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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DENNIS R. COMPTON, SAMUEL JEFFERIES,
and RON SHARPE

Appeal 2020-001739
Application 15/256,162
Patent 8,246,813 B2
Technology Center 3000

Before JEFFREY B. ROBERTSON, RAE LYNN P. GUEST, and
JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ requests our review under 35 U.S.C. § 134(a) of the Examiner’s decision to reject claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 30, 31, 33, 35, and 37–47 of reissue application 15/256,162, which seeks to reissue U.S. Patent No. 8,246,813 B2 (“the 813 patent”).² We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies Ecolab USA Inc. as the real party in interest. Appeal Brief filed September 3, 2019 (“Appeal Br.”) at 2.

² Non-Final Office Action entered January 30, 2019 (“Office Act.”).

CLAIMED INVENTION

Appellant's invention relates to using zinc octoates to remove hydrogen sulfide from petroleum streams. 813 patent, col. 1, ll. 15–16; col. 1, l. 66–col. 2, l. 4. Claims 1 and 35 illustrate the subject matter on appeal, and are reproduced below from the Claims Appendix to the Appeal Brief with underlining and brackets omitted, and emphasis added to highlight contested subject matter:

1. A method for removing sulfide from a petroleum stream, the method comprising
adding to the petroleum stream an effective amount of a zinc octoate,
wherein *the molar ratio of zinc complexed with octanoic acid is from 2.1:3 to 1.97:3.*

35. A method for removing hydrogen sulfide from a petroleum stream, the method comprising
adding to the stream a composition comprising zinc octoate,
wherein the molar ratio of zinc complexed with octanoic acid is not 1:2 and
the composition has a viscosity of less than 100 cP.

Appeal Br. 17, 21 (Claims Appendix).

REJECTIONS

The Examiner maintains the following rejections in the Examiner's Answer entered October 21, 2019 ("Ans."):³

³ The Examiner withdrew the rejection of claim 31 under 35 U.S.C. § 251 for new matter, and rejection of claim 31 under 35 U.S.C. 112, first paragraph for failing to comply with the written description requirement, based on the recitation of "at least 1 minute" in the Answer. Ans. 5. The

- I. Claim 31 under 35 U.S.C. § 251 as based upon new matter added to the patent for which reissue is sought;
- II. Claim 31 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement;
- III. Claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 30, 31, 33, 35, and 37–47 under 35 U.S.C. § 103(a) as obvious over Taylor⁴ in view of Reichert,⁵ Peterangelo,⁶ and Andor;⁷ and
- IV. Claim 26 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, Andor, Draper,⁸ and Buras.⁹

FACTUAL FINDINGS AND ANALYSIS

Upon consideration of the evidence relied upon in this appeal and each of Appellant's contentions, we affirm the Examiner's rejection of claim 31 under 35 U.S.C. § 251 as based upon new matter, rejection of claim 31 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement, rejection of claims 1, 5–8, 10–13, 16, 17, 20, 21,

Examiner also withdrew the rejection of claims 30, 35, and 37–47 under 35 U.S.C. § 112 second paragraph, as being indefinite in the Answer. Ans. 5–6.

⁴ Taylor et al., US 5,000,835, issued March 19, 1991.

⁵ Reichert et al., US 4,902,408, issued February 20, 1990.

⁶ Peterangelo et al., *Correlation between Rheological Properties of Zinc Carboxylate Liquids and Molecular Structure*, 111 J. Phys. Chem. B, 7073–7077 (2007).

⁷ Andor et al., *Physical and Chemical Modification of Zinc Carboxylate-Containing Lubricants by Molecular Structure Changes*, 11-2 Lubrication Science 115–134 (1999).

⁸ Draper et al., US 2009/0145330 A1, published June 11, 2009.

⁹ Buras et al., US 2005/0145137 A1, published July 7, 2005.

23–28, 30, 31, 33, 35, and 37–47 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, and Andor, and rejection of claim 26 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, Andor, Draper, and Buras.

We review appealed rejections for reversible error based on the arguments and evidence the appellant provides for each issue the appellant identifies. 37 C.F.R. § 41.37(c)(1)(iv); *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (explaining that even if the Examiner had failed to make a prima facie case, “it has long been the Board’s practice to require an applicant to identify the alleged error in the examiner’s rejections”)).

Rejection I

We first address the Examiner’s rejection of claim 31 under 35 U.S.C. § 251 as based upon new matter added to the patent for which reissue is sought.

Claim 31 depends from independent claim 23, which recites a method for removing hydrogen sulfide from a petroleum stream that comprises, in part, adding to the petroleum stream a solution comprising an effective amount of tetranuclear oxo zinc octoate having 2:3 molar ratio of zinc to octanoic acid. Claim 31 recites that “the solution is added to the petroleum stream in an amount of 500 to 1500 ppm and the petroleum stream is heated at a temperature of at least 300°F for at least 1 minute.”

The 813 patent discloses experimental examples in which additives comprising zinc octoate samples were added to asphalt, and the resulting

mixtures were heated for two hours at temperatures of 315–325°F. 813 patent, col 3, ll. 10–63. The Examiner finds that the temperature range of at least 300°F recited in claim 31 has no upper limit, and, therefore, is not supported by the 315–325°F temperature range disclosed in the 813 patent. Office Act. 5. The Examiner finds that the temperature range of at least 300°F recited in claim 31, therefore, constitutes new matter. *Id.*

Appellant argues that “there is no recited temperature range within the ‘813 patent that is being violated by excluding an upper limit,” and “the key inquiry is what is the minimum temperature (and time) needed to achieve the desired hydrogen sulfide removal,” which the data in Table II of the 813 patent show “is at least 300°F for at least 1 minute.” Appeal Br. 8.

Contrary to Appellant’s arguments, however, as the Examiner explains in the Answer (Ans. 7), the “at least 300°F” temperature range recited in claim 31 constitutes new matter because it encompasses temperatures outside the limited hydrogen sulfide treatment temperature range of 315–325°F taught in the 813 patent. Both the lower limit of the range recited in claim 31 (300°F) and the boundless upper limit of the recited range are outside the narrow hydrogen sulfide treatment temperature range of 315–325°F disclosed in the 813 patent. And the 813 patent does not describe treating hydrogen sulfide at a temperature that includes 300°F, or at a temperature range having 300°F as an endpoint. Nor does the 813 patent disclose the importance or criticality of a 300°F lower temperature limit, or indicate that there is no upper limit to the temperature at which hydrogen sulfide can be effectively removed from asphalt by treating with zinc octoate.

Appellant's arguments, therefore, do not identify reversible error in the Examiner's rejection of claim 31 under 35 U.S.C. § 251 as based upon new matter added to the patent for which reissue is sought, and we accordingly sustain this rejection.

Rejection II

We next address the Examiner's rejection of claim 31 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement.

The Examiner finds that claim 31 fails to comply with the written description requirement for the same reasons that claim 31 is based upon new matter added to the patent for which reissue is sought, discussed above. Office Act. 6–7. Appellant presents the same argument for this written description rejection that Appellant presents for the new matter rejection. Appeal Br. 8–10. Because Appellant's arguments do not identify reversible error in the Examiner's rejection of claim 31 as based upon new matter, Appellant's arguments likewise do not identify reversible error in the Examiner's rejection of claim 31 as failing to comply with the written description requirement. We, accordingly, sustain the Examiner's rejection of claim 31 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement.

Rejection III

We turn now to the Examiner's rejection of claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 30, 31, 33, 35, and 37–47 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, and Andor.

Claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 31, and 33

Appellant argues claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 31, and 33 together without presenting arguments directed to any particular claim. Appeal Br. 10–15. We, therefore, select claim 1 as representative, and decide the appeal as to claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 31, and 33 based on claim 1 alone. 37 C.F.R. § 41.37(c)(1)(iv).

Taylor discloses reducing the level of hydrogen sulfide present in petroleum asphalt residue produced during the refining of crude oil by introducing a metal salt of an organic acid into “the effluent stream (residue) of asphalt” generated during the refining process. Taylor col. 1, ll. 5–8, 47–50. Taylor discloses that zinc and iron carboxylates are the “most preferred” metal organic salts for removing hydrogen sulfide from asphalt, and Taylor indicates that zinc octoate “exhibited good performance in laboratory experiments.” Taylor col. 1, ll. 51–53; col. 2, ll. 24–29.

Taylor discloses that “[i]n order to disperse the metal organic salt in the asphalt, it is necessary to employ a diluent or solvent.” Taylor col. 2, ll. 31–32. And Taylor describes experiments in which various organic salts were dissolved in different solvents, and the resulting solutions were tested for their ability to reduce hydrogen sulfide evolution from asphalt samples. Taylor col. 3, l. 7–col. 4, l. 56. Taylor indicates that the results of the experiments—set forth in Table III—show that “the preferred organic salts are iron and zinc naphthanates and octoates.” Taylor col. 4, ll. 33–56.

The Examiner finds that Taylor does not explicitly teach zinc octoate having a molar ratio of from 2.1:3 to 1.97:3, and the Examiner relies on Reichert, Peterangelo, and Andor for suggesting use of such zinc octoate in

Taylor's process for reducing hydrogen sulfide levels in asphalt. Office Act. 8–12.

Reichert discloses a process for removing hydrogen sulphide from liquids produced in refineries and petrochemical plants that involves treating the liquids with a transition metal carboxylate. Reichert col. 1, ll. 5–6, 25–27, 55–58; col. 2, ll. 17–23. Reichert discloses that suitable transition metal carboxylates include zinc carboxylates, and Reichert indicates that octoate radicals such as 2-ethylhexanoate are “especially preferred” carboxylates. Reichert col. 1, ll. 59–61; col. 2, ll. 11–12. Reichert discloses that, in general, transition metal carboxylates are viscous liquids, and are preferably “used as a solution or dispersion in a hydrocarbon (e.g. benzene or xylene) or a mixture of hydrocarbons (e.g. petrol or petroleum),” so that they “are less viscous, and can be dispersed even more easily in the liquids which are preferably freed of hydrogen sulphide, and they are more easily meterable.” Reichert col. 2, ll. 32–42.

Peterangelo discloses experiments conducted to gain an understanding of molecular structures that control the viscosities of reaction products of ZnO and 2-ethylhexanoic acid. Peterangelo pg. 7073, col. 1. Peterangelo describes determining the viscosities of thirteen samples (A–M) prepared by combining zinc oxide and 2-ethylhexanoic acid in a 2:3 molar ratio, and of one sample (α) prepared by combining zinc oxide and 2-ethylhexanoic acid in 1:2 a molar ratio. Peterangelo pg. 7074, col. 2. Peterangelo presents the results of these experiments in Table 1, which shows that the viscosities of samples A–M varied from 2.218 Pa·s to 8.200 Pa·s, while the viscosity of sample α was “high.” Peterangelo pg. 7074, col. 1. Peterangelo discloses

that the viscosities of samples A–M “agree reasonably well to the values published by Andor,” but sample α “was too viscous to measure with our apparatus.” Peterangelo pg. 7074, col. 2.

Peterangelo discloses that the experiments suggest that “the high viscosity sample prepared at 1:2 zinc oxide to 2-ethylhexanoic acid ratio has a polymer as its major component, while the samples prepared at 2:3 zinc to acid ratio have a molecular species as their major component and that a small, uncontrolled amount of polymer is responsible for the increased viscosity.” Peterangelo pg. 7074, col 2–pg. 7075, col. 1.

Andor discloses preparing twenty-two zinc carboxylate samples, including zinc 2-ethylhexanoate (zinc bis(2-ethylhexanoate) or $Zn(2\text{-ethylhexanoate})_2$) and the corresponding tetranuclear oxo complex (tetranuclear oxo zinc 2-ethylhexanoate or $Zn_4O(2\text{-ethylhexanoate})_6$), and determining the zinc and carbon contents of the samples, which Andor indicates “verified the 1:2 ratio for the bis-carboxylate compounds and the 2:3 ratio for the tetranuclear oxo complexes between the metal ion and the carboxylate groups.” Andor pg. 118–120. Andor discloses determining the viscosities of the samples, and Figure 6 of Andor shows that the viscosity of tetranuclear oxo zinc 2-ethylhexanoate (having a 2:3 molar ratio of zinc to carboxylate) was 2.63 Pa·s, while the viscosity of zinc 2-ethylhexanoate (having a 1:2 molar ratio of zinc to carboxylate) was significantly higher. Andor pg. 125; Fig. 6; *see also* pg. 120 Table 1. Andor discusses the results shown in Figure 6, as well as the results of further experiments, indicating that “[t]he tetranuclear oxo complex showed the expected Newtonian flow of isometric independent molecules, while the bis-carboxylate compound had a

plastic flow curve characteristic of stronger and anisometric intermolecular interactions,” which “led us to the conclusion that the structure of this form should be close to that of the polymeric chain.” Andor pg. 125; Figs. 5 and 7.

In view of these disclosures in Taylor, Reichert, Peterangelo, and Andor, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellant’s invention to use a zinc octoate complex having a molar ratio of zinc to carboxylate of 2:3, in a method of reducing hydrogen sulfide content in a petroleum stream, because (1) Taylor teaches using zinc octoate to treat asphalt to reduce its hydrogen sulfide content; (2) Reichert discloses that 2-ethylhexanoate is an especially preferred octoate group in zinc carboxylate for removing hydrogen sulfide from condensed gases and/or liquid product streams in processing of oil and oil products in refineries or petrochemical plants; (3) Reichert teaches that low viscosity transition metal carboxylate compositions are more easily meterable and disperse more easily; and (4) Andor and Peterangelo disclose that compared to highly viscous zinc 2-ethylhexanoate having a molar ratio of zinc to octoate of 1:2, tetranuclear oxo zinc 2-ethylhexanoate having a molar ratio of zinc to octoate of 2:3 provides the advantage of lower viscosity, as desired by Reichert. Office Act. 11–12.

Appellant argues that the combined disclosures of Taylor, Reichert, Peterangelo, and Andor would not have led one of ordinary skill in the art to “select a zinc octoate species for reducing hydrogen sulfide concentrations” in petroleum streams for numerous reasons, which we address in detail below. Appeal Br. 10–14. We note initially, however, that Appellant relies

on the Declaration of James G. Speight to support Appellant's arguments, which Appellant submitted to the Patent Office with the Appeal Brief. New evidence and affidavits, however, may not be filed after the filing of a Notice of Appeal. 37 C.F.R. § 41.37(c)(2); 37 CFR § 41.33(d)(2); MPEP § 1454. We, accordingly, do not consider the Speight Declaration, but point out that Appellant's arguments throughout the Appeal brief are nearly identical to the relied-upon opinions provided in the Speight Declaration.

Appellant argues that one of ordinary skill in the art would have understood that the data presented in Table III of Taylor do not support Taylor's statement that zinc and iron carboxylates are the most preferred metal organic acid salts for use in Taylor's method, because direct comparison of the data presented in the table is not possible due to the number of variables involved with each test sample. Appeal Br. 10–11. Appellant argues that "Reichert includes zinc in the list of suitable transition metals, but teaches that the preferred metals are iron and manganese." Appeal Br. 12 (citing Reichert col. 1, ll. 63–65). Appellant argues that a "combination of the teachings of Taylor and Reichert is that an iron-based salt is better for removing hydrogen sulfide than other transition metal salts, including zinc." Appeal Br. 12. Appellant argues that, therefore, "[a] person skilled in the art reading Taylor and Reichert together would not be motivated to select zinc carboxylate salts in view of the teachings of Taylor and Reichert to select other, better performing, metal carboxylate salts." Appeal Br. 12, 14.

Appellant's arguments do not identify reversible error in the Examiner's rejection, for reasons that follow.

As discussed above, Taylor discloses that zinc and iron carboxylates are the “most preferred” metal organic salts for removing hydrogen sulfide from asphalt, and Taylor discloses that zinc octoate “exhibited good performance in laboratory experiments.” Taylor col. 1, ll. 51–53; col. 2, ll. 24–29. Taylor also explicitly indicates that the results set forth in Table III show that “the preferred organic salts are iron and zinc naphthanates and octoates.” Taylor col. 4, ll. 33–56.

Appellant does not direct us to sufficient objective evidence of record¹⁰ that supports Appellant’s assertion that that one of ordinary skill in the art would have understood that the data presented in Table III of Taylor do not support Taylor’s statement that zinc and iron carboxylates are the most preferred metal organic acid salts for use in Taylor’s method. Appellant’s unsupported assertions to the contrary are thus mere attorney arguments, which do not constitute the requisite evidence necessary to establish that one of ordinary skill in the art would have disregarded Taylor’s explicit indication that the results set forth in Table III show that “the preferred organic salts are iron and zinc naphthanates and octoates.” *In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997) (“An assertion of what seems to follow from common experience is just attorney argument and not the kind of factual evidence that is required to rebut a prima facie case of obviousness.”); *In re Schulze*, 346 F.2d 600, 602 (CCPA 1965) (“Argument

¹⁰ As discussed above, Appellant did not timely file the Speight Declaration. Even if Appellant had filed the Declaration earlier in prosecution, however, neither Appellant nor the Declarant provides any objective evidence corroborating the opinions provided in the Declaration.

in the brief does not take the place of evidence in the record.”).

As discussed above, Reichert discloses, similar to Taylor, that zinc carboxylates remove hydrogen sulphide from liquids produced in refineries and petrochemical plants, and Reichert discloses that octoate radicals such as 2-ethylhexanoate are “especially preferred” carboxylates. Reichert col. 1, ll. 5–6, 25–27, 55–61; col. 2, ll. 11–12, 17–23.

Taylor and Reichert thus both disclose that zinc octoate effectively removes hydrogen sulphide from asphalt residue and other liquids produced in refineries and petrochemical plants, rendering the use of zinc octoate for such hydrogen sulphide removal *prima facie* obvious, regardless of whether other metal carboxylate salts are “better performing” as Appellant argues. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (quoting *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 282 (1976) (“[W]hen a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.”); *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012) (a claimed product “does not become patentable simply because it has been described as somewhat inferior to some other product for the same use”) quoting *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)); *see also In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (“[t]he prior art’s mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives”).

Appellant argues that a combination Taylor and Reichert teaches that “an excess of the metal carboxylate salt is required” in light of Reichert’s teaching that 1.1 to 5 times the amount of metal carboxylate is required to

arithmetically remove all of the hydrogen sulfide, and “Taylor’s teaching that the metal content alone should be close to at least 1:1.” Appeal Br. 12 (citing Reichert col. 1, ll. 63–65).

