptwärmetauscher (30) abgekühlt und mindestens zum Teil einer Rektifiziersäule (50) zugeführt (12, 33). Ein erster Teilstrom (26) der Einsatzluft wird dem Hauptwärmetauscher (30) zugeführt, mindestens zum Teil bei einer ersten Zwischentemperatur aus dem Hauptwärmetauscher entnommen (28) und einer Kaltverdichtung (29) zugeführt. Der erste Teilstrom (26) wird stromaufwärts seiner Entnahme (28) bei der ersten Zwischentemperatur im Hauptwärmetauscher (30) angewärmt (27). <IMAGE>

IPC 1-7 (main, further and additional classification)

F25J 3/04

IPC 8 full level (invention and additional information)

F25J 3/04 (2006.01)

CPC (invention and additional information)

F25J 3/04412 (2013.01); **F25J 1/0012** (2013.01); **F25J 1/0224** (2013.01); **F25J 1/0234** (2013.01); **F25J 3/04054** (2013.01); **F25J 3/0409** (2013.01); **F25J 3/04296** (2013.01); **F25J 3/04339** (2013.01); **F25J 3/04381** (2013.01); F25J 2205/04 (2013.01); F25J 2230/20 (2013.01); F25J 2245/40 (2013.01); F25J 2270/02 (2013.01)

Citation (search report)

- [A] EP 0689019 A1 19951227 - AIR LIQUIDE [FR]
- [PA] EP 0932003 A2 19990728 - AIR PROD & CHEM [US]
- [A] US 4224045 A 19800923 - OLSZEWSKI WALTER J, et al
- [DA] WO 9528610 A1 19951026 - AIR LIQUIDE [FR]
- [A] EP 0831285 A2 19980325 - BOC GROUP PLC [GB]

Cited by

EP2600090A1; WO2007145915A3; DE102013017590A1; EP2963367A1; WO2016005031A1; EP2312248A1; EP2520886A1; US7549301B2; DE102007031759A1; EP2469205A1; DE102010055448A1; EP2963371A1; EP2015013A2; DE102009034979A1; EP2458311A1; DE102010052545A1; DE102011121314A1; DE102012017488A1; EP2784420A1; EP2963369A1; DE102007031765A1; DE102010052544A1; EP2466236A1; EP2568242A1; DE102011112909A1; WO2014154339A2; EP2801777A1; EP2963370A1; EP2015012A2

Designated contracting state (EPC)

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

EPO simple patent family

EP 1067345 A1 20010110; EP 1067345 B1 20040616; AT 269526 T 20040715; US 6336345 B1 20020108

INPADOC legal status

2008-01-02 [PG25 PT] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO

- Ref Country Code : PT
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20041116

2007-12-31 [BERE] BE: LAPSED

- Owner name : *LINDE A.G.
- Effective date : 20051031

2006-07-03 [NLV4] NL: LAPSED OR ANULLED DUE TO NON-PAYMENT OF THE ANNUAL FEE

- Effective date : 20060501

2006-06-28 [GBPC] GB: EUROPEAN PATENT CEASED THROUGH NON-PAYMENT OF RENEWAL FEE

- Effective date : 20051022

2006-06-20 [EUG] SE: EUROPEAN PATENT HAS LAPSED

2006-05-03 [PG25 DE] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : DE
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20060503

2006-05-01 [PG25 NL] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : NL
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20060501

2005-10-31 [PG25 BE] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : BE
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20051031

2005-10-23 [PG25 SE] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : SE
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20051023

2005-10-22 [PG25 GB] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : GB
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20051022

2005-10-22 [PG25 IT] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : IT
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20051022

2005-06-15 [REG CH PL] PATENT CEASED

2005-06-10 [EN] FR: TRANSLATION NOT FILED

2005-06-08 [26N] NO OPPOSITION FILED
- Effective date : 20050317

2005-01-12 [REG IE FD4D] EUROPEAN PATENTS DESIGNATING IRELAND TREATED AS ALWAYS HAVING BEEN VOID

2004-12-16 [PGFP BE] POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE
- Ref Country Code : BE
- Payment date : 20041216
- Year of fee payment : 6

2004-10-31 [PG25 CH] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : CH
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20041031

2004-10-31 [PG25 LI] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : LI
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20041031

2004-10-31 [PG25 MC] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : MC
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20041031

2004-10-22 [PG25 AT] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : AT
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20041022

2004-10-22 [PG25 LU] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : LU
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20041022

2004-10-20 [PGFP GB] POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE
- Ref Country Code : GB
- Payment date : 20041020
- Year of fee payment : 6

2004-10-14 [PGFP DE] POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE
- Ref Country Code : DE
- Payment date : 20041014
- Year of fee payment : 6

2004-10-12 [REG SE TRGR] TRANSLATION OF GRANTED EP PATENT

2004-10-06 [PGFP SE] POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE
- Ref Country Code : SE
- Payment date : 20041006
- Year of fee payment : 6

2004-10-03 [PGFP NL] POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE
- Ref Country Code : NL
- Payment date : 20041003
- Year of fee payment : 6

2004-09-27 [PG25 ES] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : ES
- Free text : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT
- Effective date : 20040927

2004-09-16 [PG25 DK] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : DK
- Free text : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT
- Effective date : 20040916

2004-09-16 [PG25 GR] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : GR
- Free text : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT
- Effective date : 20040916

2004-09-15 [GBT] GB: TRANSLATION OF EP PATENT FILED (GB SECTION 77(6)(A)/1977)
- Effective date : 20040823

2004-07-28 [REG IE FG4D] EUROPEAN PATENTS GRANTED DESIGNATING IRELAND
- Free text : GERMAN

2004-07-22 [REF] CORRESPONDS TO:
- Document : DE 59909750 P 20040722

2004-06-30 [REG CH EP] ENTRY IN THE NATIONAL PHASE

2004-06-16 [AK] DESIGNATED CONTRACTING STATES:
- Kind Code of Ref Document : B1
- Designated State(s) : AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

2004-06-16 [REG GB FG4D] EUROPEAN PATENT GRANTED
- Free text : NOT ENGLISH

2004-06-16 [PG25 FR] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : FR
- Free text : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES
- Effective date : 20040616

2004-06-16 [PG25 CY] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO

- Ref Country Code : CY
- Free text : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT
- Effective date : 20040616

2004-06-16 [PG25 FI] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : FI
- Free text : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT
- Effective date : 20040616

2004-06-16 [PG25 IE] LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO
- Ref Country Code : IE
- Free text : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT
- Effective date : 20040616

2003-01-08 [17Q] FIRST EXAMINATION REPORT
- Effective date : 20021126

2001-09-26 [AKX] PAYMENT OF DESIGNATION FEES
- Free text : AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

2001-08-16 [R17P] REQUEST FOR EXAMINATION FILED (CORRECTION)
- Effective date : 20010601

2001-08-08 [17P] REQUEST FOR EXAMINATION FILED
- Effective date : 20010612

2001-01-10 [AK] DESIGNATED CONTRACTING STATES:
- Kind Code of Ref Document : A1
- Designated State(s) : AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

2001-01-10 [AX] REQUEST FOR EXTENSION OF THE EUROPEAN PATENT TO:
- Free text : AL;LT;LV;MK;RO;SI