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opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.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.21

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOHN F. FOLEY, STEVEN L. PLEE
and DONALD J. REMBOSKI JR.

Appeal No. 97-1070
Application 08/100,418[1]

ON BRIEF

Before JERRY SMITH, FLEMING and FRAHM, Administrative Patent Judges.

FRAHM, Administrative Patent Judge.

DECISION ON APPEAL

Appellants have appealed to the Board from the examiner's final rejection of claims 1 to 11, 14 to 16, 28 to 33, 37, and 38. Claim 36 has been canceled.[2] In the final rejection (page 3), the examiner

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[1] Application for patent filed August 02, 1993.

[2] Claim 36 was canceled in response to the first Office action as per appellants' instructions at the top of page 3 of the amendment dated April 3, 1995.

objected to claims 12, 13, 17 to 21, 34, 35, and 39 to 43 as being allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims, and indicated the allowability of claims 22 to 27 and 44 to 49. Thus, only claims 1 to 11, 14 to 16, 28 to 33, 37, and 38 remain on appeal.

BACKGROUND

The subject matter on appeal is directed to the field of compression pressure detection within an internal combustion engine (specification, page 1), and in particular, to a method and apparatus for determining low compression by measuring crankshaft acceleration of a running engine (specification, page 1 and independent claims 1, 14, 28, and 37 on appeal). As indicated in the specification (pages 1 to 3), there were no prior art compression pressure detection methods or apparatus known to appellants that first measured acceleration directly from the crankshaft of a running engine and then provided a compression pressure which was dependent upon the measured crankshaft acceleration. Appellants recognized that the prior art failed to diagnose low compression pressure in real-time on an engine in service (specification, page 1). Appellants also pointed out (specification, pages 1 to 2) that prior art systems relied on in-cylinder pressure measurement and average crankshaft velocity to predict compression, and that compression was determined during a time when the engine was taken out of normal operating service.

Appellants point out at page 2 of their specification that prior art compression pressure

detection schemes are susceptible to inaccuracies associated with transient engine operation. Appellants further point out at page 3 of their specification that such prior art schemes fail to eliminate error due to non-combustion related torque influencing the compression measurement. Appellants' invention seeks to remedy the above prior art problems in that appellants seek to provide a method and apparatus for detecting low compression pressure in an internal combustion engine which is more durable, more accurate, and is simpler to manufacture (specification, pages 2 to 3).

As further discussed, *infra*, we find that the applied references, taken as a whole, fail to teach or suggest utilizing a direct measurement of crankshaft acceleration in a running engine to predict a low compression pressure condition as recited in the claims on appeal.

Representative claim 1 is reproduced below:

1. A method of compression pressure determination in a combustion chamber of a cylinder in a running engine, said method comprising the steps of:

measuring acceleration of a crankshaft of said running engine, said measurement centered proximate a maximum rate of compression of said cylinder, and providing a first acceleration variable responsive thereto; and

providing a compression pressure variable having a magnitude indicative of a compression pressure in the combustion chamber of the cylinder in said running engine determined dependent on an amplitude of the measured first acceleration variable.

The following references are relied on by the examiner:

Buck et al. (Buck)	4,295,363	Oct. 20, 1981
Ina et al. (Ina)	4,517,648	May 14, 1985
Wier	5,386,723	Feb. 7, 1995

(filed July 26, 1993)

Claims 1 to 11, 14 to 16, 28 to 33, 37, and 38 stand rejected under 35 U.S.C. § 103. As evidence of obviousness, the examiner relies upon Wier in view of Ina and Buck.[3]

Rather than repeat the positions of the appellants and the examiner, reference is made to the Brief, Reply Brief, Answer, and Supplemental Answer for the respective details thereof.[4]

OPINION

At the outset, we note that, in accordance with appellants' statement at the top of page 3 of the principal brief, appellants make no objection to claims 1 to 11, 14 to 16, 28 to 33, 37, and 38 being grouped together for purposes of this appeal. Thus, we are in agreement with the examiner's statement at the top of page 2 of the Answer, that all of the claims on appeal stand or fall together. We select claim 1 as being representative of the group of claims on appeal. See 37 CFR § 1.192(c)(7).

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[3] We note that appellants question in their Reply Brief (page 1) whether or not the grounds of rejection set forth in the final rejection still apply on appeal. This appears to be a legitimate question since the Examiner's Answer (page 2, paragraph 18) provides no grounds of rejection, lists only new grounds of rejection (Answer, pages 2 to 6, paragraphs 19 to 23), and fails to clearly indicate whether or not the previous rejection has been withdrawn as required by MPEP § 1208(A)(6)(b). In light of the examiner's statement in the Supplemental Answer (page 1) that the only rejection pending appeal is the new grounds given in the Answer, we take the previous rejection given in the final Office action as having been withdrawn.

[4] We note that at page 1 of the Supplemental Answer, the examiner states that the Reply Brief and the amendment under 37 CFR § 1.193(b) (both filed on August 5, 1996) have been "entered and considered."

In reaching our conclusion on the issue raised in this appeal, we have carefully considered appellants' specification and claims, the applied patents, the respective viewpoints of appellants and the examiner, and all other evidence of record. As a consequence of our review, we will reverse the decision of the examiner rejecting claims 1 to 11, 14 to 16, 28 to 33, 37, and 38 on appeal.

We agree with the examiner that certain arguments by appellants are not commensurate in scope with the claimed subject matter. For example, while appellants argue (Brief, page 4 and pages 8 to 9; Reply Brief, pages 2 to 6, pages 6 to 7, top of page 11, and page 13) that none of the applied references teach or suggest measuring compression pressure "centered proximate a maximum rate of compression" of an engine cylinder as recited in representative claim 1, nothing *recited* in claim 1 requires this to occur specifically at points +/- 30 degrees BTDC or TDC as *disclosed* (specification, pages 7 to 8 and 13 to 15) and as *argued* by appellants. Representative claim 1 requires that the timing need only be centered "proximate" the recited time. Thus, we agree with the examiner (Answer, pages 3 and 5; Supplemental Answer, pages 1 to 2) that Wier teaches the recited feature of taking measurements "centered proximate" a maximum rate of compression, especially to the extent this feature is broadly set forth in claim 1.[5]

[5] We note that "the PTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into

Even so, we will not sustain the rejection under 35 U.S.C. § 103 because, in light of the applied references taken as a whole, the subject matter of claim 1 would not have been obvious within the meaning of 35 U.S.C. § 103.

Representative claim 1 is directed to a method of determining compression pressure in a running engine comprising the steps of measuring acceleration of a crankshaft in the running engine to provide an acceleration variable, and providing a compression pressure variable indicative of a compression pressure based on the measured acceleration variable. The examiner (Answer, pages 3 to 6) relies on Wier to show the recited feature of determining compression pressure by finding cam and crank positions "centered proximate a maximum rate of compression," relies on Ina to indirectly show that torque determination is similar to measuring crankshaft acceleration and that intake manifold pressure be used to determine combustion pressure, and relies on Buck to show that measuring crankshaft acceleration is very well known in the art as a means for testing compression. The examiner then states that although Buck teaches taking measurements during cranking (i.e., starting), there is no reason why the measurements could not be taken while the engine is running (Answer, page 5).

We find that three important recited features of appellants' representative claim 1 on appeal are neither taught nor would have been suggested by the applied references taken as a whole: first, that a crankshaft acceleration is measured; second, that the measurement be made while the engine is running;

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account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's specification." In re Morris, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997).

and third, that the measurement made during engine operation be used to determine compression pressure.

The examiner relies on Buck (at columns 9 and 10) to show that crankshaft acceleration is measured. Our close review of the Buck reference reveals that Buck discloses two separate and distinct embodiments. It is important to understand the relation between these two embodiments in providing a proper 35 U.S.C. § 103 analysis as to Buck's teachings and suggestions.

First, Buck discloses a "Compression Test" as discussed at column 9, line 35 through column 11, line 14 and shown in figures 3 and 4. Buck teaches that during the compression test, the engine "is operating without power" and "is being cranked as with a starter or crank motor" (column 9, lines 45 to 46). This test is used to detect a low compression based on a compression index and ratio.

Second, Buck discloses a "Power Performance Test" as discussed at column 11, line 15 through column 14, line 17 and shown in figures 5, 6, and 7. Buck teaches that during the power test the engine is running (column 11, lines 17 to 58), and that the power test detects a loss in power for an individual cylinder based on a power index and ratio.

The examiner relies on the compression test embodiment of Buck to teach the feature of claim 1

on appeal of measuring crankshaft acceleration. We find that this embodiment of Buck merely calculates a compression index for each cylinder by measuring *piston* acceleration (column 10, line 26) for use in finding a compression ratio. While it is *possible* that Buck's system *could* determine crankshaft acceleration, we find that the disclosure of Buck does not actually teach or suggest detecting acceleration at the crankshaft. While Buck does teach measuring *piston* acceleration to obtain a compression index (column 10, lines 20-38), Buck fails to teach providing a variable which reflects measured crankshaft acceleration. Furthermore, Buck's compression test embodiment does not take any measurements during normal engine operation, but during cranking.

We are in agreement with appellants that Buck does not teach measurement of acceleration of an engine's crankshaft, but instead teaches measuring time intervals (Reply Brief, page 11) . Our careful review of Buck fails to reveal any teaching or suggestion of measuring, calculating, or determining a crankshaft acceleration.

The examiner takes the position that although Buck measures compression during cranking without the engine running, it would have been obvious to measure compression during normal engine operation (Answer, page 5). We find that the compression test embodiment of Buck relied on in the rejection fails to make obvious the significant feature of the claimed invention of determining a

compression pressure *while the engine is running*. We conclude that it would not have been obvious to perform a compression test with the engine running since Buck states just the opposite (column 9, lines 44 to 46), and since the examiner has not cited any persuasive motivation for doing so (Answer, page 5). We note that although the power test of Buck may be performed during engine operation, only *power* is being determined in this test, and

not compression. We also note that Buck's power test algorithm does not explicitly determine a crankshaft acceleration, and that Buck's power test finds a power index and ratio, not an acceleration. Thus, we cannot conclude that Buck's power test embodiment cures the deficiency of the compression test embodiment of not expressly determining crankshaft acceleration during normal engine operation.

Appellants argue that neither Wier nor Ina measure acceleration of a crankshaft, nor would these references have suggested measuring acceleration of a crankshaft (Brief, page 4). Appellants additionally argue that Wier does not measure crankshaft acceleration, but instead simply measures in-cylinder pressures Z1 and Z2 and then finds a difference (Brief, pages 6 to 8). We agree on both counts.

We note that the examiner concedes that Wier fails to teach measuring crankshaft acceleration

(Answer, page 4). The examiner then attempts to rely on Ina as to this feature (Answer, page 4). We are not persuaded that Ina taught or would have suggested such a feature. Ina's pressure measurement at an engine rubber mount is not in-line with a crankshaft, nor is it even near a crankshaft. Indeed, using Ina's engine mount sensor to measure torque (and then determine acceleration from torque) would not have made the direct measurement of crankshaft acceleration obvious. This arrangement of Ina would actually introduce inaccuracies associated with transient engine operation as well as error due to non-combustion related torque, which

would influence the measurement. Thus, we find that Ina actually *introduces* the difficulties sought to be overcome by appellant, and *teaches away* from directly measuring crankshaft acceleration. Therefore, there would have been no motivation to measure or determine acceleration without recourse to appellants' disclosure.

Accordingly, we agree with appellants' argument (Reply Brief, pages 12 to 14) that the claimed method for measuring compression pressure directly from crankshaft acceleration is neither taught nor fairly suggested by any of Wier, Ina, and/or Buck taken alone or in combination. We also agree with appellants' argument that it would not have been obvious to eliminate Wier's pressure sensor measurement and then use position sensing to measure compression pressure by measuring

crankshaft acceleration (Brief, page 5 and Reply Brief, page 10). Further, we conclude that it would not have been obvious to modify Wier with Buck's compression test teaching since that would only result in a compression measurement without the engine running.

Appellants state that Wier (column 2, lines 2+) suggest detecting "faulty firing" which is unrelated to measuring "compression pressure" as recited in the claims (Brief, pages 9 to 10). We agree. We find that Wier, as well as Buck's power test embodiment, teach detection of faulty engine operation, such as misfiring or lack of fuel, which can be indicative of low compression. However, Wier and Buck teach concepts which are broader than that claimed in claim 1 on appeal

of determining compression pressure. In other words, low compression may lead to faulty firing, but faulty firing does not necessarily indicate low compression is present. Faulty firing could be the result of several other engine difficulties (loss of fuel, failure of ignition circuit, etc.). Therefore, we find that representative claim 1 on appeal, which is specifically directed toward determining compression (and not the broader concept of faulty firing) is narrower in this respect than what is taught or would have been suggested by the references relied on by the examiner.

Appellants argue that Ina relates to detecting a *torque variation*, and not a *compression measurement* as claimed (Brief, pages 10 to 11), because Ina (column 2, lines 49+) measures torque

with a pressure sensor mounted on an engine's rubber mount (Reply Brief, pages 8 to 11). The examiner states that Ina measures torque, and that since torque is proportional to acceleration, Ina can be said to indirectly measure acceleration (Answer, page 4; Supplemental Answer, page 3). In other words, the examiner alleges that sensing torque at a rubber engine mount yields results equivalent to measuring crankshaft acceleration directly. We cannot agree with the examiner, and instead agree with appellants that Ina measures torque and not compression.

The examiner relies on Buck (column 9, lines 35+) to show that measuring crankshaft acceleration is a means for testing compression (Answer, page 5). As discussed earlier, we find that Buck's compression test embodiment (column 9, line 35 to column 11, line 14) does not

actually measure crankshaft acceleration as required by claim 1 on appeal. We also find that Buck's power test embodiment (column 11, line 15 to column 14, line 16) fails to determine compression or provide a compression pressure variable as required by claim 1 on appeal.

The primary purpose of appellants' disclosed invention is to measure crankshaft acceleration directly in order to eliminate inaccuracies associated with transient engine operation (specification, page 2) and to avoid failing to eliminate error due to non-combustion related torque influencing the compression measurement which is a common problem in the prior art (specification, page 3).

Appellants attempt to overcome these difficulties with the prior art by directly measuring crankshaft acceleration. This feature is positively recited in all of appellants' claims on appeal, and to say that it would have been obvious to do so in light of a combination of three references which each individually fail to teach or suggest measuring the acceleration directly is not plausible and would require the use of hindsight.[6] To combine and modify Wier, Ina, and Buck to achieve appellants' claimed invention involves the application of knowledge not

clearly present in the prior art. *See In re Sheckler*, 438 F.2d 999, 1001, 168 USPQ 716, 717 (CCPA 1971). We conclude that there would be no motivation to combine the applied references to Wier, Ina, and Buck to achieve the subject matter of representative claim 1 on appeal.

In view of the foregoing, the decision of the examiner rejecting claims 1 to 11, 14 to 16, 28 to 33, 37, and 38 under 35 U.S.C. § 103 is reversed.

REVERSED

[6] We note that any judgement on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But when it takes into account knowledge gleaned only from the applicants' disclosure, and not only knowledge which was within the level of ordinary skill at the time the claimed invention was made, such a reconstruction is improper and is said to employ hindsight. *See In re McLaughlin*, 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971).

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