

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte VICTOR J. KETCHAM, ENZO L. COLTRINARI
and WAYNE W. HAZEN

Appeal No. 1997-0448
Application No. 08/327,980

HEARD: December 8, 1999

Before GARRIS, OWENS, and SPIEGEL, *Administrative Patent Judges*.

SPIEGEL, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner finally rejecting claims 2 through 7, 11 through 15, 17, 19 and 21 and refusing to allow claims 1, 10, 16, 18 and 20 as amended subsequent to the final rejection, which are all of the claims pending in this application.¹ Claims 1, 2, 18 and 20 are illustrative:

¹The amendment filed August 9, 1995 (Paper No. 9), cancelling claims 8 and 9 and amending claims 1, 10, 16, 18 and 20, was entered by the examiner in the advisory action mailed August 22, 1995 (Paper No. 10).

1. A process for producing molybdenum trioxide of at least technical grade from molybdenite concentrate containing molybdenite, at least one of copper in excess of 5 wt % or naturally floatable gangue minerals in excess of 10 wt %, each based on the weight of the concentrate, the process comprising the steps of:

- A. contacting an aqueous suspension of the concentrate with oxygen under a partial pressure of free oxygen of between about 75 and 200 psi and at a temperature of at least about 150 C such that at least about 95% of the molybdenite is oxidized to form a soluble hydrous molybdic oxide and insoluble molybdenum trioxide;
- B. separating the soluble molybdic oxide from the insoluble molybdenum trioxide;
- C. contacting the insoluble molybdenum trioxide with a solubilization compound to form an aqueous mixture of soluble molybdate values and insoluble residue;
- D. separating the soluble molybdate values from the insoluble residue;
- E. combining the soluble molybdate values of step D with the soluble molybdic oxide of step A to form an aqueous mixture containing soluble molybdenum values;
- F. contacting the aqueous mixture of step E with an organic solvent containing an extractive compound that is selective for the molybdenum values such that a majority of the metal contaminants remain in the aqueous mixture while a majority of the molybdenum values are extracted into the organic solvent;
- G. removing the extracted molybdenum values of step F from the organic solvent by contacting the organic solvent with an aqueous solution containing a stripping reagent selective for molybdenum values;
- H. crystallizing the extracted molybdenum values of step G; and
- I. calcining the crystallized molybdenum values of step H to produce molybdenum trioxide.

2. The process of Claim 1 in which the solubilization compound of step C is an alkali metal compound.

18. A process for producing molybdenum trioxide of at least technical grade from molybdenite concentrate containing molybdenite, at least one of copper in excess

of 5 wt % or naturally floatable gangue minerals in excess of 10 wt %, each based on the weight of the concentrate, the process comprising the steps of:

- A. contacting an aqueous suspension of the concentrate with oxygen under a partial pressure of between about 75 and 200 psi and at a temperature of at least about 150 C such that at least about 95% of the molybdenite is oxidized to form a soluble hydrous molybdic oxide and insoluble molybdenum trioxide;
- B. separating the soluble molybdic oxide from the insoluble molybdenum trioxide;
- C. contacting the insoluble molybdenum trioxide with ammonium hydroxide to form soluble molybdate values;
- D. contracting [sic, contacting] the soluble molybdic oxide with an organic solvent containing an extractant that is selective for the soluble molybdic oxide such that a majority of the metal contaminants remain in the aqueous mixture while a majority of the soluble molybdic oxide is extracted into the organic solvent;
- E. removing the extracted molybdic oxide of step D from the organic solvent by contacting the organic solvent with an aqueous solution containing a stripping reagent selective for molybdenum;
- F. combining the soluble molybdate values of step C with the extracted molybdic oxide of step E to form a mixture of soluble molybdenum values;
- G. crystallizing the soluble molybdenum values of step F; and
- H. calcining the crystallized molybdenum values of step G to form molybdenum trioxide.

20. A process for producing molybdenum trioxide of at least technical grade from molybdenite concentrate containing molybdenite, at least one of copper in excess of 5 wt % or naturally floatable gangue minerals in excess of 10 wt %, each based on the weight of the concentrate, the process comprising the steps of:

- A. contacting an aqueous suspension of the concentrate with oxygen under a partial pressure of free oxygen of between 75 and 200 psi and a temperature of at least about 150 C such that at least about 95% of the molybdenite is oxidized to form a soluble hydrous molybdic oxide and insoluble molybdenum trioxide;

- B. separating the soluble molybdic oxide from the insoluble molybdenum trioxide;
- C. contacting the insoluble molybdenum trioxide with at least one of lime and magnesium hydroxide to form a mixture containing soluble molybdate values;
- D. combining the mixture of step C with the soluble molybdic oxide fraction of step B to form a mixture of soluble molybdenum values;
- E. contacting the aqueous mixture of step D with an organic solvent containing an extractive compound that is selective for the molybdenum values such that a majority of the metal contaminants remain in the aqueous mixture while a majority of the molybdenum values are extracted into the organic solvent;
- F. removing the extracted molybdenum values of step E from the organic solvent with an aqueous solution containing a stripping reagent selective for molybdenum values;
- G. crystallizing the extracted molybdenum values of step F; and
- H. calcining the crystallized molybdenum values of step G to form molybdenum trioxide of at least technical grade.

The references relied on by the examiner are:

Chiola et al. (Chiola)	3,598,519	Aug. 10, 1971
Barry et al. (Barry)	3,656,888	Apr. 18, 1972
Vertes et al. (Vertes)	4,046,852	Sep. 6, 1977
Sohn	4,376,647	Mar. 15, 1983
I.G. Farbenindustrie Aktiengesellschaft (GB '472) (published Great Britain patent specification)	331,472	Jul. 3, 1930

Appeal No. 1997-0448
Application No. 08/327,980

ISSUES²

Claims 1-7 and 10-19 stand rejected under 35 U.S.C. § 103 as being unpatentable over Barry in view of Vertes and Chiola. Claims 20 and 21 stand rejected under 35 U.S.C. § 103 as being unpatentable over Barry in view of Vertes and Chiola as applied to claims 1-7 and 10-19 and further in view of Sohn. Claims 20 and 21 stand rejected under 35 U.S.C. § 103 as being unpatentable over Barry in view of Vertes and Chiola and Sohn as applied to claims 1-7 and 10-21 and further in view of GB '472. We reverse.

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims and to the respective positions articulated by the appellants and the examiner. We make reference to the examiner's answer (Paper No. 15, mailed June 25, 1996) for the examiner's reasoning in support of the rejections and to the appellants' brief (Paper No. 14, filed February 20, 1996) for the appellants' arguments thereagainst.

THE INVENTION

The claimed invention is directed a process of producing molybdenum trioxide from molybdenite comprising forming an aqueous slurry of molybdenite, pressure oxidizing the slurry at a partial pressure of free oxygen of between about 75 and about 200 psi and at a temperature of at least

²According to the advisory action mailed August 22, 1995 (Paper No. 10), the final rejection of claims 1-21 under 35 U.S.C. § 112, second paragraph, as indefinite has been overcome by the amendment filed August 9, 1995 (Paper No. 9).

about 150E C to form soluble and insoluble molybdenum species, solubilizing the insoluble molybdenum species by alkaline digestion, separating the soluble molybdenum species from any residual insoluble contaminants, extracting the molybdenum species from the aqueous media with an organic solvent, and recovering the molybdenum values from the organic solvent as molybdenum trioxide (brief, pages 3-4; abstract). According to the specification, this process allows a greater recovery of higher purity molybdenum trioxide from low grade molybdenum concentrates containing greater than 5 wt % copper or greater than 10 wt % of naturally floatable gangue materials, e.g., talc and sericite, than can be recovered from conventional techniques, e.g., roasting (para. bridging pages 9-10).

OPINION

I. Rejection of claims 1-7 and 10-19 as obvious over Barry in view of Vertes and Chiola

Barry describes a process of producing molybdenum trioxide from a molybdenite concentrate typically comprising in excess of about 80% molybdenum sulfite, about 5 to about 10% silica and less than 1% of contaminating metals, e.g., copper,³ comprising (A) pressure oxidizing an aqueous slurry of particulate concentrate at a partial pressure of free oxygen above about 50 psi, preferably from about 300 psi to about 600 psi, and at a temperature of at least about 100E C, preferably from about 150E C to about 250EC, to substantially convert the molybdenum disulfide to the corresponding oxide;⁴ (B)

³See Barry, col. 2, lines 22-26 and 52-58.

⁴See Barry, col. 1, lines 52-70; col. 3, lines 65-68; col. 4, lines 6-40.

filtering the resultant acid aqueous slurry to separate the insoluble molybdenum trioxide product, which also contains unreacted molybdenum disulfide and any other solid contaminating material, e.g., silica, from the filtrate which contains some dissolved molybdenum sulfate;⁵ (C) transferring the filtrate to a neutralizer wherein a caustic is added to precipitate dissolved molybdenum trioxide which is recovered by filtration;⁶ (D)(1) contacting the insoluble molybdenum trioxide product with aqueous ammonium hydroxide, thereby producing soluble ammonium molybdate; (D)(2) filtering the ammonium molybdate from residual solid contaminants;⁷ (D)(3) concentrating the ammonium molybdate in a crystallizer;⁸ and (D)(4) calcining to produce ammonium gas which is recycled back to aqueous ammonium hydroxide, thereby yielding high purity molybdenum trioxide.⁹ The residual solid contaminants of (D)(2) is preferably accumulated and treated as in steps (A) through (D)(2) above, with the corresponding filtrate containing ammonium molybdate being combined with the filtrate of step (D)(2) above.¹⁰

⁵See Barry, col. 4, lines 61-75.

⁶See Barry, col. 5, lines 1-8.

⁷See Barry, col. 5, lines 22-40.

⁸See Barry, col. 5, lines 41-43.

⁹See Barry, col. 5, lines 43-50.

¹⁰See Barry, col. 5, line 51 - col. 6, line 3.

Vertes discloses roasting a molybdenite concentrate, pressure oxidizing roasted concentrate which consists predominantly of molybdenum oxide, of which the majority is in the form of molybdenum trioxide, at a temperature from about 150EC to about 350EC and a partial pressure of oxygen of at least about 100 psi whereby suboxides of molybdenum are converted to molybdenum trioxide and contaminating metal molybdates and sub-molybdate compounds thereof are converted to aqueous acid soluble molybdate compounds.¹¹ The resultant slurry is filtered to separate the solids, i.e., predominantly molybdenum trioxide and insoluble gangue contaminants.¹² Thereafter, the filtered solids are solubilized with aqueous ammonium hydroxide solution and filtered to separate or “leach out” soluble ammonium molybdate compounds from residual solid contaminants.¹³ The resultant filtrate is crystallized and calcined to produce ammonium gas which is recycled back to aqueous ammonium hydroxide, thereby yielding high purity molybdenum trioxide.¹⁴ Alternatively, the filtered solids can be solubilized with an aqueous alkali metal hydroxide solution (instead of solubilized with aqueous ammonium hydroxide solution) to form the corresponding soluble alkali metal molybdate compound.¹⁵

¹¹See Vertes, col. 3, line 7 - col. 4, line 50.

¹²See Vertes, col. 4, lines 51-57.

¹³See Vertes, col. 4, line 57 - col. 5, line 3.

¹⁴See Vertes, col. 5, lines 4-24.

¹⁵See Vertes, col. 5, lines 25-30 and col. 6, lines 5-14.

Chiola discloses a process for separating molybdenum values from impurities comprising (a) digesting a molybdenite concentrate in sulfuric acid to form a feed solution (b) which is then contacted with an organic solvent comprising a tertiary amine dissolved in an aromatic hydrocarbon solvent to selectively extract at least a portion of the molybdenum values into the organic solvent, (c) contacting the resultant organic extract with an aqueous stripping solution containing ammonium ions and ammonium molybdate to remove at least some of the molybdenum from the organic extract and to form an aqueous ammonium molybdate solution, and (d) separating the aqueous ammonium molybdate from the organic extract.¹⁶

According to the examiner, it would have been obvious to one of ordinary skill in the art “to have replaced the ammonium compound of Barry with the alkali compounds of Vertes because the substitution of art recognized equivalents as shown by Vertes would have been within the level of ordinary skill in the art” (answer, page 4, para. 4). In addition, according to the examiner, it would have been obvious to one of ordinary skill in the art “to extract the molybdenum of Barry with a tertiary amine because Chiola teaches such from a similar sulfuric acid solution containing molybdenum as in Barry” (answer, page 4, para. 6).

¹⁶See Chiola, col. 3, lines 3-22 and col. 4, lines 45-47.

To establish a *prima facie* case of obviousness, there must be both some suggestion or motivation to modify the reference or combine the reference teachings and a reasonable expectation of success. Furthermore, the prior art must teach or suggest all the claim limitations. *In re Vaeck*, 947 F.2d 488, 493, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

Here, all of the claims ultimately require production of *molybdenum trioxide* and claims 2-7 and 10-17 specifically require use of an alkali metal solubilizing compound, e.g., sodium or potassium hydroxide. Use of a sodium or potassium hydroxide solution as an alternative to an ammonium hydroxide solution, as suggested by Vertes, results in formation of the corresponding sodium or potassium molybdate compound. Vertes explicitly states that the calcination procedure used to produce molybdenum trioxide from ammonium molybdate *cannot* be used with potassium and sodium molybdates.¹⁷ The examiner does not point out, and we do not find, where Vertes discloses or suggests how to obtain the required molybdenum trioxide from sodium or potassium molybdate. Neither Barry nor Chiola disclose or suggest how to convert soluble sodium or potassium molybdate into molybdenum trioxide. Rather, the only place we find this disclosure is in the appellants' specification. Thus, as to claims 2-7 and 10-17, which all require use of an alkali metal solubilizing compound, e.g., sodium or potassium hydroxide, we conclude that the examiner has relied on impermissible hindsight in making his determination of obviousness. *In re Fritch*, 972 F.2d 1260,

¹⁷See Vertes, col. 5, lines 43-48.

Appeal No. 1997-0448
Application No. 08/327,980

1266, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992) (“It is impermissible to engage in hindsight reconstruction of the claimed invention, using the applicant’s structure as a template and selecting elements from references to fill the gaps.”).

Independent claims 1 and 18, as well as independent claim 20 and all of their respective dependent claims, require recovering various molybdenum species from one or a specified combination of two aqueous media through an organic solvent extraction process. Appellants acknowledge that “Chiola, et al. generally teach a solvent extraction process similar to the one taught in step F of Claim 1 and in dependant [sic] Claims 5-7 and also in step F of Claim 18 and dependent Claim 19 of the present invention” (brief, page 16, last para.). The examiner is of the opinion that it would have been obvious “to extract the molybdenum of Barry with a tertiary amine because Chiola teaches such from a similar sulfuric acid solution containing molybdenum as in Barry” (answer, page 4, para. 6). However, it is unclear which “molybdenum” fraction(s) of Barry the examiner is referring to. More specifically, the examiner has failed to explain how one of ordinary skill in the art would have modified the process of Barry by the disclosure of Chiola to obtain the sequence of reaction steps recites in claims 1 and 18 (and 20). The examiner has not established that the ammonium molybdate solution of Barry (see steps (D)(1) and (D)(2) above) has a “pH below about 0.5,” as required by Chiola (col. 3, lines 5-8) or, if not, why one would have adjusted the pH of the ammonium molybdate to below about 0.5. The

examiner has failed to address why various aqueous fractions in Barry should be combined at particular points in the process. Furthermore, Chiola describes modifying prior art processes where molybdenite ore is processed to ammonium molybdate using a one-component ammonium hydroxide process to produce the ammonium molybdate (col. 1, line 68 - col. 2, line 2), similar to those described by Barry and Vertes, with a two-component solvent extraction process (col. 2, lines 67-72) where the feed solution is first contacted with an organic extraction solvent containing a tertiary amine and *then* contacting the molybdenum-pregnant organic solution with an ammonium solution (col. 3, lines 9-20). The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Laskowski*, 871 F.2d 115, 117, 10 USPQ2d 1397, 1398-99 (Fed. Cir. 1989); *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984).

Based on the foregoing, we conclude that the examiner has not established a *prima facie* case of obviousness as to claims 1-7 and 10-19 over Barry in view of Vertes and Chiola.

II. Rejection of claims 20-21 as obvious over Barry in view of Vertes and Chiola as applied to claims 1-7 and 10-19 above, and further in view of Sohn.

Sohn discloses reacting fine powders of molybdenite and lime (CaO) with steam (i.e., water vapor) to produce calcium molybdate and hydrogen.¹⁸

¹⁸See Sohn, col. 9, lines 41-60.

The examiner states, without further explanation, that “calcium molybdate ... would appear to be soluble (see the abstract).” According to the examiner, it would have been obvious to one of ordinary skill in the art “to use lime to form soluble molybdates in the process of Barry because Sohn teaches that such use also forms soluble molybdates, eg. calcium molybdate, which are similar to the soluble molybdates formed in Barry and Vertes” (answer, page 5, para. 4).

Assuming *arguendo* that calcium molybdate is water-soluble, the examiner still has not explained how one of ordinary skill in the art would have obtained molybdenum trioxide from calcium molybdate, especially given Vertes’ disclosure that calcination is not a universally applicable method of converting any and all molybdates to molybdenum trioxide. The examiner has not pointed out, and we do not find, where Barry, Vertes, Chiola and/or Sohn disclose or suggest how to obtain molybdenum trioxide from calcium molybdate. Thus, we conclude that the examiner has not carried his burden of establishing a *prima facie* case of obviousness of claims 20 and 21 over Barry in view of Vertes and Chiola, taken further in view of Sohn.

III. Rejection of claims 20-21 as obvious over Barry in view of Vertes and Chiola and Sohn as applied to claims 1-7 and 10-21 above, and further in view of GB ‘472.

GB ‘472 discloses forming normal calcium molybdate directly without the formation of water-soluble molybdates by treating completely roasted molybdenum glance with lime, preferably at boiling

heat, by avoiding any excess of lime to prevent formation of soluble molybdates,¹⁹ and extends this process to forming other molybdates of alkaline earths and of magnesium.²⁰

According to the examiner, it would have been obvious to one of ordinary skill in the art “to have replaced the lime of Sohn with the magnesium hydroxide of GB ‘472 because the substitution of art recognized equivalents as shown by GB ‘472 would have been within the level of ordinary skill in the art” (answer, page 6). Again, the examiner has not explained how one of ordinary skill in the art would have obtained molybdenum trioxide from calcium molybdate or magnesium molybdate, especially given Vertes’ disclosure that calcination is not a universally applicable method of converting any and all molybdates to molybdenum trioxide. The examiner has not pointed out, and we do not find, where Barry, Vertes, Chiola, Sohn and/or GB ‘472 disclose or suggest how to obtain molybdenum trioxide from calcium molybdate. Thus, we conclude that the examiner has not carried his burden of establishing a *prima facie* case of obviousness of claims 20 and 21 over Barry in view of Vertes and Chiola, taken further in view of Sohn, and further in view of GB ‘472..

CONCLUSION

To summarize, the decision of the examiner (I) to reject claims 1-7 and 10-19 under 35 U.S.C. § 103 as being unpatentable over Barry in view of Vertes and Chiola, (II) to reject claims 20 and 21

¹⁹See GB ‘472, page 1, lines 53-75.

²⁰See GB ‘472, page 2, lines 1-3.

Appeal No. 1997-0448
Application No. 08/327,980

under 35 U.S.C. § 103 as being unpatentable over Barry in view of Vertes and Chiola as applied to claims 1-7 and 10-19 and further in view of Sohn, and (III) to reject claims 20 and

Appeal No. 1997-0448
Application No. 08/327,980

21 under 35 U.S.C. § 103 as being unpatentable over Barry in view of Vertes and Chiola and Sohn as applied to claims 1-7 and 10-21 and further in view of GB '472 is reversed.

REVERSED

BRADLEY R. GARRIS)	
Administrative Patent Judge)	
)	
)	
)	
)	BOARD OF PATENT
TERRY J. OWENS)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
)	
)	
)	
CAROL A. SPIEGEL)	
Administrative Patent Judge)	

Appeal No. 1997-0448
Application No. 08/327,980

GARY R. PLOTECHER
WHYTE HIRSCHBOECK DUDEK
111 EAST WISCONSIN AVENUE
SUITE 2100
MILWAUKEE, WI 53202

APPEAL NO. 1997-0448 - JUDGE SPIEGEL
APPLICATION NO. 08/327,980

APJ SPIEGEL

APJ OWENS

APJ GARRIS

DECISION: REVERSED

Prepared By:

DRAFT TYPED: 20 Dec 00

FINAL TYPED: