UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MATTHIAS STEGMAIER, JUERGEN SOJKA,
MICHAEL WALTER, THOMAS ZEIN,
ANDREAS KRAUTTER and HOLGER PLOTE

Appeal 2009-1019
Application 10/514,995
Technology Center 3700

Decided: January 14, 2009

RICHARD E. SCHAFER, JAMESON LEE and SALLY C. MEDLEY, *Administrative Patent Judges*.

MEDLEY, *Administrative Patent Judge*.

DECISION ON APPEAL

A. Statement of the Case

Robert Bosch GmbH ("Bosch"), the real party in interest, seeks review under 35 U.S.C. § 134(a) of a Final Rejection of claims 6-15. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

Bosch's invention is a method for determining the loading of a particle filter. The method includes determining a flow resistance variable of the particle filter based on a temperature in the particle filter and a pressure difference across the particle filter. The temperature in the particle filter is modeled based on a temperature measured upstream from the particle filter, and takes into account the thermal capacity of the particle filter, the thermal capacity of the exhaust gas, and the exhaust-gas mass flow. (Spec. Abs., 3, 6-7).

Representative claim 6, reproduced from the Claim Appendix of the Appeal Brief, reads as follows:

> A method for determining a loading of a particle filter, the method comprising:
>
> determining a variable characterizing a flow resistance of the particle filter based on a temperature in the particle filter and a pressure difference across the particle filter; and
>
> determining a conclusion regarding the loading of the particle filter based on the flow resistance;
>
> wherein a temperature upstream from the particle filter is measured, and the temperature in the particle filter is modeled based on the measured temperature, the model taking into account a thermal capacity of the particle filter, a thermal capacity of an exhaust gas, and an exhaust-gas mass flow.

The Examiner relies on the following prior art in rejecting the claims on appeal:

Cullen et al. ("Cullen")	5,722,236	Mar. 3, 1998
Christen et al. ("Christen")	6,405,528	Jun. 18, 2002
Hirota et al. ("Hirota")	6,588,204	Jul. 8, 2003

The Examiner rejected claims 6-15 under 35 U.S.C. § 103(a) as unpatentable over Christen, Hirota and Cullen.

B. Issue

Does Bosch demonstrate that the Examiner erred in determining that the claimed invention is obvious over the prior art?

C. Findings of Fact ("FF")

Christen

1. Christen describes diesel particle filter (DPF) [16, 16a, 16b] that includes a filter [26], a pair of temperature sensors [30], [32], and a pair of pressure sensors [34], [36] and a mass air flow (MAF) sensor [38]. (Col. 3, ll. 8-39; figs. 2-3).
2. The temperature sensors [30], [32] measure the temperature upstream and downstream of the DPF [16], [16a], [16b] and produce corresponding temperature signals [T_{upDPF}], [T_{dnDPF}]. (Col. 3, ll. 11-15).
3. The pressure sensors [34], [36] measure the pressure upstream and downstream of the DPF [16], [16a], [16b] and produce corresponding pressure signals [P_{upDPF}], [P_{dnDPF}]. (Col. 3, ll. 15-20).
4. The temperature, pressure, and air mass flow sensors permit determination of the DPF load (l_{DPF}). (Col. 3, ll. 40-42)
5. The equation for calculating the DPF load (l_{DPF}) includes the temperature in the DPF (T_{DPF}), the pressure drop across the DPF (Δp_{PDF}) and the effective restriction (A_{DPF} (l_{DPF})). (Col. 4, ll. 23-47; col. 5, ll. 49-58; equations 10, 11).
6. The effective restriction (A_{DPF} (l_{DPF})) accounts for the clogging of the DPF by particulate matter which gradually accumulates in the DPF. (Col. 5, ll. 31-33).
7. The temperature in the DPF (T_{DPF}) used in the DPF load equation can be either the temperature upstream of the DPF [T_{upDPF}] or the temperature

downstream of the DPF [T_{dnDPF}] or the average of the two temperatures. (Col. 5, ll. 59-65).

Hirota

8. Hirota describes that the temperatures of the gas flow-in portion and the exhaust gas flow-out portion of particulate filter [70] may be estimated on the basis of the temperature of the exhaust gas, an amount of reducing materials in the exhaust gas, and the like, that change in accordance with the engine operating condition. (Col. 22, ll. 29-35).

Cullen

9. Cullen describes a NOx (nitrogen oxides) trap [30] comprising two bricks [30a], [30b] and a temperature sensor [32] located in the space "D" between bricks [30a], [30b]. (Col. 2, l. 62-col. 3, l. 2; fig. 1)
10. The sensor [32] provides an accurate measurement of the temperature of the trap [30] during steady-state condition but has a time constant of about 15 minutes during which the measurement data is relatively inaccurate. (Col. 3, ll. 2-6; col. 9, ll. 9-11, 43-45).
11. An estimate [ext_tso] of what the temperature sensor [32] at location "D" should be reading during the transient state is calculated. (Col. 5, ll. 42-43; col. 9, ll. 32-58; fig. 5a; equations 24, 25).
12. The estimate [ext_tso] of what the temperature sensor [32] should be reading is based on a filter constant [fk_ntD], a time constant [tc_ntD] and the steady state temperature [ext_ss_ntD] at location "D" which is equal to the instantaneous temperature [ext_ntC] near the front face "C" of the trap. (Col. 8, l. 55-col. 9, l. 12; fig. 5a; equations 20-23).
13. The time constant [tc_ntD] is due to the thermal capacitance of the trap substrate and material and is calculated based on the total air flow,

which accounts for the engine air mass flow [am]. (Col. 7, l. 19; col. 9, ll. 9-15; fig. 5a; equation 21).

14. The instantaneous temperature [ext_ntC] near the front face "C" of the trap is calculated based on the exotherm temperature [ext_ntr_exo] and heat capacity of the total heat flow [exh_ht_cap] which ultimately accounts for the heat capacity of the air [EXP_CP_AIR2] and the engine air mass flow [am]. (Col. 7, ll. 1-26; fig. 5a; equations 10, 15, 16, 19).

C. Principles of Law

In *KSR*, the Supreme Court rejected the rigid application of the "teaching suggestion or motivation" (TSM) test, instead favoring the "expansive and flexible approach" used by the Court. *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1739 (2007).

In an obviousness analysis, it is not necessary to find precise teachings in the prior art directed to the specific subject matter claimed because inferences and creative steps that a person of ordinary skill in the art would employ can be taken into account. *Id.* at 1741.

"Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references." *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

D. Analysis

<u>Christen</u>

Bosch argues that Christen does not describe "modeling" because the term requires using characteristic variables of the particle filter such as the thermal capacity of the particle filter. (App. Br. 5, Reply Br. 3). Bosch further argues that Christen's average temperature does not suggest

modeling because no characteristic variables of the particle filter are taken into consideration (e.g., particle filter thermal capacity, exhaust gas thermal capacity, and an exhaust-gas mass flow). (App. Br. 5, Reply Br. 3).

Bosch's arguments are not persuasive because the Examiner does not rely upon Christen for describing a model that uses, considers or accounts for characteristic variables of the particle filter. (Final Rejection 3, Ans. 4). Instead the Examiner relies on Cullen to teach a temperature model that accounts for particle filter characteristic variables. (Final Rejection 4, Ans. 4-5). Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.

Hirota

Bosch argues that Hirota does not suggest modeling of the temperature in the particle filter or suggest anything relating to the temperature upstream of the particle filter. (App. Br. 5, Reply Br. 4). Bosch argues that instead Hirota describes simulation of the temperature downstream from the filter or estimation of temperatures outside of the particle filter. (App. Br. 5, Reply Br. 4).

Bosch's arguments are unpersuasive. Hirota describes that the temperatures of the gas flow-in portion and the exhaust gas flow-out portion *of the particulate filter* may be *estimated* on the basis of at least the temperature of the exhaust gas and an amount of reducing materials. (FF[1] 8). It would have been obvious to one of ordinary skill in the art that the gas flow-in portion and the gas flow-out portion of the particulate filter are merely the portions of the filter that contact the gas flowing into the filter

[1] FF denotes Finding of Fact.

and the gas flowing out of the filter. Thus, the temperatures of the gas flow-in portion and the exhaust gas flow-out portion *of the particulate filter* are also the temperatures *in* the filter. Further, it would have been obvious to one with ordinary skill in the art that the temperature of the exhaust gas described by Hirota is measured upstream from the particle filter following exit from the engine since Hirota describes that the temperature model is based on factors that change in accordance with the engine operating condition. (FF 8).

Bosch further argues that the combination of Christen and Hirota does not suggest modeling of the temperature in the particle filter or such modeling based on the thermal capacity of the particle filter, thermal capacity of an exhaust gas, and an exhaust-gas mass flow. (Reply Br. 3). Bosch's argument is not persuasive because the Examiner does not rely upon Christen or Hirota to describe modeling of the temperature in the particle filter or the model's taking into account the particle filter thermal capacity, exhaust gas thermal capacity, and an exhaust-gas mass flow. Instead, the Examiner relies on Cullen to teach accounting for catalyst (i.e., particle filter) thermal capacity, exhaust gas thermal capacity, and an exhaust-gas mass flow in a temperature model. (Final Rejection 4, Ans. 4-5). Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.

<u>Cullen</u>

Bosch argues that Cullen does not describe measuring the upstream exhaust gas temperature (i.e., temperature upstream from the particle filter) with a temperature sensor, but instead describes an approximation of the

upstream exhaust gas temperature. (App. Br. 6, Reply Br. 4). Bosch's argument is not persuasive because it attacks the Cullen reference individually. The Examiner does not rely on Cullen for describing measurement of the temperature upstream from the particle filter. Instead, the Examiner relies on Christen for describing measurement of the temperature upstream from the particle filter. (Final Rejection 3, Ans. 3-4, FFs 1-2). Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.

Bosch further argues that Cullen does not describe (1) using the specific heat capacity of the component (i.e., exhaust catalyst or particle filter) for computing the temperature of the NOx trap; and (2) using the exhaust-gas mass flow for calculating the temperature at point "C". (App. Br. 6; Reply Br. 5). Bosch's arguments are not persuasive because they are not commensurate in scope with the claim language. As explained before, the claim language does not require *using* the specific heat capacity of the particle filter or *using* the exhaust-gas mass flow. The claim language merely requires the model to take into *account* the thermal capacity of the particle filter and the thermal capacity of an exhaust gas. Cullen describes a time constant [tc_ntD] that is used in the estimate of the temperature at location "D" [ext_tso], which corresponds to the location of temperature sensor [32] in the filter, where the time constant accounts for the specific heat capacity of the trap (i.e., filter) substrate and material. (FFs 9-13). Cullen also describes using the engine air mass flow [am] (i.e., exhaust-gas mass flow) for calculating the instantaneous temperature at point "C" [ext_ntC], which is ultimately used in the estimation of the temperature of

point "D" [ext_tso]. (FFs 10-12, 14). Therefore, Cullen's estimate of the temperature at point "D" [ext_tso] ultimately accounts for the specific heat capacity of the trap through the use of the time constant [tc_ntD], and also accounts for the exhaust-gas mass flow [am] through the calculation of the instantaneous temperature at point "C" [ext_ntC].

Combination of References

Bosch argues that the Examiner has not explained (1) which features of Cullen and Hirota would be incorporated or how they would be incorporated into the teachings of Christen; (2) the specific modification to the teachings of Christen; and (3) why one of ordinary skill in the art would be motivated to select the specific features taught in Cullen and Hirota for the purpose of the general modification asserted by the Examiner. (Reply Br. 5).

Bosch's arguments are not persuasive. The Examiner explains that Christen is modified by Hirota to estimate the temperature in the filter (i.e., the exhaust gas flow-out portion of the filter) based on a thermal model that takes into account an upstream exhaust gas temperature. (Final Rejection 3-4, Ans. 4). The Examiner explains that the combination of Christen and Hirota is further modified by Cullen to model the instantaneous temperature in the filter based on temperatures upstream of the filter, the detected steady state temperature of the filter, catalyst (i.e., particle filter) thermal capacity, exhaust gas thermal capacity, and an exhaust-gas mass flow. (Final Rejection 4, Ans. 5). The Examiner finds that one of ordinary skill in the art would have been motivated to do so in order to provide an effective means to accurately determine the temperature of the filter during a transient condition of the engine. (Final Rejection 4, Ans. 5). The Examiner's rationale is reasonable.

For all of the foregoing reasons, Bosch has not sufficiently demonstrated that the Examiner erred.

E. Conclusions of Law

Based on the Findings of Fact and the Analysis above, Bosch has not sufficiently demonstrated that the Examiner erred in determining that the claimed invention is obvious.

F. Decision

The decision of the Examiner rejecting claims 6-15 under 35 U.S.C. § 103(a) as unpatentable over Christen, Hirota and Cullen is affirmed.

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

AFFIRMED

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