Contrary to Appellant’s arguments, however, Reichert does not teach that “an excess of the metal carboxylate salt” relative to hydrogen sulphide “is required” to remove the hydrogen sulphide from liquids produced in refineries and petrochemical plants. Rather, Reichert discloses that “[g]ood results, i.e. complete removal of hydrogen sulphide within a short period of time, are even obtained, if an equivalent amount of transition metal carboxylate is used per amount of hydrogen sulphide to be separated off is used.” Reichert col. 3, ll. 12–17. Reichert goes on to disclose that, “[h]owever, in general, to be on the safe side, an excess of transition metal carboxylate is used, for example 1.1 to 5 times the amount by weight which is required arithmetically to remove all of the hydrogen sulphide present.” Reichert col. 3, ll. 17–21. Thus, far from “requiring” excess transition metal carboxylate, Reichert explicitly discloses that “complete removal of hydrogen sulphide within a short period of time” is achieved when using an “equivalent” amount of transition metal carboxylate per amount of hydrogen sulphide.

Appellant does not provide a citation to the asserted teaching in Taylor that “the metal content alone should be close to at least 1:1,” and, therefore, it is unclear to which passages of Taylor Appellant is referring. We note, however, that Taylor discloses that “[g]enerally, from 1 to 3 ppm of metal ion for each 3 ppm of H₂S in the asphalt is sufficient . . . to reduce the residue H₂S in the asphalt to between 2 and 50 ppm.” Taylor col. 3, ll.

3–6. Contrary to Appellant’s argument, Taylor thus actually teaches that using one-third of the amount of metal ion relative to hydrogen sulphide, up to an equivalent amount of metal ion and hydrogen sulphide, is sufficient to reduce hydrogen sulphide residue in asphalt to a very low level.

Furthermore, claim 1 places no numerical limit on the amount of zinc octoate used in the recited method, other than requiring use of an “effective amount” of zinc octoate. Nor does claim 1 place any requirement on the amount of hydrogen sulphide removed from a petroleum stream using the recited method. Taylor and Reichert’s methods are directed to removing hydrogen sulphide from liquids produced in refineries and petrochemical plants, such as asphalt, and the combined disclosures of the references, therefore, would have suggested use of an amount of zinc octoate effective to remove at least some hydrogen sulphide from such liquids, which is all that claim 1 requires.

Appellant argues that one of ordinary skill in the art would not have selected a zinc octoate composition for reducing hydrogen sulfide in asphalt based on Peterangelo’s teachings because the zinc octoate viscosities disclosed in Peterangelo are very high and variable, and one of ordinary skill in the art would have understood that “the large viscosity variability would not provide a consistent product that could be used at an industrial level.” Appeal Br. 13, 14 (citing Peterangelo Table 1). Appellant argues that the “viscosity data in Peterangelo also suggests that zinc octoate reactions with asphalt are diffusion controlled and the diffusion of a high molecular weight material into the asphalt to reduce hydrogen sulfide would be slow and relatively inefficient.” Appeal Br. 13, 14. Appellant argues that “a person

skilled in the art would draw the same conclusions from Andor as from Peterangelo, namely that the different zinc octoate structures have different spatial structures that would directly control the diffusion of the octoate into asphalt.” Appeal Br. 13, 14.

Appellant’s arguments again do not identify reversible error in the Examiner’s rejection, for the following reasons.

Appellant’s argument that one of ordinary skill in the art would not have selected a zinc octoate composition for reducing hydrogen sulfide in asphalt based on Peterangelo and Andor’s teachings is improperly based on Peterangelo and Andor only, and does not take into consideration the Examiner’s reliance on the disclosure in Taylor and Reichert that zinc octoate effectively removes hydrogen sulphide from asphalt residue and other liquids produced in refineries and petrochemical plants. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (“Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.”); *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (The test for obviousness “is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”).

As discussed above, Reichert discloses that transition metal carboxylates are viscous liquids, and are preferably “used as a solution or dispersion in a hydrocarbon (e.g. benzene or xylene) or a mixture of hydrocarbons (e.g. petrol or petroleum),” so that they “are less viscous, and can be dispersed even more easily in the liquids which are preferably freed of hydrogen sulphide, and they are more easily meterable.” Reichert col. 2,

ll. 32–42. Peterangelo and Andor’s disclosures together indicate that the viscosity of tetranuclear oxo zinc 2-ethylhexanoate, which has a 2:3 molar ratio of zinc to oxoate, is significantly less than the viscosity of zinc 2-ethylhexanoate, which has a 1:2 molar ratio of zinc to octoate.

As the Examiner finds (Office Act. 8), Taylor does not explicitly teach the molar ratio of zinc to octoate in the zinc octoate described in the reference, but Reichert discloses that less viscous transition metal carboxylates can be dispersed more easily in liquids being treated for removal of hydrogen sulphide, and are more easily meterable. In view of Peterangelo and Andor’s disclosure of the relatively low viscosity of tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate, one of ordinary skill in the art seeking to use a lower viscosity zinc octoate to remove hydrogen sulphide from asphalt residue according to Taylor’s method, would have used tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate, as disclosed in Peterangelo and Andor, which would provide the benefit of enhanced dispersibility and meterability, as disclosed in Reichert.

On the record before us, Appellant does not timely present sufficient evidence to support Appellant’s assertion that one of ordinary skill in the art would have understood that the high viscosity, and the large variability in the viscosity, of the tetranuclear oxo zinc 2-ethylhexanoate disclosed in Peterangelo would not provide a consistent product that could be used at an industrial level. Appeal Br. 13 (citing Peterangelo Table 1). Appellant’s unsupported assertion is thus mere attorney argument, which does not constitute the requisite evidence necessary to establish the asserted

understanding of one of ordinary skill in the art. *Geisler*, 116 F.3d at 1470; *Schulze*, 346 F.2d at 602.

Nor does Appellant provide sufficient evidence to support Appellant's assertion that the viscosity data disclosed in Peterangelo would have suggested that zinc octoate reactions with asphalt are diffusion controlled, and the diffusion of a high molecular weight material into the asphalt would be slow and relatively inefficient. *Geisler*, 116 F.3d at 1470; *Schulze*, 346 F.2d at 602. Even if Appellant had provided evidence earlier in prosecution to support this assertion, as discussed above, Peterangelo discloses that the experiments described in the reference suggest that the high viscosity sample, prepared using a 1:2 zinc oxide to 2-ethylhexanoic acid ratio, has a polymer as its major component, while the samples prepared using a 2:3 zinc to acid ratio had a molecular species as their major component. Peterangelo pg. 7074, col 2–pg. 7075, col. 1. And as also discussed above, Andor discloses that the tetranuclear oxo zinc complex showed the expected Newtonian flow of isometric independent molecules, while the bis-carboxylate zinc compound had a structure close to that of a polymeric chain. Andor pg. 125; Figs. 5 and 7.

Peterangelo and Andor thus indicate that tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate has the structure of independent molecules, while zinc 2-ethylhexanoate having a 1:2 molar ratio of zinc to octoate has the structure close to that of a polymeric chain. Accordingly, if zinc octoate reactions with asphalt are diffusion controlled as Appellant asserts, the diffusion of tetranuclear oxo zinc 2-ethylhexanoate (having a 2:3 molar ratio of zinc to carboxylate) into asphalt would be faster

than the diffusion of zinc 2-ethylhexanoate (having a 1:2 molar ratio of zinc to carboxylate) into asphalt, providing a further reason that would have prompted one of ordinary skill in the art to use tetranuclear oxo zinc 2-ethylhexanoate in Taylor's method of removing hydrogen sulphide from asphalt residue.

Although Appellant presents an additional argument based on "the claimed viscosity values" (Appeal Br. 13–14), claim 1 does not recite any viscosity value, and Appellant's argument is, therefore, based on subject matter that is not actually claimed. *In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) ("[A]ppellant's arguments fail from the outset because . . . they are not based on limitations appearing in the claims.").

We, accordingly, sustain the Examiner's rejection of claims 1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 31, and 33 under 35 U.S.C. § 103(a).

Claims 30, 35, and 37–47

Appellant argues claims 30, 35, and 37–47 as a group on the basis of claims 30 and 35, which Appellant argues together. Appeal Br. 14–15. We, therefore, select independent claim 35 as representative, and decide the appeal as to claims 30, 35, and 37–47 based on claim 35 alone. 37 C.F.R. § 41.37(c)(1)(iv).

Claim 35 requires the recited method for removing hydrogen sulfide from a petroleum stream to comprise adding to the stream a composition comprising zinc octoate in which the molar ratio of zinc complexed with octanoic acid is not 1:2, and the composition has a viscosity of less than 100 cP.

As discussed above, Taylor discloses reducing the level of hydrogen sulfide present in asphalt by introducing a metal salt of an organic acid into the asphalt. Taylor col. 1, ll. 5–8, 47–50. Taylor discloses that “[i]n order to disperse the metal organic salt in the asphalt, it is necessary to employ a diluent or solvent.” Taylor col. 2, ll. 31–32. Taylor exemplifies dissolving various organic salts in different solvents. Taylor col. 4, ll. 20–32.

As also discussed above, Reichert discloses that transition metal carboxylates are viscous liquids, and are preferably “used as a solution or dispersion in a hydrocarbon (e.g. benzene or xylene) or a mixture of hydrocarbons (e.g. petrol or petroleum),” so that they “are less viscous, and can be dispersed even more easily in the liquids which are preferably freed of hydrogen sulphide, and they are more easily meterable.” Reichert col. 2, ll. 32–42.

In view of these disclosures in Taylor and Reichert, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellant’s to dilute the tetranuclear oxo zinc 2-ethylhexanoate disclosed in Peterangelo and Andor with a solvent to lower its viscosity, such as to a viscosity below 100 cP as recited in claim 35, to improve the meterability and dispersibility of the tetranuclear oxo zinc 2-ethylhexanoate, as taught by Reichert, when using it in Taylor’s method to reduce the level of hydrogen sulfide present in asphalt. Office Act. 18–19.

Appellant argues that the Examiner’s position to “‘just add solvent’ is insufficient to bridge the viscosity gap between Peterangelo’s teachings of a viscosity range of 2240 cP to 8200 cP and the claimed viscosity range of 100 cP,” and “would apply to any zinc carboxylate ratio, including the 1:2 ratio

that produced an even higher viscosity.” Appeal Br. 14–15.

Appellant’s arguments, however, do not take into consideration Taylor’s disclosure that in order to disperse a metal organic salt in asphalt, the salt must be dissolved or dispersed in a diluent or solvent. Nor do Appellant’s arguments take into consideration Reichert’s disclosure that transition metal carboxylates are viscous liquids, and when used to remove hydrogen sulphide from liquids produced in refineries and petrochemical plants, their viscosity is preferably lowered by dissolving or dispersing them in one or more hydrocarbon solvents, which increases their dispersibility in the liquids, and their meterability. Reichert’s disclosure that the viscosity of zinc octoate affects its meterability and dispersibility establishes that zinc octoate viscosity is a result-effective variable. *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012) (“A recognition in the prior art that a property [or a result] is affected by the variable is sufficient to find the variable result-effective.”).

In view of these disclosures in Taylor and Reichert, one of ordinary skill in the art seeking to remove hydrogen sulphide from asphalt as disclosed in Taylor using tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate as suggested by Peterangelo and Andor (discussed above), would have lowered the viscosity of the tetranuclear oxo zinc 2-ethylhexanoate by dissolving it in a solvent to improve its dispersibility in the asphalt and increase its meterability, as disclosed in Reichert. In so doing, the ordinarily skilled artisan would have arrived at a suitable viscosity for achieving a desired level of dispersibility and meterability, such as a viscosity of less than 100 cP as recited in claim 35,

through nothing more than routine experimentation. *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980) (“[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.”).

Similar to the argument that Appellant presents for claim 1 discussed above, Appellant argues that “Peterangelo provides no motivation to select the tetrameric form of the zinc octoate salt because the viscosities in Peterangelo are still too incredibly high to be commercially useful and vary over a wide range with no teachings or explanation as to how to more tightly control the viscosity.” Appeal Br. 15.

As discussed above, however, in view of Peterangelo and Andor’s disclosure of the relatively low viscosity of tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate, one of ordinary skill in the art seeking to use a low viscosity zinc octoate to remove hydrogen sulphide from asphalt according to Taylor’s method would have used tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate. As also discussed above, the ordinarily skilled artisan would have would have lowered the viscosity of the tetranuclear oxo zinc 2-ethylhexanoate by dissolving it in a solvent as disclosed in Taylor, which would improve its dispersibility in the asphalt and increase its meterability, as disclosed in Reichert.

We, accordingly, sustain the Examiner’s rejection of claims 30, 35, and 37–47 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, and Andor.

Rejection IV

Finally, we address the Examiner's rejection of claim 26 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, Andor, Draper, and Buras.

Claim 26 depends from claim 25, which depends from claim 23. As discussed above, claim 23 recites a method for removing hydrogen sulfide from a petroleum stream that comprises, in part, adding to the petroleum stream a solution comprising an effective amount of tetranuclear oxo zinc octoate having a 2:3 molar ratio of zinc to octanoic acid. Claim 25 recites heating the petroleum stream for 2 hours or less, and claim 26 recites that the heating takes place at temperatures of 315 to 325°F.

The Examiner determines that, although Taylor, Reichert, Peterangelo and Andor “render obvious claim 26, i.e., the references teach heating takes place in the claimed temperature range of 315–325°F,” claim 26 “is also rendered obvious further in combination with Draper and Buras.” Office Act. 19–21.

Appellant argues that “Draper teaches using zinc oxide, not zinc octoate,” and “teaches nothing about the efficacy of zinc octoate species . . . for reducing hydrogen sulfide concentrations or the time and temperatures needed in order for zinc octoate to be effective.” Appeal Br. 15 (citing Draper ¶ 26). Appellant argues that Buras’ “generic teaching of the temperatures at which asphalt is typically used at does not render obvious the times and temperatures for reducing the hydrogen sulfide concentration . . . claimed in claim 26.” Appeal Br. 15 (citing Buras ¶ 26 and Table III).

Appellant's arguments do not identify reversible error in the

Examiner's rejection, for reasons that follow.

Draper discloses a method for reducing hydrogen sulfide emissions from asphalt by admixing a hydrogen sulfide scavenging additive with the asphalt "either prior to or concurrent with heating the asphalt." Draper ¶¶ 8, 16. Draper discloses that suitable hydrogen sulfide scavenging additives include zinc oxide, zinc sulfonate, and zinc carbonate, and Draper indicates that the additives are "effective at temperatures in the range of 275°F to 375°F, which is a more commonly used temperature for handling asphalt." Draper ¶¶ 12, 26. Draper discloses that "once admixed with an asphalt, the additives of the invention may most effectively reduce hydrogen sulfide concentration within the asphalt over the course of a period of from 1 hour to about 4 days." Draper ¶ 25.

Buras discloses reducing hydrogen sulfide emissions during the production of asphalt by adding a hydrogen sulfide scavenger to asphalt while mixing at elevated temperatures, which "can range up to 500°F." Buras Abstr.; ¶¶ 12, 18, 26, 27. Buras discloses that especially effective hydrogen sulfide scavengers include inorganic and organic metal salts, and Buras indicates that suitable metals for the hydrogen sulfide scavenger may be zinc, while the organic and inorganic salt forms of the metals may be carboxylates, oxides, carbonates, and sulphonates. Buras ¶ 29.

Draper's disclosure that zinc oxide, zinc sulfonate, and zinc carbonate effectively scavenge hydrogen sulfide from asphalt, together with Buras' disclosure that especially effective asphalt hydrogen sulfide scavengers include zinc carboxylates, oxides, carbonates, and sulphonates, reasonably would have suggested to one of ordinary skill in the art that zinc

carboxylates, zinc oxide, and zinc sulfonate could be used interchangeably to successfully scavenge hydrogen sulfide from asphalt according to Draper's method. Draper and Buras, considered together with Taylor, Reichert, Peterangelo, and Andor, therefore, would have suggested that zinc carboxylates, such as tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate (as discussed above), could be used successfully to reduce hydrogen sulfide emissions from asphalt using the treatment conditions disclosed in Draper.

Accordingly, the combined disclosures of Taylor, Reichert, Peterangelo, Andor, Draper, and Buras would have suggested reducing hydrogen sulfide emissions from asphalt heated to a temperature of 275°F to 375°F by admixing the asphalt with tetranuclear oxo zinc 2-ethylhexanoate having a 2:3 molar ratio of zinc to octoate, and allowing the zinc octoate to interact with the asphalt for a period of from 1 hour to about 4 days, as disclosed in Draper, rendering the temperature range of 315 to 325°F recited in claim 26, and the heating time of 2 hours or less recited in claim 25, *prima facie* obvious. *In re Peterson*, 315 F.3d 1325, 1329–30 (Fed. Cir. 2003) (“In cases involving overlapping ranges, we and our predecessor court have consistently held that even a slight overlap in range establishes a *prima facie* case of obviousness. . . . Selecting a narrow range from within a somewhat broader range disclosed in a prior art reference is no less obvious than identifying a range that simply overlaps a disclosed range. In fact, when as here, the claimed ranges are completely encompassed by the prior art, the conclusion is even more compelling than in cases of mere overlap.”). Buras' disclosure of treating asphalt with a zinc carboxylate hydrogen sulfide

scavenger while heating the asphalt to a temperature of up to 500°F further supports the prima facie obviousness of the temperature range recited in claim 26.

Because Appellant does not provide persuasive evidence demonstrating the criticality of the asphalt treatment temperature range recited in claim 26, or the treatment time range recited in claim 25, we sustain the Examiner’s rejection of claim 26 under 35 U.S.C. § 103(a) as obvious over Taylor in view of Reichert, Peterangelo, Andor, Draper, and Buras. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990) (indicating that in cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.).

CONCLUSION

Claims	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
31	251	New matter	31	
31	112, first paragraph	Written description	31	
1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 30, 31, 33, 35, 37–47	103(a)	Taylor, Reichert, Peterangelo, Andor	1, 5–8, 10–13, 16, 17, 20, 21, 23–28, 30, 31, 33, 35, 37–47	
26	103(a)	Taylor, Reichert, Peterangelo,	26	

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Claims	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
		Andor, Draper, Buras		
Overall Outcome			1, 5–8, 10– 13, 16, 17, 20, 21, 23– 28, 30, 31, 33, 35, 37– 47	

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED